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"markers" Of Vulnerability And Episodes In Paranoid And Nonparanoid Schizophrenics

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"Markers" of Vulnerability and Episodes in Paranoid and Nonparanoid Schizophrenics

by

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Submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

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Abstract

The vulnerability model of schizophrenia (Zubin & Spring, 1977) postulates that individuals have a certain level of vulnerability to schizophrenia which is a relatively enduring trait. An episode of schizophrenia is hypothesized to be a function of this level and stressful events, either in the environment or as perceived by the person. An episode, is therefore, more variable and can be viewed as a state. One way of investigating this model is to locate both "markers" or indirect correlates of vulnerability and episodes by comparing remitted and episodic schizophrenics to see how they differ (potential episode markers) and how they are similar (potential vulnerability markers).

Schizophrenics in differing phases of illness have demonstrated a letter detection deficit under conditions of rapid processing (Asarnow & MacCrimmon, 1978). It was therefore hypothesized that four groups of schizophrenics (n=56; remitted paranoid and nonparanoid; episodic paranoid and nonparanoid) would all show similar performances when compared to normal controls (n=28). This hypothesis was not borne out, as the remitted patients' performance tended to fall inbetween the episodic and normal groups. Consequently, this deficit was found not to be a reliable vulnerability marker.

Social competence (as assessed by the Zigler &

Phillips, 1960 scale) was suggested as being relatively independent of vulnerability to schizophrenia. It, nonetheless, was hypothesized as having an important influence on how a person functions in society and copes with stress. The state or more variable component of competence was hypothesized as being related to the subjective appraisal of stressful situations and the consequent coping with them. A decline in coping skills and appraisal was postulated as marking the onset of an episode of illness. Remitted and episodic patients were hypothesized to differ in terms of how they appraised and coped with a stressor (noises). Behavioral (performance), cognitive (appraisals and predictions) and physiological indices of arousal were all measured.

Remitted schizophrenics were found to be more socially competent than those who were episodic. For the episodics, the paranoids were more competent than the nonparanoids, as predicted, however, the reverse was true for the remitted group. There were consistent patterns of differences in coping strategies and predictions between paranoids and nonparanoids and it appeared that these tendencies to cope in certain ways may have been more long lasting than the episode itself.

Several vulnerability and episode markers other than those predicted emerged from the study, particularly heart rate elevation and changes in measured intelligence as episode markers. Potential vulnerability "markers" were more difficult to assess, due to the influence of symptoms, but may be different physiological variables and response styles or coping predelictions for certain subtypes of schizophrenics.

Finally, the implications of these results were discussed in relation to the vulnerability model and suggestions were made for future methodologies in this area.

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Finally and most of all, I want to thank my husband, Keith and my son, Christopher. Keith provided me with wonderful support in any number of ways, but primarily was patient and listened to me during my times of uncertainty and worry. He also is my best friend without whose

contributions I could not have had the strength to complete this dissertation. And thanks to Chris, who provided me with a good reason to finish this work and who gave me diversity and happiness during my hours away from it.

Dedication

I would like to dedicate this dissertation to all those who have suffered or are suffering the terrors of schizophrenia. I would like to especially acknowledge B. S. who died while in an episode of schizophrenia, I.K. who tried to die and J. M. and G. G. who sincerely wished they could. Perhaps this work can in some small way serve to underscore the severity of the illness and the grave need for relevant research and understanding.

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A recently proposed model of schizophrenia has postulated that individuals have a certain vulnerability to schizophrenia which is an enduring trait (Spring & Coons, 1982; Zubin & Spring, 1977). Certain aspects of this model, particularly the notion of vulnerability or susceptibility have been alluded to much earlier (cf. Collier, as cited in Maher, 1966; Meehl, 1962). This vulnerability is defined as the ability to tolerate the stresses induced by life events (Spring & Zubin, 1977) and is thought to be determined by a number of factors including heredity and early predisposing or formative experiences. Pivotal in this model is the episodic nature of schizophrenia and the threshold, which is a function of the trait of vulnerability and the state of stressful events. Therefore, the occurrence of an episode is thought to be an interaction between the person (with a certain level of the trait) and the environment (with a certain level of stressful events). When stresses of any type accumulate to a level beyond the threshold, the individual theoretically succumbs to a time limited episode of illness (see Figure 1).

This model has the simultaneous advantage and disadvantage of being very general and widely applicable. This generality makes the model extremely difficult to test and disprove. For example, Zubin and Spring suggest that internal, and therefore, unobservable stressors may increase the probability of the occurrence of an episode. Spring and Coons (1982) are aware of the problem of the "escape

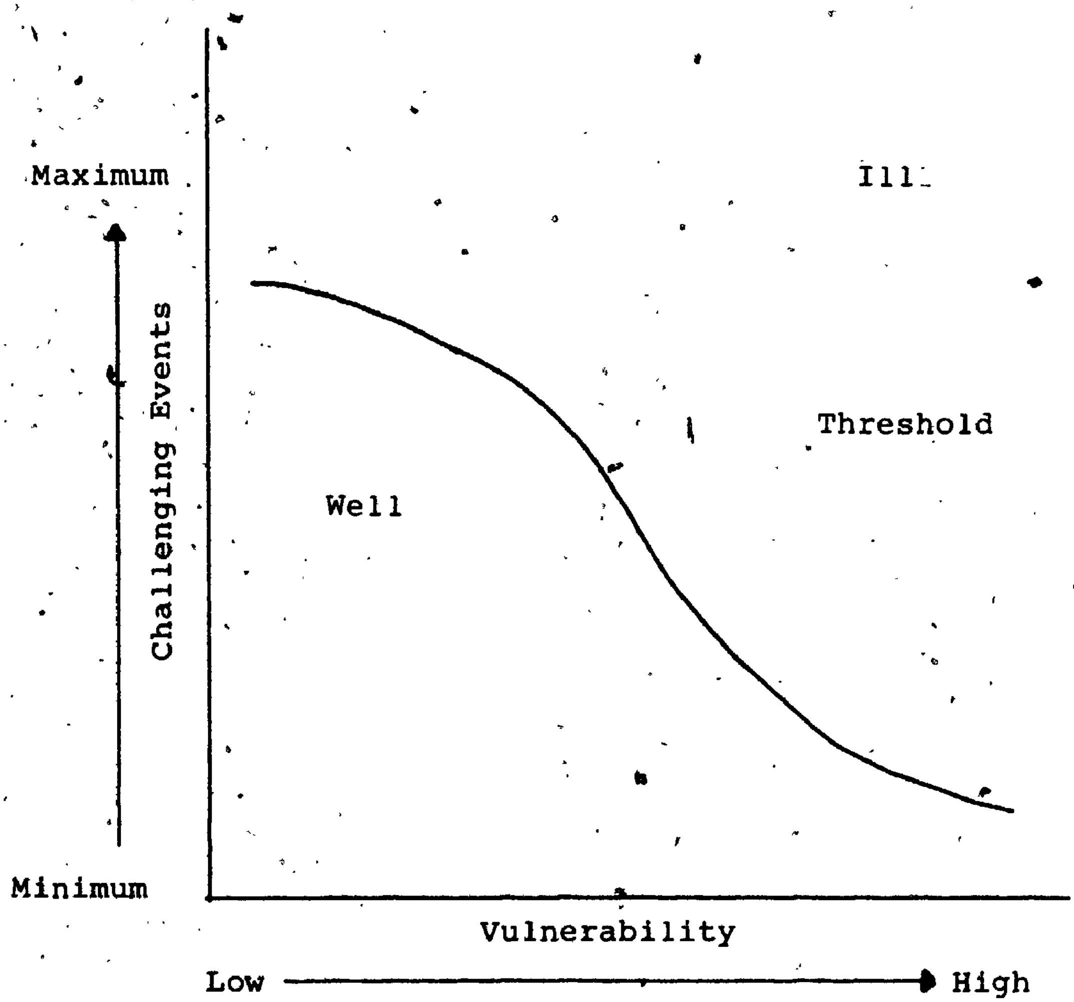

Figure 1 : The Vulnerability Model of Schizophrenia

Source: Zubin & Spring (1977)

hatch" of internal stressors if no external stressors appear to be present prior to an episode.

It is now fairly widely accepted that schizophrenia is episodic and time limited in nature (Garmezy, 1978; Spring & Zubin, 1977; Strauss et al., 1978; Zubin & Spring, 1977). This episodic nature is especially true with the almost universal use of phenothiazines. It is not clear what proportion of schizophrenics would remit without the use of medications. Spring and Zubin (1977) state that: "...a majority of schizophrenics have experienced some remission and, with support, are capable of improved functioning within one month of hospitalization." (p. 258) The Diagnostic and Statistical Manual III (1980) characterizes schizophrenia as involving phases or episodes. As yet, however, the vulnerability model has not been well researched and the main focus has been on locating genetic "markers" of schizophrenia which exist prior to illness (high risk research), during an episode and once it is past. The rationale for this research is that if an individual possesses an underlying disposition to schizophrenia, it should be manifested in some measurable way at all times. It is difficult, however, to define what these "markers" are (cf. Asarnow et al., 1977; Beuhring et al., 1982; Mednick, 1966, for examples of high risk studies).

Another strategy that has not been pursued as much as the above method of finding trait "markers" is locating "markers" of episodes--what it is about a person that changes during the state of illness. Spring and Zubin (1977) suggest that competence (defined as "the ability to achieve success in significant role contexts of everyday life " p. 278) is orthogonal to vulnerability, but may be a potential episode marker. At present, there has been virtually no research conducted regarding this suggestion. However, an episode appears to be marked at onset by a sharp decline in competence (role difficulties) and at termination by a return to premorbid competence. Obviously, the existence of symptoms of schizophrenia is another episode marker. Zubin and Steinhauer (1981) postulate that other "markers" may include coping failure, abnormal speech and thought processes, and certain psychophysiological (e.g. skin conductance and heart rate) and biochemical measures.

One method of assessing "markers" of the trait of vulnerability and the state of illness is to compare remitted schizophrenics to ones that are currently ill. Very few studies to date have assessed remitted schizophrenics and the ones that have done so have found them to have similar attentional deficits as symptomatic patients (Asarnow & MacCrimmon, 1978; 1981; 1982; Miller, Saccuzzo & Braff, 1979; Wohlberg & Kornetsky, 1973). There are advantages in looking at remitted schizophrenics--as in high risk research, the remitted schizophrenics do not have the confound of current institutionalization or the complicating effects of assessing currently psychotic subjects. A remitted sample is very similar to a hospitalized one in many ways, as almost all schizophrenics are now eventually released from hospitals. They are usually on similar medication and have definitely been schizophrenic (unlike high risk subjects, of whom only 10 to 15% will ever become schizophrenic). When comparing remitted subjects to a hospitalized sample and controlling for the effects of chronicity and hospitalization (by both groups having similar total amounts of hospitalization), one potentially can ascertain what is unique to an episode of illness and which characteristics of a subject endure once the illness is past. The former are markers of an episode and the latter are markers of the underlying vulnerability. The term "marker" is not being used in the genetic sense in the present context, but rather refers to potential "indicators" or "characteristics" of events.

Care must be taken to control for a potential sampling bias in comparing remitted and hospitalized samples. For example, it is possible that a patient may be more cooperative when remitted than he/she may have been when hospitalized. It is important only to select remitted patients who would have been suitable candidates when they were symptomatic. This check was done in this study by utilizing patient files and psychiatrist's ratings and will be expanded upon in the <u>Method</u> section.

The present research compared groups of episodic paranoid and nonparanoid schizophrenics to remitted paranoid and nonparanoid schizophrenics and normal controls. Two main tasks were utilized. The first of these was an information processing task requiring the rapid detection of letters, which has been found in past research to not distinguish episodic and remitted subjects. The second was a stressor task which required the subject to make predictions about their own behavior and then attempt to cope with a stressor stimulus. It was predicted that this latter task would differentiate between the groups in certain ways which will be described in more detail in a later section.

Information Processing Vulnerability "Markers"

A major supposition of the information processing approach to cognition is that the result (visual images, short term memory, reaction time, etc.) is not instantaneous, but is the product of two or more stages or processes (Long, 1980). Most of the relevant research in this area has been aimed at finding perceptual or attentional deficits in schizophrenics--in other words, problems with the initial stages of processing. The reason for this research bias is that most theories of schizophrenia have postulated an attentional problem of some sort, such as a defect in the "filtering" of incoming stimuli in the Broadbent (1952) tradition (e.g. McGhie, 1970) or generally slowed processing (Yates, 1966). Whatever the specific problem, an attentional deficit is likely to affect all other processes and the way an individual reacts to all stimuli. An attentional problem may not affect other aspects of information processing, however, if the deficit can be compensated for in some way. Examples of this buttressing effect could include: allowing extra time for input if the deficit is hypothesized to lie in slow processing or allowing the stimulus to remain in view while processing continues to compensate for an encoding deficit (i.e. Neufeld, 1978). Component processes are likely to be less affected, as well, if they depend minimally on others. Even including all of these qualifications, however, a fairly basic problem is being suggested, as an attentional deficit stands a greater probability of having a negative impact than do other, less dependent processes.

The evidence for an attentional deficit is mixed. Part of the problem may lie in the fact that there is little shared variance between the various tasks utilized (Asarnow et al., 1978; Neale & Oltmanns, 1980). Slightly different facets and stages of the wider construct of attention are probably being measured. Other complicating factors include the effects of motivation, medication, use of different subgroups of schizophrenics, and response styles of some of these subgroups (cf. Broga & Neufeld, 1981a). In the study by Broga and Neufeld, for example, paranoid schizophrenics were low in processing efficiency, but higher in their tendency to respond on the task; whereas nonparanoids were higher in processing efficiency and lower in response propensity.

More recent strategies have utilized experimental paradigms from cognitive psychology and have tended to minimize the above mentioned factors. Much of this research has investigated the "visual information store"

(Sperling, 1960) or "iconic memory" (Neisser, 1967) of schizophrenics. This store is believed to be the first stage of processing and is similar to a visual persistence effect.

> There is now little argument with the claim that the visual system exhibits a persistence effect in the form of a rapidly decaying image or icon following the termination of a brief stimulus. (Long, 1980, p. 787)

Thus, the icon is believed to remain intact after the offset of a stimulus for a brief period of time. Research has indicated that this precategorical process has a large capacity, is rapidly fading (in the order of milliseconds) and is followed by a transfer of some of the information to short term store.

Because schizophrenics clinically appear to have problems "paying attention", a deficient icon has been suggested as being related to these difficulties (Neale et al., 1969; Neale, 1971). The icon, however, is a perceptual phenomenon, distinct from attention, but may have ramifications for it.

The first measure used with both normals and schizophrenics to assess the capacity of the short term visual store (icon) has been the span of apprehension task (Sperling, 1960). This technique measures the "size" of the store and is relatively unaffected by short term memory if measured accurately. Sperling compared a whole report technique where the subject was required to report a whole array of briefly presented stimuli, to a partial report technique where the subject only had to report some portion of the array. In the latter technique, the subject was cued by a tone to report certain stimuli. Consequently, since the process of responding in itself did not interfere as much, short term memory did not interfere and performance improved. Estes and Taylor (1964) and Estes (1965) have also developed a technique for assessing perceptual span using the partial report technique. The relative advantages and disadvantages of these techniques will be detailed further below.

This differentiation from memory is significant, as schizophrenics have been shown to have greater memory problems than normals (Koh, 1978). With practice, it is likely that the reporting of the stimuli becomes almost an automatic process for the subject (Schneider & Shiffrin, 1977). Consequently, the assessment of the short term visual store is likely to be relatively unaffected by motivation. It may still have the problem of response style discussed above (Broga & Neufeld, 1981a), however, this problem can be partially taken into account by assessing the overall pattern of group differences. For example, more "liberally responding" paranoids should be advantaged on certain tasks, indicated by better performance, whereas, more conservative nonparanoids may perform less well on those same tasks. If this pattern does not exist, a response style explanation of the results cannot legitimately be made. Other criticisms are applicable as well, such as the exclusive use of letters-numbers stimuli in past research and output interference (as reported by Long, 1980). The exact mechanisms of performance on these tasks are far from resolved and interpretation of the present research will not extend to specific processes, but rather to patterns of group differences. This issue will be returned to later in the section.

The first study to assess short term visual store in schizophrenics was that of Neale et al. (1969). They used Estes' technique where the size of the array was varied (one or eight letters) and the subject had to report whether or not a "T" or an "F" was present. They found that the span size was reduced for schizophrenics (both good premorbid paranoids and poor premorbid nonparanoids) only in the presence of noise (eight letters). Neale (1971) basically replicated these results, again finding no differences between subtypes of schizophrenics, but in addition showed that other types of psychiatric patients and institutionalized inmates did not show the reduced span. A problem with this procedure is that the letters must be processed to the point of meaning (Neufeld & Broga, Note 1) to determine whether or not a "T" or "F" is present. It is possible that this processing is more than what is required in other iconic memory tasks.

Cash, Neale and Cromwell (1972) used a full report procedure and found no differences between acute schizophrenics and nonschizophrenics (primarily neurotic patients). They interpreted this data as an indication of adequate iconic storage in schizophrenics, however, given the confounded nature of the full report strategy, as discussed above, this interpretation is questionable. Davidson and Neale (1974) suggest that this finding may be due to the possibility that schizophrenics initially process fewer letters, thus have fewer to report (and therefore do poorly in partial report), but in a full report strategy, there may be less interference potential during report. Because nonschizophrenics process more letters, and have more to lose from short term memory, they are at a disadvantage resulting in similar performance for both groups.

Knight, Sherer and Shapiro (1977) compared the full report to the partial report technique and found that some schizophrenics (overinclusive) performed as did the controls, whereas others (middle and underinclusive) performed poorly under both conditions and did not appear to have the normal advantage of partial report. These results are at odds with the above study, perhaps because of the type of patients and subtypes used. Cash et al. gave very little information on their subjects so this hypothesis is difficult to evaluate. In addition, some schizophrenics may not have the usual advantage of partial report techniques due to the reason suggested above by Davidson and Neale (1974).

Davidson and Neale (1974) examined the effects of the target-noise similarity on the perceptual span using the Estes procedure. For example, they varied the similarity of the noise or background letters to the target, a "T" or "F". Schizophrenic's performance was poorer than alcoholic controls, but the target-noise manipulation affected both groups similarly. They conclude that schizophrenics have similar iconic recognition processes to controls, but simply perform them at a slower rate. Davidson and Neale's study, however, actually measured accuracy of report as opposed to speed of processing, thus their results cannot be taken as clear support for the schizophrenic slower speed of processing hypothesis. Broga and Neufeld (1981b) suggest that the:

> ...parallel decrease between patients and controls in target letter detection with increased noise target letter similarity could be taken as evidence against a slower processing rate...however, testing the comparative rates of change in performance may be tenuous in this case since it is possible that the increase in the required number of stimulus features over the similarity conditions may not have been large enough to reveal such inequalities in performance rate changes. (p. 560)

Broga and Neufeld (1981a) assessed paranoid schizophrenics, nonparanoid schizophrenics and normal controls on partial report procedure. They displayed eight letters briefly and varied the length of time between precue and display, and display and postcue. Five different delay times from display to postcue were assessed (0, 100, 200, 300 and 600 msec.). The cue indicated to the subject to report a single letter, rather than a row, in order to reduce the processing required and response demands upon the subjects. A significant main effect for groups was found--all groups were distinct at precue, order of performance was normal, paranoid, then nonparanoid, and at one postcue (100 msec.), only the normals and paranoids differed significantly, while the nonparanoids fell inbetween. Consequently, there was some evidence of inferior item detection among schizophrenics under precue and one postcue condition, but not all. It seems possible that by having a longer time between display and postcue, schizophrenic deficit was compensated for by allowing longer processing time.

Asarnow and MacCrimmon (1978), using a similar technique as the Neale studies, again found no paranoid-nonparanoid differences and found that both hospitalized and remitted schizophrenics showed a deficit. All schizophrenic groups did more poorly with increasing numbers of irrelevant letters. Therefore, this task appears to be relatively unaffected by the stage of development of disorder, as a precategorical processing defect has also been found in a subsample of high risk subjects (Asarnow et al., 1978). It may, however, be sensitive to variations in procedure or the use of categories other than paranoid-nonparanoid or premorbid adjustment, as indicated by Cash, Neale and Cromwell (1972) and Knight, Sherer and Shapiro (1977).

Asarnow and MacCrimmon (1981) replicated and extended their earlier results by comparing carefully selected groups of remitted schizophrenics, remitted manic-depressives and normals on the same task as their previous study. The schizophrenics made fewer correct responses than both other groups when more (four and nine) irrelevant letters were present. A subgroup of the schizophrenics, which could not be distinguished from the rest of the sample in terms of symptom type or severity, adjustment, demographic features, etc., accounted for these differences.

It should be noted that the Asarnow studies analyzed raw scores only, not the corrected scores using Estes' procedure. They also utilized a somewhat different methodology than the usual span of apprehension tasks--their stimuli were presented via a slide projector equipped with a tachistoscopic shutter, rather than being presented directly on a tachistoscope viewer. The projected images were larger than other studies (2.5 cm long). Because of these procedural differences, it is not clear whether or not their studies tapped a similar process to the Neale et al. studies.

A number of studies have also been performed using other techniques to assess the icon in schizophrenics (e.g.

Saccuzzo, Hirt & Spencer, 1974; Saccuzzo & Miller, 1977; Brody, Saccuzzo & Braff, 1980; Saccuzzo & Braff, 1981). These studies have used the backward masking procedure, where a stimulus is presented briefly and then a "mask" is displayed following it. A major assumption in this procedure is that the mask "erases" the visual persistence effect (Long, 1980). By varying the time between stimulus and mask (inter-stimulus-interval), one can theoretically chart the decay of the icon and rate at which decay occurs. This approach is aimed primarily at duration of the icon, whereas the preceding one is directed at its size and capacity. The major problem with the masking procedure is that it is not really known what the real effects of the mask are and other possibilities besides "erasure" exist (Long, 1980), such as an integration effect where the mask degrades the stimulus. The backward masking studies will not be reviewed in detail, as this procedure was not used in this study. For a review, see Broga and Neufeld (1981b).

As in the span of apprehension data, it seems as though the effects of backward masking are consistent over the developmental phases of illness. Miller, Saccuzzo and Braff (1979) showed that remitted schizophrenics (asymptomatic for three months prior to testing) were susceptible to the effects of the mask and showed slower processing times. Steronko and Woods (1978) found that a sample of college students with a schizotypic profile on the MMPI

(2-7-8), but no thought disorder required a longer inter-stimulus-interval than normals to recognize target letters. Furthermore, the Sc scale on the MMPI was a statistically significant predictor of critical inter-stimulus-interval. In a recent study (Saccuzzo and Schubert, 1981), both schizophrenic adolescents and adolescents with "schizotypal personalities" demonstrated a backward masking deficit. Only the schizophrenics required a longer stimulus duration for accurate identification in an unmasked condition.

The conclusions reached from all of the various strategies used to assess the icon attribute schizophrenic deficiency to speed of processing, rather than a deficit in the icon itself (Knight et al., 1980; Spaulding et al., 1980). Few differences have been demonstrated between paranoid and nonparanoid schizophrenics. In addition, as noted above, (Asarnow & MacCrimmon, 1978; 1981; Miller, Saccuzzo & Braff, 1979) the problem appears to be relatively unaffected by the stage of development of the disorder using either the span of apprehension task or the masking procedure. The deficit may also be specific to schizophrenics (unlike many other "schizophrenic" deficits), as other groups of psychiatric patients or institutionalized subjects performed normally (e.g. Asarnow & MacCrimmon, 1981; Neale, 1971; Saccuzzo & Braff, 1981).

A reduced span, as indicated by less accommodation of increasing numbers of irrelevant stimuli, and a susceptibility to masking appears to be evident in schizophrenics. It is possible that both the stimuli and mask act as distractors to the patient and reduce their speed of processing: distractors referring to the additional stimuli in the former case and the mask itself in the latter case. This interpretation must be qualified by the above noted criticisms (Davidson & Neale, 1974) mainly surrounding the differentiation between speed of processing and the quality of the icon. In fact, because of the confusion over exactly what is being measured (speed of processing, iconic storage, span of apprehension), the task in this study was assigned the neutral name of letter detection. The underlying reasons for this processing deficit is not the focus of the present study. Of major interest is the consistency of the finding over phases of development of illness and the relative independence of the deficit to symptomatology. Because the findings of the span of apprehension task are slightly less complex than the backward masking task, and because number of irrelevant stimuli will make the task somewhat more comparable to another part of the study (see later sections), this procedure was utilized. This aspect of the study was essentially a replication of previous findings comparing hospitalized and remitted paranoid and nonparanoid schizophrenics, using number of distractors and number of trials as within group factors.

Competence and Symptomatology

Competence

If schizophrenics demonstrate an information processing deficit that is relatively independent of the stage of disorder and symptomatology, what are some possible implications of this finding? One potential answer to this question is that competence and methods of coping with the underlying disorder are what distinguish schizophrenics from one another. Competence, as defined here, is something which is relatively stable and may be orthogonal to the schizophrenic process (Spring & Zubin, 1977). Spring and Zubin's definition of competence seems closely aligned to coping ability and was not the same definition utilized in the current study. Coping ability, on the other hand, is a reflection of how an individual deals with stresses and events at any given point in time. Competence and coping ability are related to each other; competence could be viewed as a "trait", whereas coping as the "state" of the trait. The marker of the episode could be a sharp decline in coping skills at onset and a return to premorbid coping skills at offset.

There is some research that indirectly supports this viewpoint and attests to the significance of competence measures. Lewine, Watt, Prentky and Fryer (1980) found that preschizophrenic's interpersonal, but not cognitive skills differentiated them from their peers (measurements were taken retrospectively from school records). Lewine, Watt and Fryer (1978) found that childhood interpersonal competence could differentiate subtypes of adult schizophrenia, with schizoaffectives having the highest competence, paranoids with intermediate competence and undifferentiated schizophrenics with the lowest. These studies can be criticized on a number of points, particularly on the generality of the measures (high risk research has shown that only very subtle cognitive deficits may be apparent early- Asarnow et al., 1977) and the possible interaction between early information processing manifestations and interpersonal skills.

In another vein, Roff and Knight (1978), Knight, Roff, Barrnett and Moss (1979) and Knight, Roff and Watson (1981) have questioned the utility of cognitive symptoms in terms of predicting long term outcome. They essentially found that affective symptoms and interpersonal skills predict outcome better than thought disorder symptoms. These studies suggest that the construct of interpersonal or social competence may be a major determining force in outcome. In these studies, however, the thought disorder scale measured global symptoms which included delusions, hallucinations, confusion and bizarre thinking. The affectivity scale included such symptoms as apathy, poor interpersonal relations and withdrawal. It is possible that patients high on thought disorder symptoms were more similar to paranoid schizophrenics and those high on affectivity symptoms were more similar to nonparanoid, process schizophrenics. Thus, they may actually have been different subtypes of thought disorder symptoms rather than totally different classes. This differentiation will be detailed further below. In addition, it seems likely that their measures of interpersonal skills and affectivity were correlated, thus it is not surprising that both were predictors of outcome. Another study, however, (Klein & Williamson, 1981) found virtually no relationship between premorbid adjustment and affective symptoms. Two other recent studies (Watt et al., 1982; Parnas et al., 1982) show that high risk children had no indication of early withdrawal, but did have interpersonal difficulties. Note that the Knight et al. studies investigated the relationship of symptoms to outcome, whereas the others mentioned (Klein & Williamson, 1981; Parnas et al., 1981; Watt et al., 1982) assessed premorbid adjustment. It is impossible to know at this date what the outcome for the high risk children will be--such as whether or not those with interpersonal difficulties are more likely to be diagnosed as schizophrenic in the future. The exact components of competence have not been delineated as yet, however, it appears that interpersonal competence is related to outcome (cf. Stoffelmayr & Hunter, 1983).

Subtypes of Schizophrenia

It is widely acknowledged that the category of schizophrenia is extremely broad and the variation between different types of schizophrenics is great. There are a number of subclassification schemes that have been researched, including the process-reactive (usually based on pre-morbid competence); acute-chronic (usually based on length of hospitalization) and paranoid-nonparanoid distinctions. The first two dichotomies are related to the developmental course of the illness, and the chronicity variable especially is confounded with institutionalization and changing samples over time (Strauss, 1973). For example, not only does the chronic group have a longer period of illness, they also tend primarily to be more nonparanoid and process in nature. Unfortunately, it is not clear whether the patients or the symptoms change over time (Strauss, 1973). Strauss cites suggestive evidence that paranoid patients gradually disappear from hospitalized samples. Depue and Woodburn (1975), however, found results that support the idea that paranoid symptomatology disappears over time. They looked at records of rehospitalization of patients diagnosed as paranoid schizophrenic at first admission. Half of the sample remained paranoid on subsequent admissions; while the other half changed to nonparanoid. These results only apply to hospitalized (therefore, more chronic) patients. The problem of diagnostic unreliability also exists--knowing a patient has had several previous admissions may increase the likelihood of a nonparanoid diagnosis. The possibility that paranoid symptoms may decrease over increasing amounts of illness and hospitalization is not an issue in the present study, however, as subjects were equated for length of hospitalization.

Paranoid thought disorder appears to be quite distinct from other schizophrenic thought disorder clinically and it is demarcated by the presence of a delusional system often without clinically apparent intellectual deterioration. Nonparanoids have no such system, but have the symptoms of fragmented thought, flat affect and social withdrawal. This dichotomy is therefore a symptom based one rather than being determined by the development of the disorder. In sum, patients in this study were subclassified into paranoid and nonparanoid categories for two reasons:

1) This classification has shown research promise in terms of reducing group heterogeneity and demonstrating systematic performance differences (e.g. Broga & Neufeld, 1981a; Chapman & Chapman, 1973a; Goldberg et al., 1968; Neufeld, 1976). Berkowitz (1981) has noted some problems with the distinction, particularly in the inconsistent and poorly reported ways that it is measured across studies and the consequent problems with comparability. The present study attempted to measure the distinction as reliably and comprehensively as possible.

2) The paranoid/nonparanoid dichotomy is symptom based and therefore theoretically is limited to the episode of illness. Little is known about how remitted paranoids and nonparanoids differ from each other and indeed if they do in any systematic way.

The Relationship between Competence and Symptomatology

Major researchers into the relationship between premorbid competence and schizophrenia have been Zigler and Levine (1973; 1981a; 1981b). They have extensively discussed premorbid competence and the paranoid/nonparanoid distinction (Zigler, Levine & Zigler, 1976). It has been shown that in hospitals with a wide diversity of patients, those with good premorbid adjustment are about equally distributed between paranoids and nonparanoids, but almost all patients with poor premorbid adjustment are nonparanoids. This conclusion is not universally held, as shown by Eisenthal, Harford and Solomon (1972), who found paranoid status to be independent of premorbid competence and chronicity. Nevertheless, Zigler, Levine and Zigler (1976) use their findings to postulate a developmental model of schizophrenia and hypothesize that the paranoid schizophrenic is at a higher developmental stage than the nonparanoid. Cromwell (1972) has also suggested that because paranoid symptoms appear clinically to require more advanced cognitive development, these may be more predominantly found in the more intelligent and more cognitively advanced person. Thus, Cromwell states that clinical symptoms may be telling us more about the cognitive level (or competence) of the patient than about the disorder itself.

If Zigler and Levine are correct, the paranoid schizophrenic with good premorbid competence should show relatively little disorganization and social withdrawal and the nonparanoid with poor premorbid competence should demonstrate the opposite symptom pattern. The nonparanoid with good competence may fall somewhere inbetween.

It appears possible that premorbid competence may be an interaction of a number of variables, including early information processing and/or related deficits, social and environmental factors. The association between the identified, relatively consistent information processing deficit, episodes and stressors potentially could be fairly complex. For example, life events, or subjectively disturbing, if not objectively hazardous (cf. Rabkin, 1980; Spring & Coons, 1982) events may arise for which the deficit is critical (cf. Neufeld & Broga, 1981, regarding the concept of "critical deficit"). Another possibility may be that the deficit may simply be correlated with another, unidentified deficit which is critical to the events. Other more complex possibilities exist, however, for the purposes of expedience, the first alternative was the working position adopted by the present research. Furthermore, it was hypothesized that the individual's competence influences this relationship between these variables. It is possibly not intimately related to the basic schizophrenic process, but has a significant effect on it, especially on how the individual copes before, during and following illness. It is possible that competence may distinguish groups of schizophrenics and may predict the type of symptoms they display during an illness episode, hence the relationship between premorbid competence and paranoid/nonparanoid schizophrenia. The type of symptom "chosen" by the patient may be to some degree a reflection of their underlying competence and current coping style (see Figure 2).

Distinction between "Traits" and "States"

At this point it is important to recognize the relatively arbitrary distinction between "traits" and "states" (Allen & Potkay, 1981). A trait typically refers to an attribute of an individual that is consistent over time, whereas a state refers to something more changeable, such as a mood. There are no currently accepted criteria for determining when a state becomes a trait (that is, how long must the mood last, for example). Allen and Potkay (1981) note the general confusion and potential nonfalsifiability in this area of research partly due to an inconsistent use of labels (i.e. the same label has been used to refer to both states and traits) and the use of the same instrument with changed instructions for measuring states and traits (e.g. "How do you generally feel?" as opposed to "How do you feel now?").

In the present context, these problems were partially overcome by the use of differing labels and differing measuring techniques. For example, competence was assessed in quite a different way than current coping. What are being referred to as traits in the present study (competence and vulnerability) and states (episodes or symptoms and differing methods of coping) merely refer to consistency over time or the collective presence or absence of a particular characteristic in the former case and the distribution of symptomatology or different "amounts" of a characteristic over time (Neufeld, 1982b) in the latter case. One must bear in mind that the set of factors that are associated with the trait could be quite different from those related to the state (Neufeld, 1982b).

Premorbid social competence, as measured by the Zigler-Phillips (1960) scale (and modified by Zigler & Levine, 1973), is a composite score based primarily on demographic data. The six "items" used are age, education, marital status, occupation, employment history and intelligence. This measure was taken in the present study in order to assess the relationship between social competence and symptomatology (paranoid/nonparanoid), stage of development of disorder (hospitalized/remitted), iconic processing deficits and strategy of coping response.

No one to date has attempted to simultaneously assess what is the same and what is different between a hospitalized and remitted schizophrenic sample. That goal was one of the major aims of this research. It was hypothesized that what remains constant across groups is an iconic processing (letter detection) deficit and what changes is the way the individual makes subjective appraisals or judgments regarding stressors and copes with these same stressors. This discussion will now turn to these latter topics.

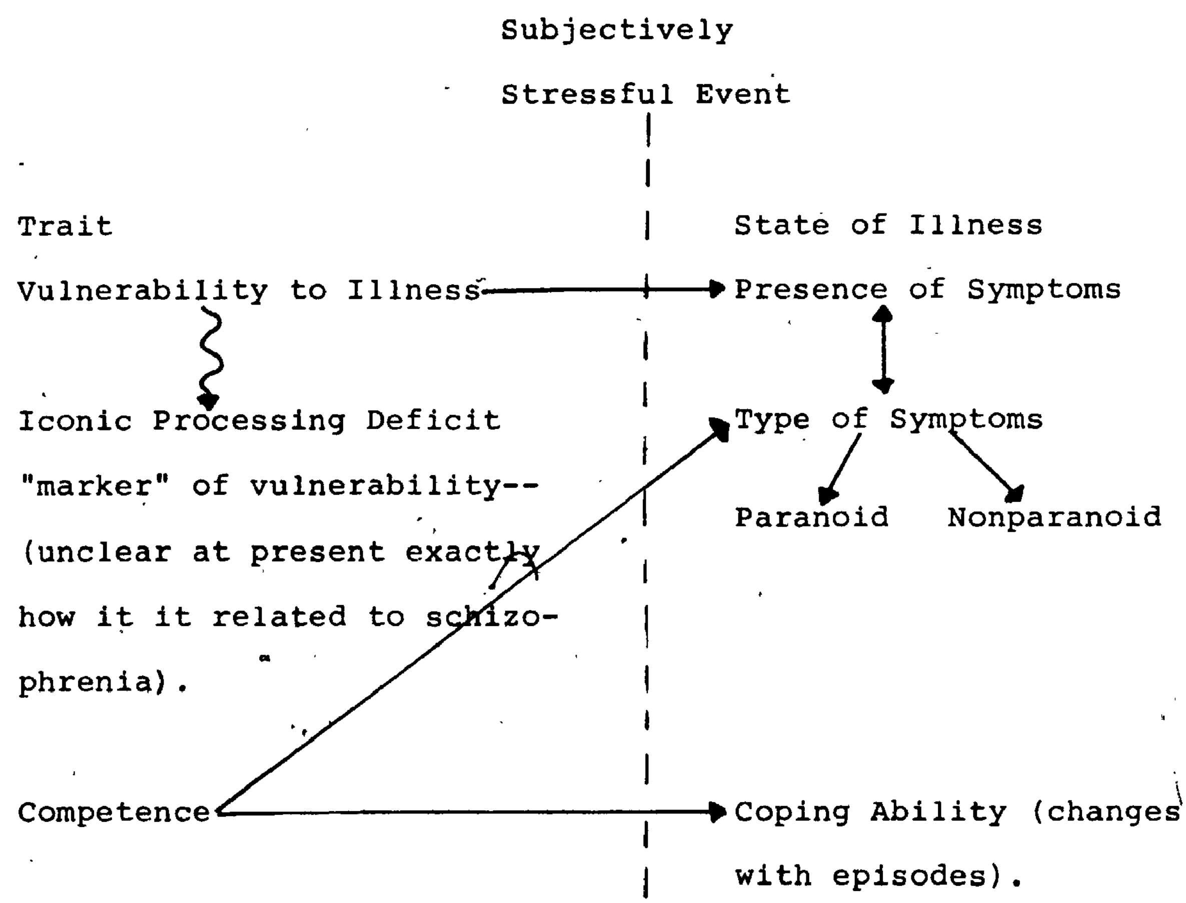

Figure 2: Tentative model of "states" and "traits".

Arousal, Stress Appraisals and Coping: Potential Episode "Markers"

The hypothesis that schizophrenia is exacerbated by an increase in life stresses prior to an episode of illness has yielded discouraging results. While schizophrenics generally report increased stresses, these tend to be relatively small increases and it is not known whether they are cause or effect. Clancy, Crowe, Winokur and Morrison (1973) found clear precipitants for only eleven percent of schizophrenics and Harder et al. (1980) found that the relationship between life stresses and pathology only accounted for three to seven percent of the variance. Thus, it appears that the relationship between life stresses and schizophrenia is small, although Dohrenwend and Egri (1981) suggest that it is underestimated. They propose that there may be an interaction or additive effect between unusual and usual or everyday life events resulting in a greater impact for those more vulnerable to schizophrenia.

If there is no appreciable increase in life stress, then what may differ between the responses of schizophrenics and nonschizophrenics to stress are: 1) physiological arousal to stresses may be higher than normal, resulting in greater anxiety in similar situations; 2) cognitive appraisal of stressful situations may be different than normal and/or 3) coping strategies may be different or inappropriate to the situation if appraisal is incorrect.

All of these three hypotheses could lead schizophrenics to have a more pronounced response to fewer or different stresses than normals. There is some evidence in the life stress literature showing that events reported as personally stressful by schizophrenics are less objectively stressful than those reported by depressives or normals (Beck & Worthen, 1972; Spring & Coons, 1982). The focus will now turn to physiological response to stressful stimuli.

Physiological Arousal

Some early theories of schizophrenia have postulated a link between attention and arousal (Silverman, 1964). Silverman suggests that early in life all schizophrenics are overaroused, but the paranoid schizophrenic learns to cope by becoming hypervigilant in terms of scanning the environment for potential threat; whereas the nonparanoid attempts to avoid anxiety by directing attention away from the environment onto internal processes (minimal scanner). This theory would predict that acute schizophrenics of both types would be overaroused, as in an episode of illness, and the coping mechanisms would not be working effectively.

Unfortunately, the state of the data make it impossible to draw firm conclusions about schizophrenics' arousal and especially the link between arousal and attention. A number of studies have found that schizophrenics have a high resting degree of arousal (under no stimulation) (Crooks & McNulty, 1966; Fenz & Velner, 1970; Goldstein & Acker, 1967; Magaro, 1973; Marks et al., 1960; Van Zoost & McNulty, 1971; Williams, 1953). The results did not hold for all autonomic measures and tended to be most consistent for heart rate and skin conductance. Many of the studies' results are confounded with chronicity and medication, however, both of which can influence arousal. For example, a sedentary existence, as in an institution, could increase heart rate. Spohn et al. (1977), in a well controlled double blind study, found that drug treatment effects were demonstrable primarily for skin conductance and heart rate and tended to reduce autonomic activity over time. In the above cited studies, however, the high resting levels were found for both medicated and nonmedicated subjects, and especially for chronic patients. Depue and Fowles (1973) drew the conclusion that chronic schizophrenics are overaroused in terms of electrodermal activity (skin conductance). Few studies to date have looked at arousal in schizophrenics without the confound of large amounts of institutionalization.

The differences between schizophrenics and normals tend to be greatest at resting levels, and normals may show a greater reaction to stressful stimuli (Crooks & McNulty, 1966; Fenz & Velner, 1970; Van Zoost & McNulty, 1971). The latter two studies indicated that reactive schizophrenics were more similar to normals than process schizophrenics on some measures. Unfortunately, in both of these studies, the designation of schizophrenia was again confounded with chronicity, with the process groups being far more chronic than the reactives. Bernstein et al. (1980) suggest that chronic's underresponsiveness may be due to the lack of specificity in the stimuli used. They found that increasing the significance of the task increased their vigilance and decreased their hyporesponsiveness. If schizophrenics do show a lesser physiological increment in stressful situations, it may also be due to a ceiling effect (Schmolling & Lapidus, 1972)--there is simply less room for change as arousal is already so high. In addition, arousal in a resting state may be high, as Magaro (1973) notes, because schizophrenics are not in a true "resting" state in the laboratory, but are threatened or overstimulated by the novelty of the situation.

It seems that some schizophrenics are in a state of general overarousal, but this conclusion does not represent the whole picture. Arousal may vary between subclassifications of schizophrenics. For example, nonparanoid patients may be more aroused and less able to habituate to stimulation than paranoids (Berkowitz, 1981). Using galvanic skin response (GSR) as a measure of arousal during a nonstressful habituation task, Rubens and Lapidus (1978) found that schizophrenics (both inpatients and outpatients) could be divided into overresponders and under-responders in terms of the GSR orienting response. Each of these patterns of arousal was distinct from the non-schizophrenic subjects. Their inpatients were much more chronic than the outpatients (almost twelve years versus just over four months of total hospitalization) and tended to be more severely ill on some measures of pathology (Rubens, Note 2). In this sense, the outpatients were less symptomatic and severely ill than the inpatients, although Rubens hesitates to call them remitted. In addition, Rubens and Lapidus tested all subjects after a six week delay and found that some subjects changed their response (about 25%) into the opposite pattern. The authors used these results to suggest that the schizophrenic is deficient in dealing with stimulation, whether it is internal or external in origin. The two modes of arousal were thought to be attempts to modulate stimulation and the changes over time were seen to represent an attempt to compensate for this deficit. This idea is supported by the finding that more of the outpatients (8/20) were changers than were inpatients (3/20). It is possible that the outpatients in this study were more intact and making more effort to cope with their deficits.

Rubens and Lapidus (1978) also suggest overresponders reacted to a normal range of stimuli as though they were all potential danger signals. This category sounds suspiciously like paranoid schizophrenia, although they did not investigate or suggest this category. Caution should be exercised on this point, however, as Neale and Oltmanns (1980) note that the physiological responder/nonresponder distinction has not been shown to be related to tradit-ional subgroupings of schizophrenia.

Several recent studies (Straube, 1979; Zahn, Carpenter & McGlashan, 1981) have recognized the need to assess physiological responding in acute schizophrenics. Straube demonstrated that acutely symptomatic subjects show a high proportion of nonresponders in terms of skin conductance. Zahn et al. found schizophrenics to have a higher heart rate and skin conductance fluctuation than normal, but a decreased response to several tasks (rest, mild tones, reaction time and mental arithmetic). In addition, Straube compared medicated and nonmedicated schizophrenics and found no differences in terms of nonresponders versus responders, but did find that those on medication tended to have lower skin conductance. Thus, these two studies appear to have fairly similar results to those noted above with chronic subjects; acute schizophrenics may have higher resting physiological levels of heart rate and skin conductance, but less response to certain tasks.

Iacono (1982) compared remitted schizophrenics to normal subjects on heart rate and electrodermal response. Similar to Straube's study, there were a surprising number of skin conductance nonresponders in the remitted group, but no differences in terms of heart rate. Thus, it is possible that heart rate is differentially affected by episodes, whereas skin conductance is not. This speculation, however, is an unanswered question at this time, as no study prior to the present one has assessed physiological responding comparing groups of remitted and episodic schizophrenics. This comparison was one of the aims of the present study.

Cognitive Appraisal and Coping Strategies: Past Research

Very few studies have investigated cognitive factors related to anxiety in schizophrenia--such as how the schizophrenic interprets his/her arousal, how subjectively anxiety arousing he/she rates the situation and how he/she copes with arousal. The only research to date to specificially compare schizophrenics' ratings and arousal has been that of Shean (Payne & Shean, 1975; Shean, 1982; Shean, Faia & Schmaltz, 1974; Shean & Faia, 1975).

Shean (1982) views the thought disorder present in schizophrenic episodes as a defensive manouvre to control responses to stressful, threatening situations. He suggests that nonparanoid schizophrenics may withdraw and avoid focusing attention externally because not to do so would result in increased arousal and stress; whereas the paranoid schizophrenic may utilize coping strategies or defenses such as projection, involving focusing their attention in a particular way. This hypothesis depends on intact selective attention in paranoid subjects, as they are presumed to have the ability to control where in the environment their attention is concentrated. In a dichotic shadowing task, paranoid schizophrenics were able to attend to material that was related to their delusions (Schneider, 1976). The results imply that the information related to delusions affects the paranoid schizophrenic in a similar way to information which normals consider to be important. Straube and Germer (1979) also found no deficit in schizophrenics on a dichotic task with relevant affective stimuli for all groups, unlike Schneider's task, where the information was only relevant to the paranoids. Paranoid patients, therefore, may appear to be inattentive to certain aspects of the environment because they are scanning for information that they consider to be relevant and potentially threatening. This idea is quite similar to Silverman's (1964) theory. He hypothesized basically that paranoid schizophrenics cope with their internal arousal by being hypervigilant, excessive scanners and nonparanoid schizophrenics cope by focusing attention internally and minimally scanning the environment.

These hypotheses were given support by Shean, Faia and Schmaltz (1974). This study attempted to look at the patterns of cognitive appraisal in paranoid and nonparanoid schizophrenics. Stressors (e.g. slides of homocide victims, white noise) were administered to the subjects, while physiological recordings were taken and stress ratings made by the subjects. The paranoid subjects tended to deny (underrate) their physiological anxiety, whereas the nonparanoid subjects tended to overrate their physiological responses by reporting to be disturbed by all stimuli. According to Shean et al., the results indicate that the paranoid group was overcontrolled with a rigid cognitive structure, while the nonparanoid group appeared to be deficient in cognitive strategies and control of feelings.

Payne and Shean (1975) again found that paranoids underrate their responses and this tendency increased over trials, however, the normals and not the nonparanoids tended to overrate. One problem with both of these studies is that there were group differences in chronicity which potentially could account for the results. The nonparanoid groups were both considerably more chronic than the paranoids. The correlations between hospitalization and ratings indicated that the longer the paranoids were hospitalized, the more they underrated. It appears that the length of hospitalization may have accentuated the paranoid-nonparanoid differences in this study.

Shean has attempted to compare subjective appraisals of anxiety to physiological anxiety in terms of overraters and underraters. What may be unique to schizophrenic arousal may therefore not necessarily be the absolute level, but the interpretation of the arousal and the subsequent attempts at coping with it.

Cognitive Appraisal and Coping Strategies: Neufeld's Model

A recently proposed model of stress and psychopathology (Neufeld, 1982a) can be seen to be related to the above ideas. Neufeld has hypothesized a decisional model of anticipatory stress, formulated according to mathematical expectancy theory, which is aimed primarily at appraisal of available coping resources. When a person is making a decision about coping with a situation, a number of variables must be taken into account, such as whether entry into the situation is optional or not, the perceived likelihood of it being stressful and the perceived severity of the stress. The expected stress (E(stress)) in a situation is thus an appraisal based upon these variables.

This formulation can be related to psychopathology in two ways. The first of these involves the content of the judgments. If a person tends to anticipate negative outcomes and severe stress, he/she is likely to have a high value of E(stress). This judgment, could in turn, be related to the depressive's pessimism and feelings of hopelessness.

The second way of relating this formulation to psychopathology involves the availability or efficiency of the judgments irrespective of content. An individual who has a decreased capacity to process and synthesize information, for example, associated with schizophrenia, will probably have difficulties making stress related judgments as well. This initial difficulty would be related to making the judgments regarding the components of E(stress). A deficit may be evident particularly when processing demands are greatest (Neufeld, 1982a) as increased strain is placed upon the limited capacities of the individual.

Following a judgment of E(stress), which involves a synthesis of available information, is the formulation of a decision regarding what to do about the stress, or the propensity or reticence to engage in coping behavior. In this model, the decision is made by comparing the relative merits (or stressfulness) of engaging in counter stress activity versus no counter stress activity:

$$\frac{E(\text{stress}) \mid \text{counter-stress activity}}{E(\text{stress}) \mid \text{no counter-stress activity}}$$

Thus, the stress expectancy given counter-stress activity is compared to the E(stress) given none. Active coping is simply defined as the propensity to engage in counter-stress activity. The tendency to cope using counter-stress activity is expected to vary inversely with the size of the ratio--therefore, a higher numerator would lead to passive coping and vice versa. The closer the ratio is to 1.0, the more difficult the coping decision is to make and therefore stress arousal should theoretically increase due to decisional uncertainty. Arousal should also covary with the smaller component of the ratio--as the smaller term increases, stress arousal should commensurately increase. This covariation assumes that subjects are somewhat aware of these ratio values and what they predict in terms of behavior. Consequently, arousal should be more influenced by the most likely behavioral option--either passive or active coping. Obviously, inefficiency in carrying out initial judgments of E(stress) would have implications for decisions regarding coping behavior as well. For example, the behavior chosen may be quite inappropriate to the actual situation. If the judgments themselves are eroded, so is the ratio purportedly associated with coping propensity, resulting in impoverished estimations. The resultant behavior may be selected virtually in the absence of judgments. In this case, the coping decision may not be effective in reducing arousal.

Past research (Nielson, 1982) has found the overall ratio to correlate .85 with performance scores on a reaction time stress-avoidance task using undergraduate subjects. This value exceeded the corresponding correlations for each component of the ratio separately, thus the ratio was more useful in predicting behavior than either prediction by itself.

This model has the advantage of being readily testable and potentially useful in explaining diverse types of coping behavior. It seems likely that the model is idealized as there are likely to be sources of unexplained variance due to other components such as motivation, affect, and so on, not included in the model. The main uses of the ratio include the possibility of quantifying relations among its constituent constructs and the specification of the antecedent experiences of the subject and the stimulus properties determining the component values.

The Relationship between Neufeld's Model and Schizophrenia

For schizophrenics, there are several possible results of lower efficiency in cognitive appraisal (Neufeld, Note 3). First of all, cognitive deficit may result in increased deficiencies in detecting, encoding, and interpreting stress relevant environmental cues. This deficit would have the effect of inefficient appraisal of the stimuli and available coping options (Lazarus & Launier, 1978). Inefficient appraisals would, therefore, adversely influence judgments of E(stress). As well as inefficient appraisal, schizophrenics may have decreased access to information regarding coping options or "counter-stress activity". They may have difficulty in synthesizing the available information into formulated predictive judgments as well as potentially less information at hand, such as the advisability or inadvisability of coping activity. In addition, these consequences do not take into account the possibility that stress arousal may additionally exacerbate the necessary operations for cognitive appraisals, resulting in even lower efficiency. Thus, this model may well be a multiplicative one (Neufeld, Note 3).

It must be recognized that the specific sources of schizophrenic inefficiency in synthesis and formulation of a decision may be numerous and complexly related. Identifying these relationships is beyond the scope of this project; at this stage, a more general approach will be taken. The present study was aimed at the aspect of inefficient cognitive appraisals and the resulting coping decision and arousal as a function of stress.

Given that paranoid schizophrenics tend behaviorally to be hypervigilant, excessive scanners and have been shown to underrate their arousal (Payne & Shean, 1975; Shean, Faia & Schmaltz, 1974; Silverman, 1964), they may have a high propensity to engage in coping behavior (active coping) as a means of decreasing anxiety. Because paranoids have been shown in some research to be less efficient processors than nonparanoids (see following section), their subjective stress expectancy ratio may be even more eroded than nonparanoids, possibly increasing anxiety further. It is also possible that if the paranoids are less able to process information, they may "regress to the mean", which could lead to more equality in the ratio and also greater possible arousal associated with decisional uncertainty as the ratio approaches 1.0. If there is greater anxiety and indecision, it is not clear at this point what the outcome would be, however, if the paranoids' typical method of dealing with arousal is vigilance, they may tend towards active coping.

Nonparanoids, on the other hand, with their behavioral withdrawal and demonstrated overrating (Shean, Faia & Schmaltz, 1974), may have a propensity towards more passive coping responses. Nonparanoids could potentially have a lack of coping strategies available to them, hence may be more prone to increased arousal when engaging in active coping and consequently may withdraw. Whether or not these hypotheses would be borne out in schizophrenic's predictions is an unanswered question at this point. Paranoid schizophrenics may have less efficient anticipatory appraisals and more effective coping resources pertinent to a lessening of anxiety, whereas nonparanoids may show the opposite pattern. This hypothesis is, admittedly, a highly speculative one. If the subjective stress expectancy ratio is eroded in both paranoid and nonparanoid schizophrenics because they are less able to synthesize its components, a decisional uncertainty may result again and by default, passive coping may be the option taken, simply by a lack of choice:

> Because formulation of these values would be deficient, so would formulation of the inequality in expectancy values (i.e. values corresponding to ratings less than 1) associated with the propensity to engage in counterstress activity. (Neufeld, 1982a, p. 266)

This argument applies to both groups of episodic schizophrenics, but may be more true of the paranoids, if they have a reduced processing ability.

The judgments of remitted schizophrenics have not been investigated as yet, however, it seems probable that their predictions are likely to be more closely attuned to their actual behavior than are either those of episodic paranoids and nonparanoids. Their judgments may bear closer resemblance to their actual coping behavior and to their subjective and physiological arousal. This correspondence may be related to the likelihood that they are supposedly dealing more realistically with their environment as they are out of hospital and may not be experiencing as much coping failure as someone who is actively schizophrenic. In addition, they do not have the symptoms of active thought disorder and/or hallucinations to deal with. It is also possible, however, that because they are dealing with a more demanding environment (e.g. in terms of employment, interpersonal relationships, etc.), the remitted schizophrenics may be experiencing as much or even more coping failures than their hospitalized and more sheltered counterparts. In this case, their judgments may be more realistic, but they could tend towards more passive coping responses.

In the present study, probability judgments concerning an upcoming trial involving a potential stressor were made in terms of the two components of the above mentioned ratio (e.g. "What are the chances that the stressor will continue if you <u>do not</u> do your best to try to stop it?", and "What are the chances that the stressor will continue if you <u>do</u> your best to try to stop it?") These two judgments refer to the passive and active components of the ratio, respectively. The judgments made it possible to assess the expectancy values both separately and in ratio form in terms of predicting behavior. In addition, degree of anticipated anxiety was measured prior to a stressor situation. These judgments were assessed, as well as coping behavior, physiological anxiety and rated anxiety during the stressor task. All subjects, thus, made predictions and were then exposed to a stressor stimulus. In order to measure physiological arousal, skin conductance, heart rate and muscle tension were recorded throughout the procedure.

Schizophrenics have been shown many times over to have difficulty in making perceptual or cognitive judgments, although seldom have they been required to engage in stress related judgments. Gillis and Blevens (1978), for example, found that both paranoids and nonparanoids had difficulty using external criteria to make complex judgments, but for different reasons. The paranoids showed poorer task knowledge (defined as "the extent to which an individual's cognitive system is isomorphic with the environmental task" p. 587), but no deficit in cognitive control ("the consistency with which such knowledge is implemented" p. 587). The nonparanoid patients demonstrated the opposite pattern. The authors hypothesize that the nonparanoids cannot effectively implement what they know about the environment, while paranoids are capable of implementing strategies but evaluate the situation incorrectly. This interpretation is similar to the present hypothesis of inefficient paranoid appraisals and nonparanoid lack of coping strategies (specifically, in comparison to each other, rather than to normals). Paranoid schizophrenics may proceed making judgments using subjective criteria other than the ones provided by the environment or the experimenter (Dobson & Neufeld, 1982;

McCormick & Broekema, 1978). In the latter study, the paranoids used a "jump to conclusions" response strategy in making perceptual judgments about ambiguous stimuli. Neither the nonparanoids nor the controls responded like this--they tended to show a more sequential development of their judgments. The paranoids tended to respond suddenly and impulsively. It is possible that this is how paranoids cope with other types of stimuli as well--a decision is made quickly and unsystematically, but may be tenaciously held onto once made. On the other hand, it must be kept in mind that because of a degraded ratio and the consequent uncertainty due to this deterioration, there may be a reduced propensity to actively cope.

Complexity of judgments is another relevant issue. Schizophrenics have long been shown to have difficulty with more complex tasks, while at times they are little different from normals when performing simple tasks (e.g. Dobson & Neufeld, 1982). This result has also been demonstrated with the previously discussed span of apprehension task (Neale, 1971; Neale et al., 1969), with number of distractors serving as complexity. By varying levels of intensity of the stressor task stimuli (using white noise of differing levels of loudness), it was possible to assess whether schizophrenics had trouble coping with all or only some levels. Increasing intensity may increase the coping demands placed upon the subject in a similar way as increased complexity increases cognitive demand. Obviously, it must be recognized that increased stress intensity is quite different than complexity. However, schizophrenics may be able to cope with a low stress level, but not a high one. Coping in this context refers to the subject's propensity to engage in active or passive coping as well as "stressor impact" (ratings of anxiety and physiological parameters immediately following stimulus offset).

Schmolling and Lapidus (1972) state that task complexity is significant, as schizophrenics may find many tasks complex, thus increasing their anxiety in that situation. This anxiety in turn, if too high, causes their performance to deteriorate, suggesting why schizophrenics are poorer than normals on so many differing tasks. They indicate that it is important to look both at the complexity of the task and the arousal of the subject. If schizophrenics find an attentional task very difficult and are highly aroused, they may have a greater deficit. Consequently, physiological recordings, predictions and ratings were taken during the letter detection task as well as during the stressor task. These measures made it possible to assess how the subject's arousal corresponded with ratings of difficulty for both of the tasks. Because remitted patients have shown attentional deficits when free of symptoms, it does appear unlikely that an iconic processing deficit is due to a generalized poor performance and arousal alone.

In a way, the attentional and stressor tasks can both be conceptualized as stressors, in that both were making performance demands upon the subject in this study. Cognitive appraisals were required in both situations, and both tasks were new and demanding for the subject. The letter detection task could be interpreted as being more cognitively stressful or demanding, whereas the stressor task may have been more threatening in other ways, to be detailed further in a later section. An attentional deficit, however, was hypothesized to be specific to schizophrenia, in that it may be found over all developmental phases and subtypes of the disorder; whereas the stressor task was not presumed to be specific to schizophrenia, but was a situation which most persons would find anxiety arousing.

Thus, the letter detection task was not being conceptualized as a stressor in the present study, however, some similar appraisals and physiological recordings were measured during this task, primarily to see if the schizophrenic's general level of anxiety was high, as Schmolling and Lapidus (1972) might predict. These variables also made it possible to make a comparison between the letter detection and stressor tasks.

Methodological Considerations

A recent review of some of the methodological issues in research on schizophrenia has been presented by Neufeld and Broga (1981). The considerations that are most germane to the present study are discussed briefly below.

Psychometric Inequalities

Much recent attention has been paid to the problem of psychometric artifact in the measurement of schizophrenic "differential deficit" (Chapman & Chapman, 1973a; 1973b, 1978). Differential deficit refers to "a greater loss in one ability than in one or more other abilities" (Chapman & Chapman, 1973b, p. 380) as opposed to a more "generalized deficit". This deficit, then, is measured by the comparison of two or more tests. Unfortunately, as the Chapmans point out, the different tests may not be equal in psychometric properties, thus obscuring true differences in ability which may or may not exist in the subjects. For example, schizophrenics generally have been found to have better recognition than recall memory (Bauman, 1971; Bauman & Murray, 1968; Koh, 1978), however, recognition tasks also tend to be intrinsicially easier than recall ones. Because a recall task may have a better discriminating effect, group differences may be artificially magnified.

Chapman and Chapman strongly suggest the use of matched tasks to alleviate this problem. One task should be a specific test of the hypothesis under consideration, while the other should be a control for generalized deficit (as opposed to differential deficit). These two tasks should be matched in advance on a normal sample in terms of the psychometric properties of difficulty, variability and reliability. Psychometric theory also states that the higher the reliability and variance of a test, the greater its discriminating power will be. All other things being equal, items of a 0.50 difficulty level will be the most discriminating.

There are a number of problems with the use of the procedures advocated by Chapman and Chapman. One significant difficulty is that in many areas, it is not clear what an appropriate control task should be. If a task is found, for example, to make difficult items more discriminable, many other aspects of the procedure may be changed and the study may be rendered theoretically meaningless or unclear (but psychometrically sound). This problem is true of the span of apprehension procedure (Neale & Oltmanns, 1980), as equating conditions with differing number of distractors for discriminability will probably also equate them in terms of difficulty level as well. As noted earlier, investigating group differences at various levels of difficulty was one of the aims of the present research. Consequently, the process of matching may produce more problems than it solves.

Neufeld and Broga (Note 4; 1981) discuss several difficulties inherent in the Chapman's arguments. They point out that the Chapman's main concern is with reliability of measures and between subject variance (which correlate quite highly, Chapman & Chapman, 1978)--as the higher the reliability of a test, the better it will discriminate between persons with differing true scores. They state that while this principle is appropriate for discriminating individuals, it may not be where subjects are divided a priori into groups (e.g. schizophrenic/nonschizophrenic). Through the use of Chapman and Chapman's own data, they show how increasing test reliability may lead to decreased discriminability of between group differences. Essentially, this finding is due to the possibility that increased reliability may cause individual differences to be pronounced, increasing within group variance. As this variance increases, the power of the statistical test for detecting between group differences may also be decreased, especially if there is no equal increase in between group reliability or sensitivity. It appears that the use of matched tasks is a most complicated and unclear procedure, which is most appropriate for the detection of individual differences.

Another important contribution that Neufeld and Broga (1981) make is the distinction of "critical deficit" from "differential deficit". Whereas the latter concept refers to the absolute magnitude of a particular deficit; the former is the importance of this deficit according to its effects on the individual's transactions with the environment. For example, schizophrenics may have a specific area of information processing deficit which is relatively minor compared to normal subjects' performance, but when the person is interacting, these effects may be compounded many times. It seems likely that this point may be especially applicable in the area of stress and schizophrenia.

Taken together, the concepts of psychometric matching and critical deficit may at times be conflicting, especially when difficulty levels are being manipulated. According to Chapman and Chapman's point of view, it is extremely difficult to research tasks of differing degrees of difficulty or complexity as they suggest that the tasks should be equated or that all items should be around the 0.50 difficulty level. Obviously, this criterion would obliterate any differing levels. In addition, modifying a task to make it more psychometrically sound may result in it not assessing a critical deficit. Neufeld and Broga (1981) state:

> The researcher may wish to maintain naturally occurring inequalities in task characteristics bearing on sensitivity to disorder-affected abilities in order to preserve the ecological validity of results. Certain underlying deficits in abilities may be less critical than others of equal or lesser magnitude if the tasks in which the former abilities participate are relatively insensitive to the corresponding deficits. (pp. 576-577).

Taking all of the above arguments into consideration, psychometric matching was not done in the present study.

It is not clear what an appropriate control task would be for either the letter detection procedure or the stressor task. The present approach, thus, utilized the concept of critical deficit, due to the difficulties inherent in psychometric matching as well as to preserve external validity as much as possible. Because variation in differing intensities and difficulty levels is so much a part of the variety of situations encountered in daily life, it is very important to investigate these variables.

Medication

Any research on the schizophrenic process must confront the thorny issue of medication. Most studies that have computed correlations between chlorpromazine equivalencies (e.g. Davis, 1976) and dependent variables have found no significant effects (Dobson & Neufeld, 1982; Neufeld & Bróga, 1981). However, phenothiazines reduce symptoms, so obviously thought disorder is affected. The effects of these drugs on studies of cognitive deficit may be to reduce the number of errors made on various tasks. In a double-blind study comparing the effects of chlorpromazine to a placebo, Spohn et al. (1977) found that the patients on medications performed better than placebo patients on a span of apprehension task. They generally found drug effects for attentional (including reaction time), but not cognitive measures (e.g. abstract reasoning). They also found effects for arousal indices including heart rate and skin conductance in the direction of deactivation. These effects tend to be in the opposite direction of the current predictions (i.e. greater number of errors, increased arousal in certain situations), so, if anything, continuation on medication could reduce the likelihood of finding significant results.

Braff and Saccuzzo (1982) confirmed this result with their backward masking test of speed of information processing. They found that both medicated and nonmedicated schizophrenics had a deficit compared to depressed controls; the medicated schizophrenics, however, tended to be faster than the nonmedicated ones.

Bohannon, Strauss and Wagnon (1982) compared nonmedicated to medicated outpatient schizophrenics in a study of reaction time. It is not clear whether or not their subjects were in a period of remission at the time of testing. They tended to have poor premorbid adjustment, but their current level of functioning was not reported. In addition, one quarter of the sample were schizo-affective, a group which is ideally not included in studies of schizophrenia due to a major influence of affective symptoms. Regardless of the problems inherent in their sample, these researchers found no reliable differences between medicated and drug free schizophrenics, although the patients receiving phenothiazines tended to be non-significantly slower than the others. This result is at odds with the Spohn et al. study, possibly due to differing samples.

Schizophrenics' true performance is no doubt obscured by the use of phenothiazines and it is not known specifically in many cases what these effects are. There are, however, considerable problems inherent in withdrawing patients from medication. Patients who are withdrawn tend to be chronic (Neufeld & Broga, 1981), those who relapse after being withdrawn are removed from the study and more actively psychotic patients are probably not included at all, thus the sample eventually obtained is a biased one. Spohn and Fitzpatrick (1980) present results which indicate that informed patient consent and ward staff consent are sources of bias. They found that the poor premorbid, less socially competent patients with a shorter period of illness tended to consent to drug withdrawal most often.

The costs to the patient must be compared to the research benefits of drug withdrawal for any given study. When one considers that relapse is almost inevitable in patients who are withdrawn from medication (Spohn & Fitzpatrick, 1980), the costs are potentially quite high. In the Spohn et al. (1977) study, 23/63 patients were withdrawn from the study during the initial washout phase, primarily due to relapse. In the current study, therefore, no attempt was made to withdraw patients from medications. As in past research, the effect of medication was considered by investigating its correlations with dependent variables.

The Remitted/Episodic Distinction

If schizophrenia is presumed to be time limited and episodic, how does an investigator determine whether an individual is in an episode or not? Obviously, being hospitalized is not indication enough, as many patients probably remain in hospital once an episode is past for a variety of reasons (e.g. having no place to go, no one has noticed that the episode is past) and there are probably many symptomatic schizophrenics who are not hospitalized.

The problem of defining onset and offset of episodes is discussed by Spring and Zubin (1977). They suggest, as previously noted, that coping changes may be a good indicator. This hypothesis may in fact be true, but with the current state of the knowledge, these changes can only be studied and not used as criteria of episodes. Studying these changes was one of the goals of the present study.

The presence or absence of symptoms seems to be the best potential discriminator. While it is extremely difficult to say exactly when symptoms begin or end, it is possible to determine whether there is a relative absence of symptoms. For this reason, only remitted patients who had been out of hospital for at least three months and who remained out of hospital for three more months following testing were used. Assessment procedures were utilized to investigate current symptomatology. It was predicted that the symptom picture of remitted subjects would differ from the hospitalized sample as well as from the normal sample, the latter differences being due to their competency levels and history of being institutionalized, as well as residual effects of the schizophrenic process.

Summary and Predictions

In the current dissertation, potential "markers" of the trait of vulnerability to schizophrenia and the state of illness were investigated. In order to assess these markers, currently ill schizophrenics were compared to remitted subjects not in an episode of illness. As remitted subjects are not currently ill, they should differ from nonremitted patients in terms of episode variables. It was postulated that a letter detection deficit remains stable across remitted and nonremitted subjects, thus may be a "marker" or indirect correlate (as opposed to a more direct measure) of vulnerability. Thus, all groups of schizophrenics were hypothesized to show reduced letter detection ability compared to normals and this reduction may be particularly evident with an increased number of distractors. Because so few studies have compared remitted and episodic schizophrenics, it was possible that other vulnerability "markers" could be suggested by the present study, such as certain aspects of the physiological measures or reaction time.

It was hypothesized that the trait of competence is orthogonal to vulnerability; the state of coping, however, which is influenced by, but not the same as, competence may be a potential marker of episodes. A decline in the ability to subjectively appraise stressful situations and to cope with them may be an episode marker. Thus, differences in appraisals and coping may distinguish remitted and nonremitted subjects. Remitted schizophrenics may have a greater capacity than episodic patients to make more realistic judgments about stressful situations and may be more able to predict their reactions to them. It was also possible that episodic schizophrenics could be more aroused due to their illness, thus showing greater physiological responses and reduced capacity to make judgments and cope.

The relationship between social competence, coping and symptomatology (paranoid/nonparanoid status) was also under investigation. While research has found some differences between paranoid and nonparanoid subjects in terms of social competence, no one has researched how these variables are related to coping or to the remitted/nonremitted dimension. Based upon the previous findings noted in the section on <u>Competence and Symptomatology</u>, paranoid subjects may have a higher social competence score than nonparanoids; but remitted and episodic patients may not differ from each other. In addition, subjects with higher levels of competence, as assessed by the Zigler-Phillips measure, particularly remitted patients, may be more able to realistically appraise how anxious they think they will be in a situation, how difficult they think they will find it and so on. This hypothesis suggested that the predictions of more highly competent and/or remitted patients may be more closely correlated with their actual performance than the predictions of the less competent and/or episodic patients.

The differences between paranoid and nonparanoid schizophrenics on the stressor task were difficult to predict due to the lack of past research in the area. Paranoids may tend towards more active coping; nonparanoids towards passive, but this hypothesis must be qualified by the statements made previously in the sections on Cognitive Appraisals and Coping Strategies.

METHOD

Subjects

Episodic schizophrenics were selected from the inpatients of London Psychiatric Hospital; remitted schizophrenics from the Schizophrenic Outpatient Clinic at the same facility and normal subjects from Canada Manpower, London, Ontario.

All schizophrenics, both episodic and remitted were divided into paranoid and nonparanoid groups based upon the Maine Scale of Paranoid and Nonparanoid Schizophrenia (Magaro, Abrams & Cantrell, 1981), which can be administered verbally or obtained through hospital records (Magaro, Note 5). Remitted patients, therefore, were divided into paranoid and nonparanoid groups on the basis of their Maine Scale scores during their previous hospitalization. This information was collected and scored by two raters independently. Interrater reliability for both the interviews and records was calculated and found to be high (records- Paranoid scale, r=.925; Nonparanoid scale, r=.819; interviews- Paranoid scale, r=.964; Nonparanoid scale, r=.972). Remitted patients' current status on this scale was also assessed. Foulds '(1965) Symptom Sign Inventory (SSI) and the Gordon and Gregson (1970) modified SSI paranoid-nonparanoid scale were also administered to all subjects as an additional check for the paranoid/nonparanoid categorization, as well as to assess the current status of the psychiatric inpatients with respect to the "personal illness-normal" and "psychotic-neurotic" scales of the SSI (in accordance with past studies in this laboratory). To select the most similar group of remitted patients to compare to the inpatients, information as to the status of the patient when ill and at present was obtained from the chart and the attending psychiatrist (See Appendix A). The outpatients were administered the above scales to determine whether or not they were currently symptomatic. If they were relatively symptom free, they were included in the study, provided they met the other criteria detailed below.

To be eligible for participation, normal subject's scores on the "personal illness-normal" scale of the SSI and the Maine Scale had to fall in the normal ranges. For a pictoral representation of the multiple assessment criteria which each subject was required to meet, see Figure 3.

The Zigler-Phillips (Zigler & Levine, 1973) revised scale of social competence was assessed using age, education, marital status, occupation, employment history and intelligence as items. Schizophrenic subjects were excluded from the study if their cumulative amount of hospitalization (excluding leave of absence periods) was greater than three and a half years. Other exclusion criteria included: electroconvulsive therapy in the six months prior to testing, evidence of brain damage, alcoholism or drug addiction taken from the hospital records. Only subjects between eighteen and forty five with a meas-

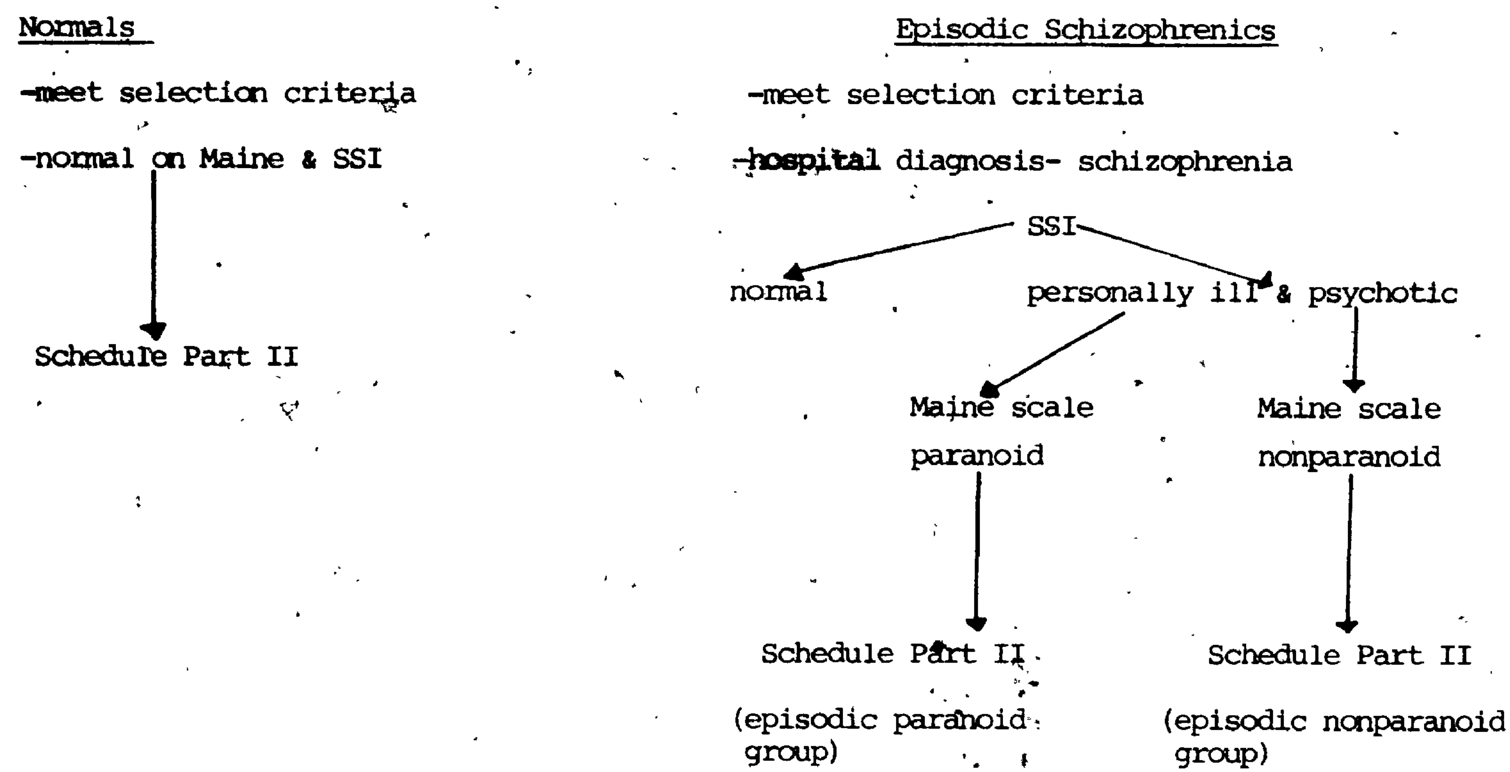

Figure 3: Subject Selection Criteria (normals and episodic groups)

Remitted Schizophrenics

-meet selection criteria

-similar to patient group at time of illness.

-diagnosis- remitted schizophrenia

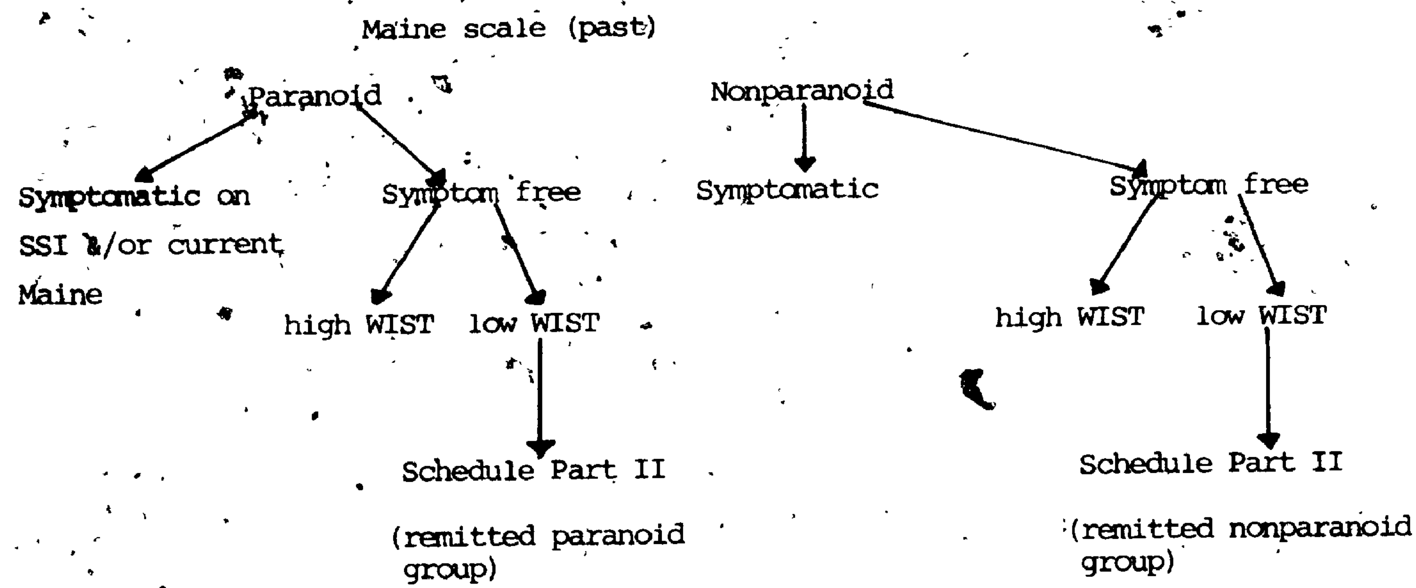

Figure 3: Subject Selection Criteria (remitted groups)

ured IQ of at least 80, and with normal corrected vision were tested. The groups were balanced with respect to sex, with equal numbers of males and females in each (eleven and three, respectively). Former psychiatric contact served as an exclusion criteria for the normal sample. Only remitted subjects who had been out of hospital for at least three months were approached. In addition, these groups were followed up for three months past the date of testing. Only one patient (from the remitted paranoid group) was readmitted during this time, for three days only and with no apparent psychotic symptoms. For the schizophrenic groups, chlorpromazine equivalencies (Davis, 1976) were computed. For drugs not included in Davis (1976), Lehmann's (1975) and Lehmann's (Note 6) conversion ratios were utilized. An estimate of the remitted patient's average medication when hospitalized was computed using amounts obtained from medical records.

In this study, the socioeconomic levels, age and IQs of the sample were not explicitly equated between groups because to match the groups on these variables would also match them on social competence scores. The investigation of naturally occurring differences in social competence was one of the goals of this study.

Thus, fourteen (14) subjects in each schizophrenic group, and 28 in the normal group (N=84) were assessed using the:

1) Maine scale- Two scores were obtained for each remitted patient, past (from records) and current (from interview). The past rating was used to assign the subject to a group, while the present one was an assessment of current symptom status.

2) Symptom Sign Inventory interview, including the Gordon and Gregson scale.

3) Zigler-Phillips social competence scale.

4) WAIS-Clarke Verbal Intelligence test (Note 7). Two scores (past, which was obtained from hospital records, and current) were acquired for each remitted patient.

5) Whitaker Index of Schizophrenic Thinking (Whitaker, 1973).

Psychometric Measures

The Symptom Sign Inventory (SSI) was developed by Foulds (1965) and is administered individually in a structured interview format. It is objectively scored according to scales ranging from normality to personal illness, psychosis to nonintegrated psychosis and non-paranoid and paranoid schizophrenia. Its utility, in conjunction with Gordon and Gregson's (1970) weighted items, has been demonstrated in a number of studies of paranoid/nonparanoid schizophrenia (Broga & Neufeld, 1981a; Korboot & Damiani, 1970; Neufeld, 1975; 1976; Yates & Korboot, 1976).

The Maine Scale (Magaro, 1981; Magaro et al., 1981) has recently been developed as another tool to distinguish paranoid and nonparanoid schizophrenics. It is also administered in a structured interview format and partially overlaps with the SSI. Its two advantages are that the item scores can be obtained from hospital records and it has a more finely graded index of the severity of paranoid and nonparanoid symptomatology. Its test-retest reliability (over a four day period) ranged from .74 to .76, which is acceptable and it correlates from approximately .43 (nonparanoid) to .70 (paranoid) with the appropriate scaled values of the SSI.

A test for the presence or absence of current thought disorder was given (Whitaker Index of Schizophrenic Thinking; Whitaker, 1973). Whitaker has developed, standardized and validated this test to measure the severity of thought disorder. This instrument is brief and has the advantages of being easily administered and objectively scored.

There are two forms of the test, A and B, which are identical except for the items presented. Form A consists of emotionally tinged items, whereas B does not. Because acute schizophrenics tend to have higher scores on Form A (Whitaker, 1973), this version was utilized in the present study. In Whitaker's study, Form A (using a total score of 20 as a cutoff) correctly identified 80% of hospitalized schizophrenics. Thus, in this study, remitted patients were excluded if their score on this test exceeded 20.

The WAIS-Clarke questionnaire (Note 7) is a multiple choice version of the WAIS vocabulary test. The WAIS vocabulary is a good estimate of overall intelligence, and has been found to correlate at a .920 level with the WAIS-Clarke (Paitich & Crawford, Note 7).

The Zigler-Phillips measure of social competence is based upon six variables (age, education, marital status, occupation, employment history and intelligence) which are thought to be indicative of an individual's cognitive, interpersonal and social functioning (Zigler & Levine, 1981). This index has been shown to be reliable--the average inter-judge agreement in patient categorization is .99 (Zigler & Levine, 1973). The measure is thus easy to administer and is a relatively reliable measure of the effectiveness with which the person has dealt with societal demands (education, occupation, etc.). As suggested by Zigler & Levine, the Dictionary of Occupational Titles (1965) was utilized in order to categorize occupations.

General Procedure

After potential candidates were selected according to the above criteria, the patient was given general information regarding the study, asked to volunteer and informed consent was obtained (see Appendix B). Subjects were tested individually on verbal and written questionnaires for approximately 45 minutes.

If the subject fell into an appropriate category once the tests were scored, the second session was scheduled. The second session lasted approximately one hour and consisted of the letter detection and stressor tasks administered in random order. In this session, first of all, subject instructions were given and questions answered. The physiological recording apparatus was then attached to the subject, the polygraph calibrated and the subject relaxed and habituated to the situation for approximately ten minutes. Both tasks were preceded by several practice trials, so that the subject became familiar with the requirements of the study and some of the stimuli.

Following the two tasks, the subjects were debriefed and given additional information about the study. Any questions were answered. Careful questioning was done by the experimenter to see if the subject was upset by any of the procedures; finally a questionnaire (Appendix C) was completed to ensure the subject had understood the purpose of the study and to allow him/her to indicate his/her feelings about it. All subjects were then paid for their participation.

Physiological Measures

Heart Rate Heart rate was monitored by a Grass Model 7D polygraph, in conjunction with an EKG Tachograph. Beckman skin electrodes (10 mm in diameter), applied with Beckman Electrode Electrolyte gel, were placed on either side of the heart (one on each forearm) and a ground clip on the right earlobe.

Scoring for all physiological measures was done in five second intervals: baseline (Time 1) was just prior to the stimulus onset and the second (Time 2) was just following stimulus offset. Heart rate was scored in beats per minutes as the highest (accelerating) and lowest (decelerating) heart rate in the five second intervals. Primary interest centers on heart rate in this study due to its sensitivity as a measure of stress arousal, particularly in males (who predominated in the sample) (K. Dobson & Neufeld, 1981).

Skin Conductance Skin conductance was measured, using skin electrodes, from the third and index fingers of the subject's nonpreferred hand. The monitoring apparatus was the Grass Model 7D polygraph, using a Model 7P1 Low Level DC preamplifier with a constant current of 20 μA, DC.

Scoring was conducted on the five second intervals described above. At each point the maximum level of conductance was obtained in microhmos according to the following formula:

$$\frac{1}{\text{Resistance in ohms}} \times 10^6$$

Frontalis Muscle Tension This measure was monitored on the polygraph, using two Beckman skin electrodes placed just above the middle of the subject's eyebrows. Muscle tension was recorded as the average .2-second integrated microvolt activity during each five second scoring epoch. This measure was utilized as it has been found to discriminate among stressed and nonstressed normals even when other physiological measures fail to do so and is especially sensitive for female subjects (cf. K. Dobson & Neufeld, 1981).

Procedure

Letter Detection Task

As this aspect of the study was intended to replicate previous findings on the span of apprehension in remitted and episodic paranoid and nonparanoid schizophrenics, the procedure followed was similar to those used in past research (Davidson & Neale, 1974; Neale, 1971; Neale et al., 1969). As in these studies, Estes' (1965) technique for estimating the span was utilized. Using this technique, the subject was required to report which of two letters ("T" or "F") was present in a briefly presented display. The procedure has the advantage of placing less load on memory than Sperling's partial report technique as only one item, rather than an entire row has to be reported. This method provides a formula for estimating the number of items scanned and is expanded upon in Appendix D:

$$d = |2P(C) - 1|D$$

where:

d = the estimated number of letters processed

P(C) = percentage of correct recognitions

D = number of letters in the display

Raw scores were also analyzed, as the Asarnow and MacCrimmon (1978; 1981) studies only reported raw scores.

Following the instructions (see Appendix B), the subject was given six practice stimulus cards to view, each of which were presented approximately twice, so that they were familiar with the task requirements. Then, three blocks of 24 trials each were presented to each subject, for a total of 72 trials. Within each block, there were eight randomly arranged presentations of displays of one, four and eight letters. The stimuli were presented for 70 milliseconds per card, with an intertrial interval of three seconds. As the Asarnow and MacCrimmon studies used 50 millisecond trials, and most of the Neale studies used 70 msecs., a number of subjects in each group received one block of trials at 50 msecs. at the conclusion of the first three.

Stimuli were Letraset Instant Lettering capital letters placed on 3" by 5" white index cards. The displays consisted of one, four or eight letters (zero, three or seven "noise" letters). A "T" or an "F", but never both, appeared once on each card. The noise letters for each card were randomly drawn without replacement from the remaining eighteen consonants. To place letters, an imaginary circle (3¼" in diameter) was located on each card. The target and noise letters were randomly placed in the 12, 3, 6 and 9 o'clock positions, and the remaining letters for the eight letter display were placed halfway between these positions. A sample display is shown in Figure 4. All trials were presented in a two

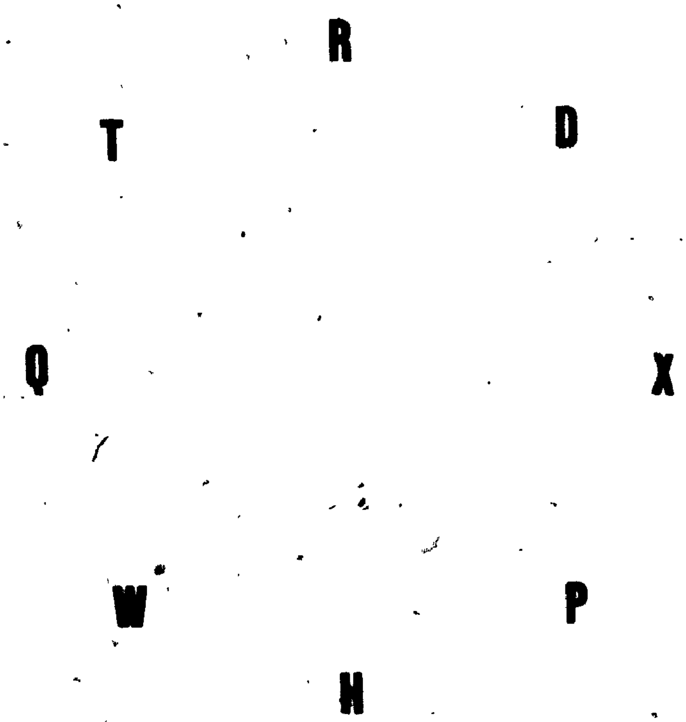

Figure 4 : A sample 8 letter display

field Gerbrands Model G-1125 tachistoscope with .20 foot-lamberts illumination in field one and .18 in field two, as measured by an Optikon 88XL Photometer. Viewing distance was 77 centimeters.

Prior to each block of trials, the subject made two ratings on a scale ranging from 0 to 100. These were:

"How tense or relaxed do you think you will be during the upcoming series of trials?"

"How difficult do you think you will find the upcoming series of trials?"

The subject made a slash on a line 100 millimeters in length, and the ends of each were varied (Very tense, very relaxed; very difficult, not at all difficult) to sustain attention.

Immediately following each block of trials, the subject again made two similar ratings, for a total of twelve ratings overall (four ratings per block times three blocks). The post block ratings were, of course, in the past tense (e.g. "How tense or relaxed were you ...?").

Physiological measures were recorded in the five seconds immediately prior to the trials (after the ratings had been made--Baseline, or Time 1) and immediately following each block of trials (Time 2) as an index of stress arousal level.

The exact procedure for a block of trials was as follows:

Ratings → Physiological Recordings (Baseline) → Trials → Physiological Recordings (Time 2) → Ratings.

There was a two to three minute rest period between blocks of trials.

Stressor Stimulus

There is little precedent for the choice of "stressor stimuli" tasks in the schizophrenia literature. For the present study, relatively high intensity white noise was chosen as a stimulus for a number of reasons. Noise has been used as a stressor for schizophrenia twice before: Van Zoost and McNulty (1971) used white noise at 60 decibels for a duration of 1.5 seconds, given six times. Shean et al. (1974) used a noise of similar intensity given three times for ten seconds each. Lefave and Neufeld (1980) have shown that white noise at 100 decibels delivered for one second is perceived by college students to be subjectively aversive and can be distinguished from less potent stimuli by cardiac and skin conductance reactions. Thus, it appears evident that noise can be experienced as a stressful, but nonharmful task.

Other advantages of noise over a task such as a paced anagrams task include the ability to vary the levels of intensity, hence change the degree of coping or demand required of the subject and the potential for manipulating the active/passive dimension. This manipulation will be discussed below. It was hypothesized that a loud noise may make greater coping demands upon the subject because it may be more aversive than a noise of a lesser intensity. In addition, noise has a discrete onset and offset and can be well controlled, making it easier to assess related physiological changes. The cognitive demands of the task are limited to the appraisal and coping choices, unlike a stressor such as a speeded anagrams task, which has additional cognitive processing requirements (cf. Dobson & Neufeld, 1981). Thus, the stressor stimulus utilized was white noise due to the reasons described above.

Stressor Task

Subjects were instructed that their task was to try to control the length of the noise played through headphones and that this job could be accomplished by tapping their finger quickly. Consequently, tapping speed and reaction time were assessed as measures of performance.

After the instructions were given (Appendix E), each subject had five practice trials with the apparatus, so that they were familiar with the task requirements. They did not hear the differing noise intensities at this time, and baseline reaction times and taps were obtained from the practice. Three noise intensities (60, 67.5 and 75 decibels) were delivered to the subject through stereo headphones for three differing lengths of time (2, 4 and 6 seconds). Nine trials were administered, with one presentation of each length and intensity (3 X 3) in random order. Three different randomizations were utilized and subjects were randomly assigned to one of these.

Prior to each trial, the subject made the following predictions, two of which were probability judgments, and two of which were additional ratings:

1) "What are the chances that the noise will continue if you do not do your best to try to stop it quickly?"

2) "What are the chances that the noise will continue if you do your best to try to stop it quickly?"

These two ratings were made on a scale ranging from .01 to 100%.

3) "How tense or relaxed do you think you will be during the upcoming situation?"

4) How difficult do you think you will find the upcoming situation?"

Following each trial, the subject again made ratings similar to the above, but only on items 3) and 4) and in the past tense (e.g. "How tense or relaxed were you...?") The first two probability judgments formed the predictive components of the coping ratio (passive and active, respectively), while the latter ratings made a pre-post comparison possible, as well as a comparison of rated anxiety and difficulty level of the two tasks. Again, all ratings were made on a 100 millimeter length line.

During a trial, subjects were first of all asked to put their finger on a telegraph key attached to a tapping board when a verbal "Ready" signal was given to begin a trial. Five seconds elapsed, during which time a physiological recording (baseline) was taken.

Noise onset occurred at the same time as a green light (the "Go" signal) was turned on. The subject was instructed that the more quickly he/she tapped their finger ("active coping"), the more likely the noise would be shorter. Thus, by more actively coping, he/she could reduce their exposure to the aversive stimulus.

The noise lengths were preprogrammed; therefore, all subjects received the same amount of total exposure to the aversive stimuli. Three measures were obtained using this strategy: reaction time (or time from the "Go" signal to the first tap), speed of tapping in the first two seconds and overall mean speed of tapping. As the lengths were variable, it was possible that fatigue may change the tapping in the longer trials, thus the two indices of tapping could differ. Tapping recording ceased when the noise on each trial terminated, at which time a red light was illuminated. Noises were pre-recorded on a Sony Stereo tape recorder and subjects used Sony Stereo headphones to listen to the noises. The tape recorder was switched off (out of the subject's vision) between trials. Reaction time and taps in two seconds were recorded on Clock Counters (Lafayette Instrument Co.) and total taps were recorded on the polygraph.

Finger tapping was chosen as the measure of active/passive coping in this instance because it has been shown (Shakow, 1963; Shakow & Huston, 1936) that the differences between schizophrenic and normal groups are minimal if the subjects are relatively cooperative. Unfortunately, this research was conducted prior to the introduction of phenothiazines, therefore, it was unknown how medicated schizophrenics would react. A lack of group differences in the task itself was desirable so as to limit any distinctions found to the type of coping chosen by the subject. During the instructions, several practice trials were administered to the subject without the stressor stimuli present in order to assess whether in fact there were group differences on this particular aspect of performance.

Another relevant issue is that of uncontrollability. Whether or not a subject has control over a stressful event has been shown to make a difference in their actual response to that event (Thompson, 1981). In this study, there was no actual control, as the noise lengths were preprogrammed to allow for equal exposure to the stressor. The situation was, however, credible, in that subjects were led to believe that they had control. Uncontrollability, thus, was not a variable being assessed in this study, but was a means of equating the stimulus exposure. The belief that the subject had in the procedure was assessed as part of the post-experimental questionnaire (see Appendix C). Subjects were asked to rate how much control they felt they had over the noises, as well as how much control other subjects had. These two ratings

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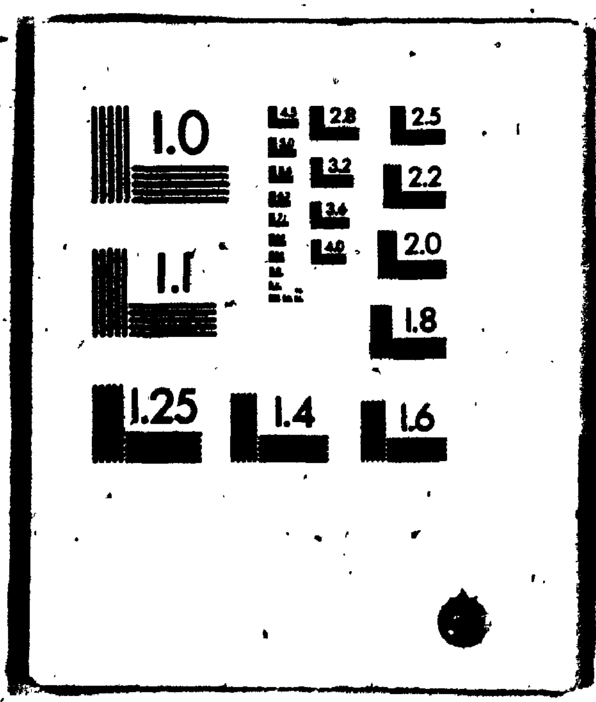

were taken in order to reveal subjects who believed that they personally did not have control, but still believed that the task was controllable by others.

Physiological measures were recorded in the five second interval immediately before each trial began (Baseline) and immediately following each trial (Time 2). Consequently, each trial proceeded as follows:

Ratings ⟶ "Ready" ⟶ Baseline Recordings ⟶ Stimulus onset & "Go" signal ⟶ Finger tapping ⟶ Stimulus offset ⟶ Time 2 Recordings ⟶ Ratings

There was a brief (fifteen second) rest period between trials to allow physiological responses to stabilize.

Rating Judgments of Stimulus Stressor Properties

All normal subjects viewed seven pictures of household objects presented on the tachistoscope for ten seconds each at the end of the letter detection and stressor tasks. At the end of the session, these subjects rated all three tasks in terms of stressfulness. This additional procedure was administered in order to make a comparison of the present cognitive (LDT) task and the stressor stimuli to a set of attention-eliciting stimuli previously documented as nonstressful (Neufeld & Davidson, 1974).

Design

The present design can be termed an "unbalanced design" (Himmelfarb, 1975) in which the control group was not crossed with all of the factors in the study. In this instance, the four schizophrenic groups can be divided into two (groups) by two (hospitalized/remitted) whereas the control group cannot. To solve this problem, twice as many controls (n=28) as schizophrenics (n=14/group) were tested. The control group was then randomly divided in half; thus artificially forming two separate control groups ("artificial" episodic and remitted normals) for a two (hospitalized/remitted) by three (normal/paranoid/nonparanoid) analysis. This procedure is one recommended by Himmelfarb (1975) for the present type of unbalanced design. Because the artificial distinction between the two normal groups may at times obscure subtle differences between the episodic and remitted patient groups, relevant analyses for some variables were computed using only the patient groups in addition to the overall analyses.

RESULTS

Demographic Variables

Table 1 presents the demographic variables for the six subject groups. A one way analysis of variance was computed on these variables for the two normal groups, which had been randomly divided into stages. No significant differences were found. These two groups will be specified throughout the Results section as Normal (1)- "artificial episodic group" and Normal (2)- "artificial remitted group". A two (stages) by three (groups) analysis of variance (ANOVA) was computed on all subject groups and a number of differences emerged. A stage effect was evident for age ($F(1,78)=4.13$, $p < .05$); with the remitted groups being significantly older (using the Newman Keul's multiple comparison procedure at a .05 probability level) than the other groups. For education and socioeconomic status (as measured by the Hollingshead two-factor index (Note 8), group effects were in evidence, ($F(2,78)=3.01$, $p < .05$; $F(2,78)=5.53$, $p < .01$; respectively). Newman Keul's comparisons indicated that the normal groups were significantly more well educated than the nonparanoids (means = 12.21 years and 10.93 years, respectively). The normals also had significantly higher socioeconomic status than the other two groups, which did not differ from each other.

There was a stage, but not a groups effect for measured intelligence ($F(1,78)=8.98$, $p < .01$), with the remitted groups attaining higher scores than the episodic groups (106.43;

Table 1: Demographic and Patient Variables.

	Ep/Paranoid		Ep/Nonpar.		R/Paranoid		R/Nonpar.		Normal(1)		Normal(2)	
	Mean	sd	Mean	sd	Mean	sd	Mean	sd	Mean	sd	Mean	sd
Age	26.57	3.78	25.57	5.39	31.79	10.42	30.93	7.10	27.50	6.57	25.71	4.01
Past Age	n/a		n/a		28.36	9.99	24.07	6.31	n/a		n/a	
Educ.(yrs)	10.71	1.64	10.14	1.14	11.50	1.95	11.71	1.86	12.14	2.69	12.29	2.46
SES[1]	4.64	.63	4.79	.58	4.50	.52	4.50	.65	4.00	.88	4.14	.86
IQ	100.36	8.20	95.00	9.61	105.71	5.84	106.07	10.22	105.00	12.40	107.50	10.33
Past IQ	n/a		n/a		93.79	10.56	96.86	9.35	n/a		n/a	
Comp.	4.07	1.77	3.07	1.14	4.86	2.12	5.29	2.20	6.14	2.11	5.86	2.11
Wist	15.57	8.53	26.93	17.89	9.86	3.57	11.71	12.39	11.43	4.43	8.93	3.65

Continued on nex t page

Table 1 (Cont'd): Patient Variables.

	Ep/Paranoid		Ep/Nonparanoid		R/Paranoid		R/Nonparanoid	
	Mean	sd	Mean	sd	Mean	sd	Mean	sd
Hosp. (mon)	18.11	11.82	16.40	11.30	14.71	10.86	18.50	10.44
Med. (mg)	696.07	756.99	641.71	655.89	215.79	189.21	132.36	100.34
Past Med.	n/a		n/a		849.07	769.52	401.86	419.85
M-Par.	14.71	2.40	7.57	1.95	6.07	1.54	6.14	1.56
P.M-Par.	n/a		n/a		15.93	2.40	7.71	1.94
M-NP	8.93	2.43	12.50	1.83	5.14	0.36	6.43	1.09
P.M-NP	n/a		n/a		9.29	1.33	13.64	1.95

[1] as measured by the Hollingshead Index (Note 8)
SES= Socioeconomic Status; Hosp= Hospitalization; Educ=Education; Comp= Competence; Med= Medication
WIST= Whitaker Index of Schizophrenic Thinking; M-Par= Maine Paranoid Scale; P.M-Par= Past Maine Paranoid Scale; M-NP= Maine Nonparanoid Scale; P.M-NP= Past Maine Nonparanoid Scale.
Ep= Episodic; R= Remitted; Normal(1)= "artificial episodic"; Normal(2)= "artificial remitted".

100.12).

For the Zigler-Phillips measure of social competence, both a groups ($F(2,78)=6.99$, $p < .01$) and a stage ($F(1,78)=4.47$, $p < .05$) effect emerged. The remitted groups were significantly more competent than the episodic ones, and the normal groups were significantly more competent than the paranoid and nonparanoid groups.

There was again a groups effect for the WIST scores ($F(2,78)=6.64$, $p < .01$), and a stage effect ($F(1,78)=13.63$, $p < .001$) plus an interaction between these two factors ($F(2,78)=3.25$, $p < .05$). The episodic patients had higher scores (more schizophrenic thinking) than the remitted groups and the nonparanoids had significantly higher scores than the paranoids and normals. In terms of the interaction, only the episodic nonparanoid group differed from the other groups.

To further explore relevant differences, a number of analyses were performed omitting the normal groups. Again, the remitted patients were significantly older than the episodics ($F(1,52)=7.74$, $p < .01$); more well educated ($F(1,52)=5.65$, $p < .05$); taking less psychotropic medication $F(1,52)=13.07$, $p < .001$), had higher IQs ($F(1,52)=12.68$, $p < .001$), had lower WIST scores ($F(1,52)=11.54$, $p < .001$) and had higher competence scores ($F(1,52)=9.18$, $p < .01$). In a comparison of the social competence scores using only the data from the episodic groups (as has been done in past studies), the paranoids were significantly more competent than the nonparanoids, as predicted ($t(26)=2.20$, $p < .05$). There were no differences between the groups or stages for socioeconomic status or length of hospitalization.

The only group effect was for WIST scores ($F(1,52) = 3.58$, $p < .06$), which was only near significant. The nonparanoid group tended to have higher scores than the paranoids.

To determine the comparability of the remitted groups to the episodic groups, a number of variables were obtained from the remitted patient's records of their most recent admission. Excellent records of symptomatology, past medications and past IQ scores (based upon the same test as utilized for the present research) had been kept. As all of the patients were from the same facility, it seemed reasonable to compare the remitted patient's past episode of schizophrenia to the episodic patient's current one.

There were no differences for medication, IQ, or age (all $p > .10$). The mean ages for the remitted paranoids and nonparanoids, at the time of hospitalization were 28.36 and 24.07, respectively. In terms of symptom severity, as measured by the Maine scale, there were no stage effects for the paranoid scale ($F(1,52)=1.69$, ns). An effect was evident for the nonparanoid scale ($F(1,52)=6.74$, $p < .01$). This effect, however, indicated that the remitted groups were more symptomatic than the currently ill subjects when hospitalized.

Even though the current status of the remitted patients was quite different from the episodic ones, both in terms of symptomatology and demographic variables, it was clear that they were similar groups when episodes were compared (length of hospitalization, medications, IQ, age, and severity of symptoms). It follows that the differences in the remitted groups were due to the greater competence levels (which may or may not have been apparent during their past episode) and their lack of schizophrenic symptoms at the time of testing.

Sex differences were not assessed due to the limited number of females in each group.

Correlations

A number of correlations were computed between the demographic variables (sex, age, education, etc.) and all the dependent variables (performance, subjective ratings and physiological measures) in each task. Due to the large number of correlations, Larzelere and Mulaik's (1977) procedures were utilized to reduce the possibility of making a Type I error. None of these correlations were significant.

It has been argued that results in schizophrenia research may be due to the effects of institutionalization or medication. Consequently, intra-group correlations for the four groups of schizophrenics were computed between these two variables and all dependent measures again using Larzelere and Mulaik's techniques. There were no significant correlations with medication, there were, however, three significantly correlated with length of hospitalization (raw score, no distractors, LDT task, r=.7982; corrected score, no distractors, r=.8104; both for remitted paranoids only; and reaction time, trial 7, noise task, r=.8612, episodic nonparanoids only). Because these findings were not consistent across groups and because the groups were approximately matched in terms of length of hospitalization, these correlations will be ignored.

Correlations were also computed between IQ, WIST scores, medication and the Maine scale scores, as a previous study (Dobson & Neufeld, 1980) has found IQ and WIST scores to be highly negatively correlated. This finding was replicated ($r=-.5369$, $p< .001$). There was also a significant positive correlation between phenothiazine dose and the WIST ($r=.3366$, $p< .01$), as found in the previous study. In addition, the nonparanoid subtest of the Maine scale and the WIST were significantly correlated ($r=.6796$, p .001), but not the paranoid subtest and the WIST. This result is not surprising, as one of the distinguishing features of nonparanoid schizophrenics is their thought disorder, which is usually less apparent or of a different type in paranoid schizophrenia (e.g. confused as opposed to delusional thinking). The Larzelere and Mulaik techniques were not applied to these latter correlations as only a few (seven) were calculated.

Letter Detection Task (LDT)

Performance Scores

For the initial analysis for this task, all the data for each set of trials was summed within each difficulty level, yielding three scores per set. The raw scores (as analyzed by Asarnow & MacCrimmon, 1978; 1981; 1982) and corrected scores (Neale studies) were both analyzed. It should be noted that ANOVAs performed on the corrected scores as in past studies are technically incorrect, as the difficulty levels are multiplied by different constants (1,4 or 8), causing unequal variance between these levels, and potentially exaggerating group differences. In the present study, these analyses were done for comparative purposes only. In the initial analysis, there were no significant effects for set ($F(2,158)=.347$, ns), nor were there any significant interactions involving this factor. Consequently, a decision was made to collapse across set, within each difficulty level.

A groups (paranoid/nonparanoid/normal) by stage (episodic/remitted) by difficulty (3) analysis of variance with repeated measures on the last factor was computed for both raw and corrected scores. There was a significant group effect for both analyses ($F(2,78)=5.91$, $p< .01$; $F(2,78)=4.68$, p ,01, raw & corrected scores, respectively). Newman Keul's multiple comparison procedure indicated that the normal group was significantly different ($p< .05$) than both the paranoid and nonparanoid groups, which were not significantly different from each other (means=13.93; 14.48; 15.96, nonparanoid, paranoid and normal, respectively).

A main effect emerged for difficulty, (F(2,156)=

6.73, $p < .01$, conservative df[1] (1,78), $p < .05$; $F(2,156) = 80.29$, $p < .001$, conservative df (1,78), $p < .01$; raw & corrected scores, respectively). The Newman Keul's test for the raw score indicates that the difficulty levels with 0 and 3 distractors were not significantly different from each other; whereas the level with seven was different from both others. As the number of distractors increased, the subject's performance decreased, as predicted (means: 0 distractors=15.33; 3 distractors=14.98; 7 distractors= 14.06). For the corrected scores, all three levels were highly significantly different ($p <$ at least .01) from each other (means: 0 distractors=.33; 3 distractors=1.11; 7 distractors=1.90).

For the raw scores, there was a tendency towards a group by stage interaction ($F(2,78) = 2.79$, $p < .066$); and a significant interaction between these two factors for corrected scores ($F(2,78) = 3.59$, $p < .05$). For the latter interaction, the multiple comparisons showed that the significant difference lay between the two episodic groups and one of the normal groups ($p < .05$, N(1) or the "artificial episodic normals"). As predicted, there were no differences between the episodic and remitted stages; there were, however, also no differences between the remitted patients and the normals. The remitted patients' scores tended to fall inbetween the other groups. As predicted, there were no differences between the paranoid and nonparanoid groups (see Figure 5).

A groups by difficulty level interaction emerged for the corrected scores only, which was not significant with exact degrees of freedom ($F(4,156)=2.43$, $p<.05$, exact df (3,130), ns).[2]

Because of the possibility of unequally changed variance due to the multiplication of the different difficulty levels by different constants (either 1, 4 or 8), an additional analysis was calculated using the corrected scores not multipled by D (See Appendix D). Similar effects were found: Groups ($F(2,78)=4.64$, $p<.01$); groups by stages ($F(2,78)=3.58$, $p<.05$) and difficulty ($F(2,156)=7.08$, $p<.001$). Even without multiplication, the levels were clearly different (means=.33; .28; and .24 for 0, 3 and 7 distractors, respectively). In terms of the interaction, only the episodic paranoids and the Normal (1) group differed significantly from each other.

To further pursue groups and stages differences, a similar analysis was computed, eliminating the control groups. For both the raw and corrected scores, there was a significant effect for stage ($F(1,52)=4.08$, $p<.05$; $F(1,52)=8.47$, $p<.01$; raw and corrected scores, respectively). There was also a significant stage by difficulty interaction for the corrected scores only ($F(2,104)=5.22$, $p<.01$, conservative df (1,56), $p\leq.05$). The latter differences were only at the most difficult level (7 distractors, see Figure 5).

Overall, it is apparent that the remitted schizophrenics did not perform in the same way as the episodic

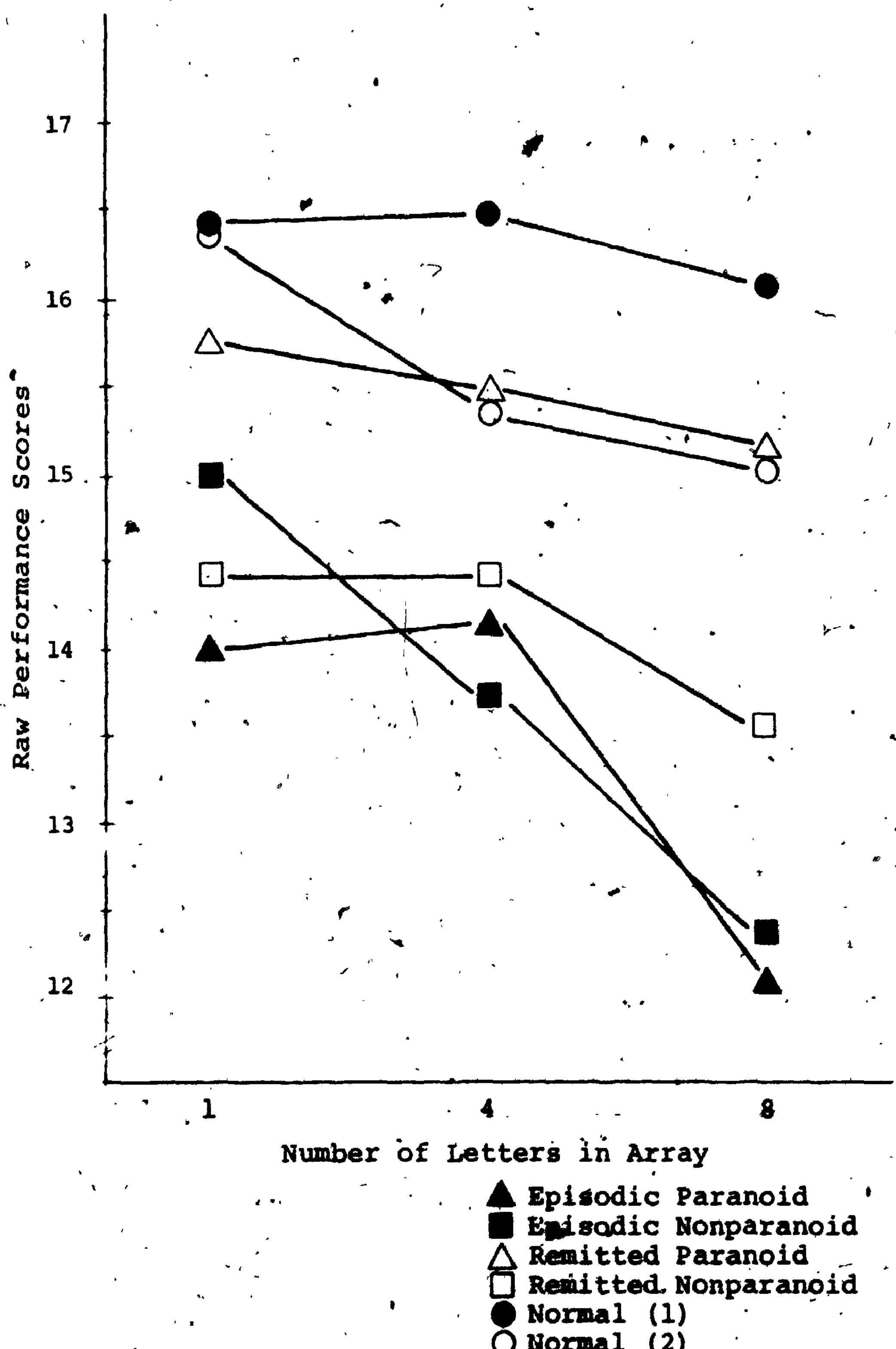

Figure 5: Groups by Stage by Difficulty- LDT Raw Scores

patients. These differences were most apparent at the level of the greatest difficulty, as indicated by the above stage by difficulty interaction. The greatest difference appeared to lie between the two groups of paranoid patients, as can be seen in Figure 5.

Subjective and Physiological Indices of Stress Arousal

For these measures (subjective ratings of anxiety and difficulty, physiological indices of heart rate, skin conductance and muscle tension), a groups (3) by stage (2) by set (3) by pre/post (2) multivariate analysis of variance was calculated with repeated measures on the last two factors. Three factors were significant in the overall MANOVA: groups (Wilks Lambda, $F(12/146)=2.04$, $p<.05$), stage ($F(6/73)=2.49$, $p\leq .05$) and pre/post ($F(6/73)=3.95$, $p<.01$).

These effects were consequently followed up with univariate analyses of variance for each of the dependent variables. For all of the results using MANOVA, only univariate F ratios corresponding to significant MANOVA effects will be reported with the exception of univariate effects which were specifically predicted or could be expected for one measure only.

No differences emerged for anxiety ratings. The only significant difference for difficulty ratings was for the pre/post factor ($F(1,78)=3.74$, $p<.05$), which was significant with conservative degrees of freedom (1,78). Subjects had a significant tendency to rate the trials as being more difficult than they predicted.

Heart Rate

The major differences occurred for the physiological variables. A groups by stage interaction was evident for decelerating heart rate ($F(2,78)=3.95$, $p<.05$). A Newman Keul's analysis of this interaction indicated that the episodic nonparanoid's heart rates were significantly faster than all other groups except the episodic paranoids. The main effect for stage was significant for both measures of heart rate ($F(1,78)=6.85$; $F(1,78)=7.92$, $p<.01$, decelerating and accelerating, respectively). The remitted groups' heart rates were significantly slower than the episodic groups' (decelerating: episodic mean=84.58, remitted=77.48; accelerating: episodic=93.12, remitted=85.88).

With respect to decelerating heart rate, a three way interaction emerged (groups by stage by pre/post ($F(2,78)=3.70$, $p<.05$; conservative df (1,78), $p<.10$, see Figure 6). To break down this effect, each group was taken separately and the uninvolved factor (set) was ignored. ANOVA's revealed a significant interaction between stage and pre/post for the paranoid group: ($F(1,1)=6.42$, $p<.05$). An interaction between these two factors was also evident for the normals: ($F(1,1)=4.70$, $p<.05$). As can be seen in Figure 6, these interactions (comparing the paranoids to normals) are in opposite directions to one another.

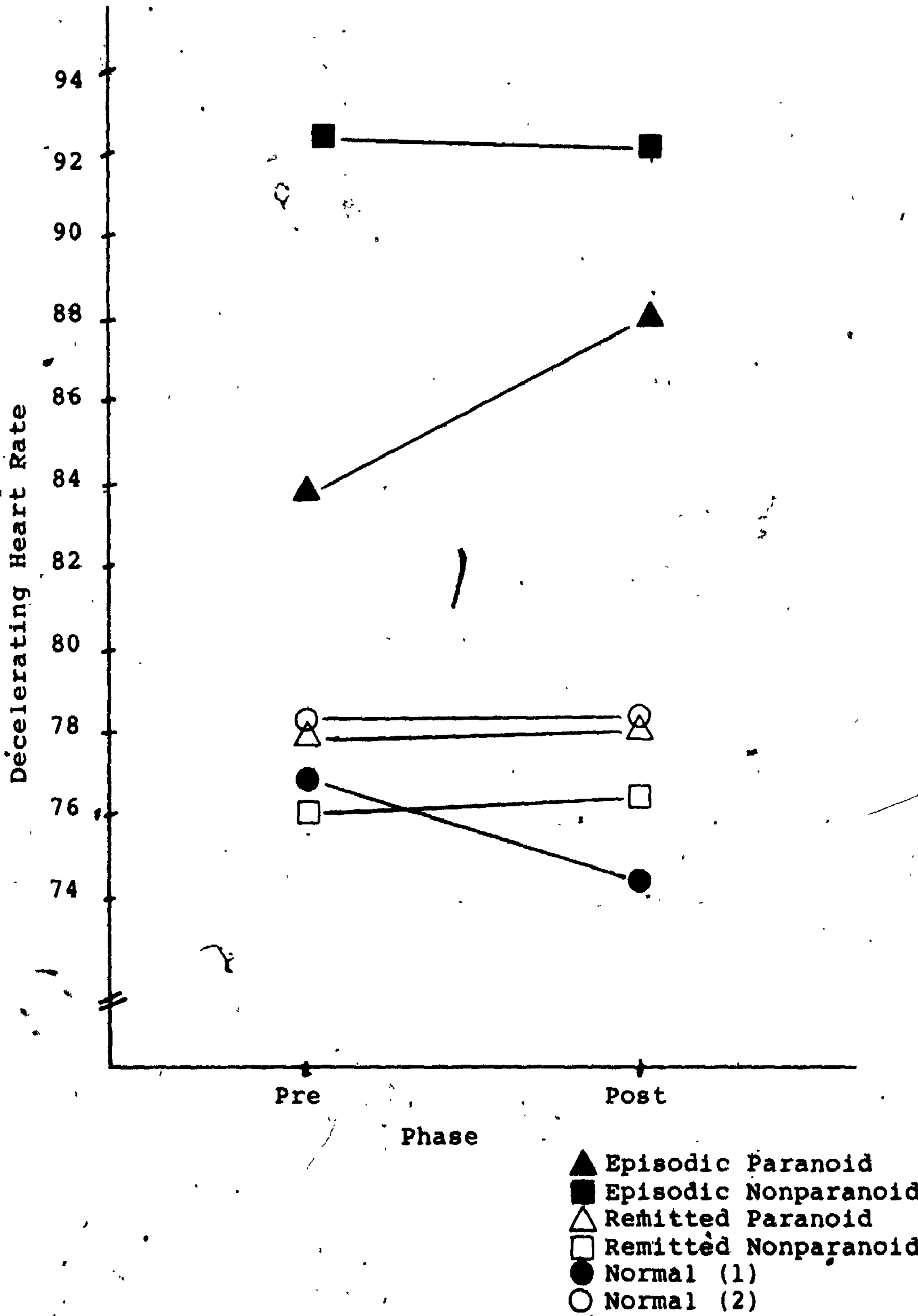

Figure 6: Groups by Stage by Pre/Post- LDT Decelerating Heart Rate

Multiple comparisons of the relevant means indicate that the episodic nonparanoids were significantly different from all other groups. The episodic paranoids were also different from all others, including the episodic nonparanoids. This group (episodic paranoid) also changed significantly from pre to post. None of the other scores differed significantly from each other, nor did they change over phases of the task.

Due to the group differences at the baseline level, analysis of covariance was conducted by using the baseline scores for each of the three sets as covariates. Strong group effects emerged ($F(2,77)=8.66$, $p<.001$; $F(2,77)=9.04$, $p<.001$, decelerating and accelerating heart rate, respectively). These differences were between the normals and the paranoids and nonparanoids (Newman Keul's, $P<.05$); the latter did not differ from each other. The normals' heart rates were slower than the other two groups even after the covariance adjustment. Stage effects again emerged ($F(1,77)=16.29$, $p<.001$; $F(1,77)=14.92$, $p<.001$), with the remitted subjects having lower heart rates overall. The interaction between groups and stages was significant ($F(2,77)=11.32$, $p<.001$; $F(2,77)=7.65$, $p<.001$, decelerating and accelerating, respectively). In both cases, multiple comparisons indicated that the two inpatient episodic groups were significantly different from all other groups ($p<.05$), which were not different from each other.

Skin Conductance

There were group ($F(2,78)=4.03$, $p < .05$) and stage ($F(1,78)=7.76$, $p < .01$) main effects in the univariate analysis for skin conductance. However, during the testing of the remitted patients, it was necessary to change the battery in the skin conductance channel of the polygraph (according to the critical direct current drift of $\pm 10\%$ of the Grass Model 7P1 preamplifier manual). This change resulted in differing baseline scores (higher conductance) for all subjects assessed after the change. Due to practical constraints, most of the remitted subjects were tested prior to the other groups. Because of the possibility of ceiling effects for the remitted patients (due to higher resistance, as the measure was assessed as resistance, then converted to conductance), intra-group pooled correlations (Baggaley, 1964) were computed between the baseline (pre) and the post data using the data points from the noise-stressor task. The tasks were both affected in the same way by the change- the noise task was chosen simply because it had more data points. The intra-group correlations were all very similar (episodic paranoid= -.116; episodic nonparanoid=-.121; remitted paranoid= -.119; remitted nonparanoid= -.112; normal= -.120). Because these values are all so similar, it appears that the reactivity or change from baseline to post trial was similar for all groups. The present uncovaried results, however, cannot validly be interpreted due to possible machine artifact as the baseline levels were quite different.

The analysis of covariance results (again using the baseline scores as covariates for each set of data) demonstrated that there were significant group effects ($F(2,77)=6.09$, $p < .01$) with the normals significantly different from the other two groups (higher conductance, Newman Keul's, $p < .05$). The effect for stage ($F(1,77)=6.92$, $p < .05$) was also significant, indicating that the remitted subjects had lower conductance than the episodics. The groups by stage interaction was significant ($F(2,77)=3.02$, $p < .05$) and the multiple comparison procedure showed that only the remitted paranoids differed from all other groups. Their scores were lower than all other groups ($p < .05$, lower conductance).

There were no other significant effects for this analysis, suggesting that there were no differential responses to set.

Muscle Tension

There were no group or stage differences in the univariate ANOVA for muscle tension, nor were any other effects significant with conservative or exact tests.

In the follow up analysis of covariance, however, a significant group effect was apparent ($F(2,77)=3.50$, $p < .05$). Using the covaried means, the Newman Keul's procedure indicated that the paranoids and normals were significantly different from each other at the .05 level, while the nonparanoids fell inbetween (adjusted means for paranoid= 39.29; nonparanoid= 33.57; normal= 29.94).

Auxiliary Analyses

Length of Stimulus Exposure

There has been some uncertainty in the literature as to the appropriate length of time to expose the stimuli in a task such as the letter detection procedure. Asarnow and MacCrimmon (1978; 1981) used an exposure time of 50 milliseconds, while the Neale et al. studies utilized 70 to 90 milliseconds. Because of this difference, a number of subjects in all groups (N=23) received an extra set of trials at 50 milliseconds after the first three sets. These trials were compared to those at 70 milliseconds for each difficulty level. All comparisons were nonsignificant.

Reliability Check

Chapman and Chapman (1978) have argued that schizophrenics' performance on differing tasks as compared to normals may partly be a function of differential individual difference psychometric sensitivity of these tasks. Consequently, the psychometric reliability of the different difficulty levels of the letter detection task was assessed as follows. Utilizing the raw scores of the normal control groups, reliability estimates in the form of "coefficient alpha" were computed using procedures for tests administered to the same sample as described by Feldt (1980). The estimated values of alpha were as follows: 1) 0 distractors= .335; 2) 3 distractors= .529 and 3) 7 distractors = .564. Using Feldt's formula for the estimation of F ratios to compare the coefficients to one another, none of the F values are significant: $F^{**}_{12}(27/27)=1.18$, ns; $F^{**}_{13}=1.21$, ns; $F^{**}_{23}=1.04$, ns. Similarly, estimated "true score variance" (Chapman & Chapman, 1978) was fairly uniform for all three difficulty levels (.195, .219 and .298 for 0, 3 and 7 distractors, respectively). These results, thus, appear to argue against the interpretation of the group differences as being solely an artifact of differing psychometric sensitivity.

Stressor Task

Performance Scores

Following the instructions to the stressor task and prior to the beginning of the trials, five practice trials were given in which baseline reaction time (RT) and number of taps were recorded in the absence of the stressor stimulus. A groups by stages analysis of variance was computed on the average of these trials. Significant groups effects emerged for both measures (RT, $F(2,78)=3.61$, $p<.05$; and Taps, $F(2,78)=10.70$, $p<.001$). Paired comparison procedures indicate that for reaction time, both the normals and paranoids were significantly different ($p<.05$) from the nonparanoids, but not from each other (means= .39 (paranoid); .48 (nonparanoid); .38 (normals)). The normal group tapped significantly faster ($p<.05$) than both other groups, which did not differ from each other (means= 6.99 (paranoid); 6.17 (nonparanoid) and 8.55 (normals)).

In addition, a groups by stage analysis was computed omitting the normal groups. For reaction time, only a near significant group effect emerged ($F(1,52)=3.63$, $p=.062$); whereas for taps there was a significant stage effect which was previously absent with the analysis including the normals ($F(1,52)=4.02$, $p<.05$). The remitted patients tapped significantly faster than the episodic patients (7.08 as opposed to 6.08 taps in two seconds).

A multivariate analysis of variance was conducted (groups(3) by stage (2) by intensity (3) by length of noise (3)) with repeated measures on the last two factors, including the reaction time measure and the two indices of tapping during the stressor trials. There were significant effects for groups (Wilks Lambda, $F(6/152)=3.09$, $p<.01$), intensity ($F(6/308)=6.58$, $p\leq.001$), and length ($F(6/308)=18.48$, $p<.001$). The univariate F ratios were thus computed for reaction time and taps. As the two measures of tapping speed were very highly correlated, ($r=.968$) and yielded very similar results, only those recorded from the polygraph will be reported. The taps from the polygraph incorporated the two second taps, as well as indicating tapping behavior over the entire noise duration (2, 4 or 6 seconds). To reiterate, the overall taps were averaged into two second segments for comparability. Because the entire behavioral segment was utilized for this data, the polygraph output was thought to reflect greater accuracy.

The main factor for groups was significant ($F(2,78)=4.14$, $p<.05$; $F(2,78)=8.75$, $p<.001$, RT and taps, respectively). Multiple comparisons of this effect showed that for RT, the normals and nonparanoids were significantly different from each other ($p<.05$), whereas the paranoids fell in the middle and did not differ significantly from either of the other two groups. The nonparanoids were significantly slower tappers than both the normals and paranoids, who, in turn, did not significantly differ from one another (means=7.94, 9.55, 10.80, nonparanoid, paranoid, normal, respectively). Main effects were also apparent for both the RT and tapping measures for intensity ($F(2,156)=7.14$, $p<.001$, conservative df (1,78), $p<.01$; $F(2,156)=15.56$, $p<.001$, conservative df (1,78), $p<.01$, RT & taps, respectively). A significant main effect was also apparent for length ($F(2,156)=3.08$, $p<.05$, conservative df (1,78), $p<.10$; $F(2,156)=41.59$, $p<.001$, conservative df (1,78), $p<.01$, RT and taps, respectively). The results for intensity and length of noises basically indicate that as the noises became louder and longer, subjects had a tendency to speed up both their reaction times and tapping. These effects demonstrate that subjects could easily distinguish between the noises and that they had the desired effect, as if a stressor is more aversive, subjects will generally try more actively to stop it (see Tables 2 & 3).

There was an interaction between stage and intensity for RT ($F(2,156)=3.43$, $p<.05$, conservative df (1,78), $p<.10$). Newman Keul's procedures showed that the differences lay at the intermediate level (67.5dB), with the episodic groups having significantly faster RT's than the remitted ones.

An analysis including only the four patient groups reflected a group effect for taps ($F(1,52)=5.39$, $p<.05$), with the paranoids tapping significantly faster than the nonparanoids (9.55 as compared to 7.94).

Table 2 : Reaction time and Taps for differing levels and lengths of noises (for all groups).

	Reaction Time		Taps	
	Mean	sd	Mean	sd
60 dB	.31	.22	9.06	3.19
67.5 dB	.30	.26	9.53	3.12
75 dB	.27	.20	9.69	3.23
2 seconds	.29	.24	8.68	3.16
4 seconds	.31	.26	9.70[1]	3.27
6 seconds	.27	.18	9.91[1]	3.00

1 averaged into 2 seconds.

All of the groups changed in a similar fashion from the practice trials to the coping task (stressor trials) (See Figures 7 & 8). Reaction time and tapping speeded up considerably; thus, it appears as though all of the groups responded behaviorally to the stressor in a similar way. Because of the initial group differences during the practice trials for RT and taps, analysis of covariance was computed using the baseline scores as covariates.

All of the effects were the same for reaction time, including the stage by intensity interaction ($F(2,155)=3.44$, $p<.05$). The episodic patients were faster than the remitted patients at all levels, with the difference the greatest at the second level of intensity ($p<.05$), once covariance on the baseline was carried out. The only significant effect for the adjusted taps was for intensity ($F(2,155)=15.56$, $p<.001$). Group effects no longer were in evidence for either of these variables.

Basically, these results suggest that all subjects coped fairly actively with the stressors, and coped more actively with the more aversive tones. It appears from the covariance analysis that the group effects may have been due to the differing baseline levels. The remaining stage by intensity interaction appears to be a stable finding.

Predictive Judgments

Multivariate analysis of variance (groups (3) by

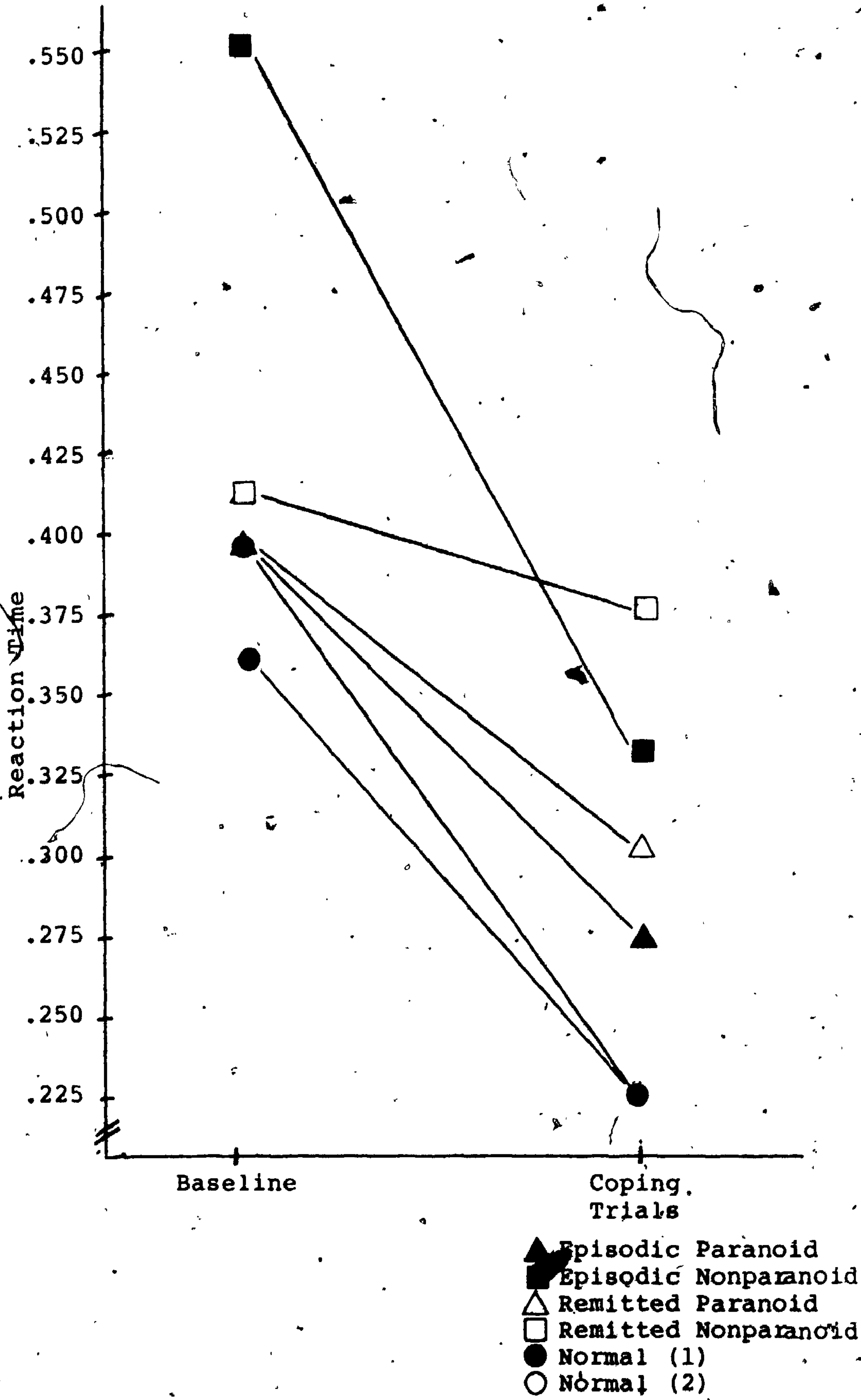

Figure 7: Change in RT from Baseline (Practice) Trials to Coping Trials (Stressor Task)

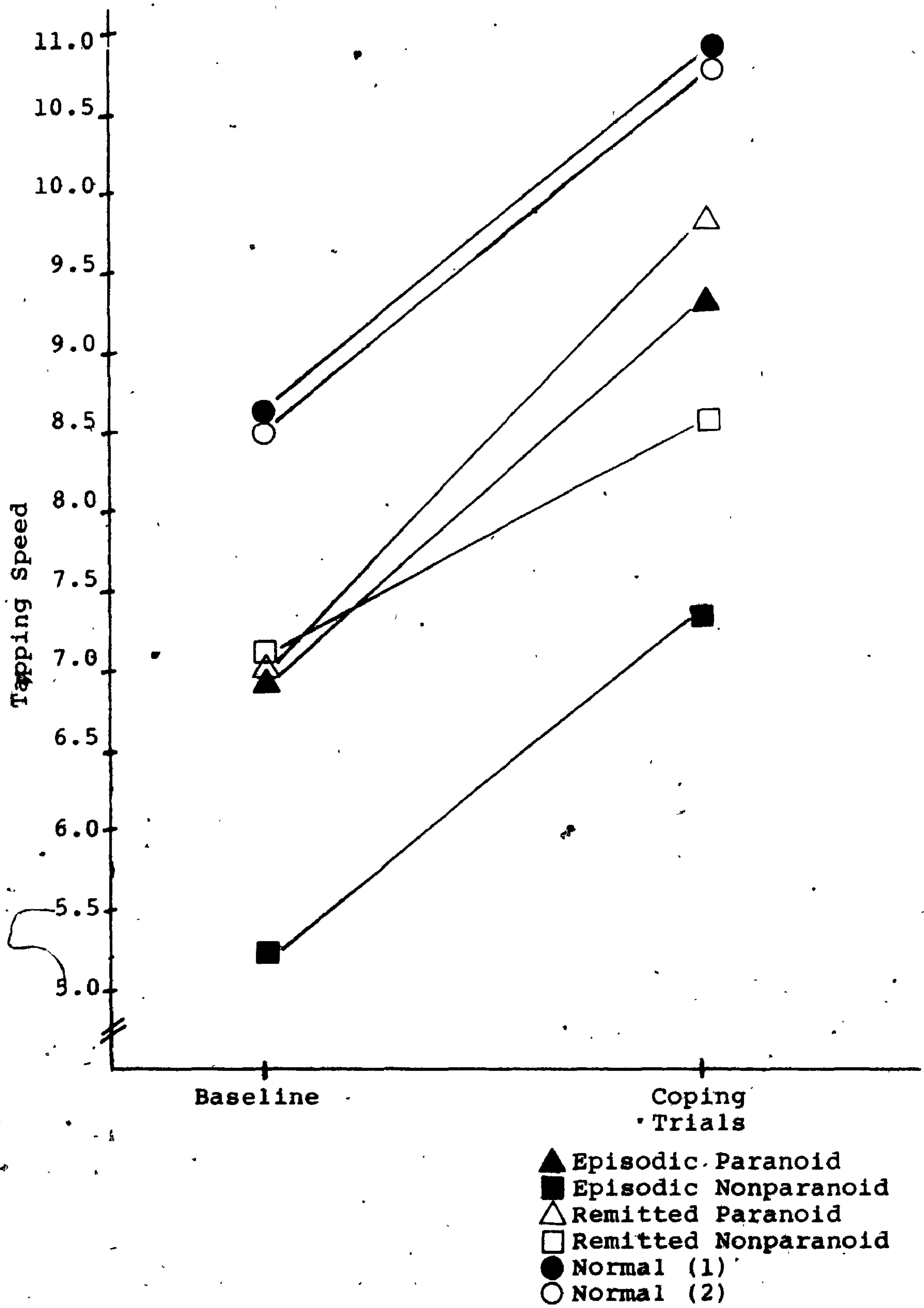

Figure 8: Change in Tapping Speed from Baseline (Practice) Trials to Coping Trials (Stressor Task)

Table 3 : Groups by Stage Means and Standard Deviations for RT and Taps (Stressor Task).

	RT		Taps	
Group	Mean	sd	Mean	sd
Ep/Paranoid	0.27	.18	9.29	3.02
Ep/Nonparanoid	0.34	.31	7.33	3.28
R/Paranoid	0.30	.13	9.82	2.97
R/Nonparanoid	0.38	.35	8.55	2.88
Normal(1)	0.23	.13	10.84	2.50
Normal(2)	0.23	.13	10.76	2.98

Ep = Episodic

R = Remitted

stages (2)) for the active and passive coping predictions and the ratio comprised of the two yielded a significant main effect for groups only (Wilks Lambda $F(6/152)=3.66$, $p<.01$). The univariate F ratios were significant for all three variables (Active coping $F(2,78)=3.91$, $p<.05$; Passive coping, $F(2,78)=6.81$, $p<.01$; Ratio, $F(2,78)=3.26$, $p<.05$). The Newman Keul's analysis revealed that the normals predicted that active coping would be effective and that passive coping would be ineffective significantly more frequently than the paranoid and nonparanoid groups. For the ratio, only the normals and nonparanoids differed significantly from each other.

These results were followed up with a groups (2) by stages (2) analysis of variance excluding the normal groups. No effect reached significance.

The means (Table 4) are in the predicted direction, with the ratios indicating that the nonparanoids predicted that passive coping would be most effective. Because the standard deviations are so substantial, any effects between the four patient groups appear to be cancelled out in significance testing. Recall that in terms of the ratios, a score near one may indicate decisional uncertainty or a "regression towards the mean", and a score greater than one predicts passive coping. The nonparanoid groups had the highest scores, but also the greatest variation in responding. These results (with the possible exception of the remitted paranoids) indicate that the patient groups had a great deal of difficulty making dictions were basically in the same range, however, as the length of the stressor increased, anxiety ratings also increased.

A number of effects were evident for difficulty ratings. There was a near significant effect for stage ($F(1,78)=3.30$, $p<.07$) and groups by stage ($F(2,78)=2.80$, $p<.065$). There was a nonsignificant tendency for the episodic patients to rate the trials as more difficult than the remitted ones and this inclination was especially true of the nonparanoids.

The pre/post effect was significant ($F(1,78)=5.86$, $p<.05$, conservative df (1,78), $p<.05$), with subjects rating the trials generally as less difficult than anticipated. The last two effects for this measure were interactions between intensity and pre/post ($F(2,156)=6.22$, $p<.01$, conservative df (1,78), $p<.05$) and length by pre/post ($F(2,156)=6.11$, $p<.01$, conservative df (1,78), $p<.05$). The former interaction probably was influenced by order, and hence, will be discussed shortly. The latter indicates a similar finding to the one with anxiety ratings--the ratings for the shorter noises (pre compared to post) were similar, but as length increased, the post ratings commensurately were modified (with post ratings greater than pre), as would be expected.

<u>Heart Rate</u>

Heart rate yielded a strong pre/post main effect predictions and had a great deal of between subject variation.

It is obvious from Table 4 that the Ratio means cannot be obtained by simply dividing the Active means by the Passive ones. While reasonable estimates can be obtained for the normal groups and the remitted paranoids, this is not the case for the other groups. The reason for this seeming discrepancy was because it was possible to have cases where the numerators and denominators were equal, but the average ratio was not (e.g. .4/.2 and .2/.1 compared to .4/.1 and .2/.2). In addition, large ratio values tended to be obtained by predictions exactly opposite of what would be expected (1.00/.01 = a ratio of 100.00). These latter predictions reflected a belief that passive coping was most likely to be an effective coping strategy in reducing the stressor length and the active coping may actually lengthen the noise duration. Thus, the theoretical range of ratio values was from .01 (complete belief in the efficacy of active coping) to 100.00 (vice versa). The subjects that responded in the manner contrary to what was expected were questioned about it (to see whether or not they had misunderstood the instructions), however, their responses tended to indicate an understanding of what they were predicting.

To follow up these analyses, a groups by stage analysis was computed on the smaller component of the ratio values, ignoring for the moment whether or not it was active or passive. The rationale for this analysis was that Neufeld's (1982a) model predicts that the smaller component should be the best predictor of stressor response (as discussed in the Introduction). In most cases, one would expect the smaller component to be very similar (or identical) to the active coping judgment (assuming a task like the present one).

No effect attained significance in the overall ANOVA. There was a trend towards a group effect ($F(2,78)=2.54$, $p=.085$). An investigation of the means (presented in the last column of Table 4) is instructive, however. The means for the active and smaller components are identical for both normal groups, but not so for any of the paranoid or nonparanoid groups. The group order of the greatest discrepancy size between the active and smaller components was exactly the same as the ordering of the ratio sizes (remitted nonparanoid, episodic nonparanoid, episodic paranoid, remitted paranoid). This finding confirms the suspicion that both groups of nonparanoids were forming the most "abnormal" or unusual predictive judgments.

Subjective and Physiological Indices of Stress Arousal

A MANOVA (groups by stages by intensity by length by pre/post) with repeated measures on the last three factors, produced main effects for groups (Wilks Lambda $F(12/146)=2.77$, $p< .01$); stages ($F(6/73)=2.63$, $p< .05$); intensity ($F(12/302)=6.89$, $p< .001$); length ($F(12/302)=2.34$, $p< .01$) and pre/post ($F(6/73)=22.11$, $p< .001$). The significant interactions were groups by stages ($F(12/146)=2.25$, $p<.01$); intensity by pre/post ($F(12/302)=2.03$, $p< .05$) and length by pre/post ($F(12/302)=2.10$, $p<.05$). Univariate analyses were utilized to follow up these multivariate effects.

Subjective Anxiety and Difficulty Ratings

There was a significant intensity effect for both anxiety and difficulty ratings ($F(2,156)=19.90$, $p<.001$, conservative df (1,78), $p<.01$; $F(2,156)=5.09$, $p<.01$, conservative df (1,78), $p<.05$, respectively). The means for these effects indicate that as the intensity levels increased, ratings of anxiety and difficulty decreased. These effects are surprising and may be due to the fact that even though three differing randomizations were utilized, there was a strong tendency for the lowest intensity noises to be presented early in the series of trials. Over all three orders, the average position from one to nine of the three intensities was 2.56 for 60 dB, 6.00 for 67.5 dB and 6.44 for 75 dB. Subjects frequently appeared to rate the earlier noises as being more difficult and anxiety provoking than later ones, and these trials often included less intense stimuli. This problem will be disentangled further when order effects are analyzed (see Auxiliary Analyses at the end of this section).

There were no group or stage effects for subjective anxiety ratings, consequently all subjects rated the trials fairly similarly. The only other effect was a length by pre/post interaction ($F(2,156)=4.16$, $p<.05$, conservative df (1,78), $p<.05$). For this interaction, all of the predictions were basically in the same range, however, as the length of the stressor increased, anxiety ratings also increased.

A number of effects were evident for difficulty ratings. There was a near significant effect for stage ($F(1,78)=3.30$, $p<.07$) and groups by stage ($F(2,78)=2.80$, $p<.065$). There was a nonsignificant tendency for the episodic patients to rate the trials as more difficult than the remitted ones and this inclination was especially true of the nonparanoids.

The pre/post effect was significant ($F(1,78)=5.86$, $p<.05$, conservative df (1,78), $p<.05$), with subjects rating the trials generally as less difficult than anticipated. The last two effects for this measure were interactions between intensity and pre/post ($F(2,156)=6.22$, $p<.01$, conservative df (1,78), $p<.05$) and length by pre/post ($F(2,156)=6.11$, $p<.01$, conservative df (1,78), $p<.05$). The former interaction probably was influenced by order, and hence, will be discussed shortly. The latter indicates a similar finding to the one with anxiety ratings--the ratings for the shorter noises (pre compared to post) were similar, but as length increased, the post ratings commensurately were modified (with post ratings greater than pre), as would be expected.

Heart Rate

Heart rate yielded a strong pre/post main effect

($F(1,78)=37.71$, $p<.001$, conservative df (1,78), $p<.01$, accelerating heart rate). According to the change scores from pre to post for this variable (see Table 5), the groups tended to respond in a similar way to the task demands. In terms of change from pre to post, the remitted paranoids tended to be the least responsive, and the normals the most. Because of the initial group differences in baseline values, which were similar in this task as the LDT, analysis of covariance was conducted by using the baseline for each trial as the covariate.

A main effect for groups was apparent ($F(2,77)=7.42$, $p<.001$; $F(2,77)=3.60$, $p<.05$; decelerating and accelerating heart rates, respectively). For the decelerating heart rate, the normal group was significantly different (slower) than both other groups and for accelerating, the normals were only significantly different from the nonparanoids (93.82 compared to 99.02 bpm). The stage factor was significant ($F(1,77)=17.89$, $p<.001$; $F(1,77)=15.05$, $p<.001$, decelerating & accelerating, respectively). The remitted stage had significantly slower heart rates than the episodics (98.12 compared to 99.82 bpm for accelerating). A significant groups by stage interaction ($F(2,77)=6.00$, $p<.01$; $F(2,77)=3.25$, $p<.05$) indicated that the paranoid and nonparanoid episodic groups had significantly faster heart rates for both measures ($p<.05$) than all other groups.

For decelerating heart rate, the only other effect was a stage by intensity interaction ($F(2,155)=3.32$, $p<.05$). While the remitted stages' heart rates responded dif-

Table 5 : Change Scores for Physiological Measures (post - pre, for all groups).

Physiological Measure

	HR		EMG		SC	
	Mean	sd	Mean	sd	Mean	sd
Group						
Ep/Paranoid	3.82	9.62	2.68	12.14	1.21	2.12
Ep/Nonparanoid	3.73	9.60	2.72	12.17	0.42	1.39
R/Paranoid	0.83	9.92	4.68	9.57	-0.09	.87
R/Nonparanoid	4.81	11.24	3.51	12.36	0.74	2.46
Normal	4.66	11.21	4.83	10.42	1.66	2.21

Ep = Episodic

R = Remitted

HR = Heart rate; EMG = Muscle Tension; SC =Skin Conductance..

ferentially to the differing intensities by increasing, the episodic subjects heart rates tended to decrease (see Figure 9).

There also was a significant main effect for length (accelerating heart rate, $F(2,155)=3.07$, $p<.05$). There was a tendency for heart rate to increase as the stimuli increased in length.

Skin Conductance

There was a strong pre/post effect for skin conductance in the univariate ANOVA ($F(1,78)=42.01$, $p<.001$), which was highly significant with conservative df (1,78), $p<$ at least .01). All groups except the remitted paranoids tended to respond in similar ways to the demands of the task in terms of skin conductance (see Table 5). The remitted paranoid groups' skin conductance tended to remain at about the same level, whereas all other groups showed an increase in conductance from pre to post (as indicated by the change scores).

Due to the reasons discussed in the above section, ANCOVA was conducted on this measure using the baseline for each trial as a covariate.

When the covariance analysis was applied, the only effect to remain was a marginally significant interaction between groups, intensity and length ($F(8,310)=2.08$, $p<.05$; conservative df (1,78) ns). This interaction indicates that the normals' skin conductance was higher at the longest length of the lowest intensity than the paranoid group at

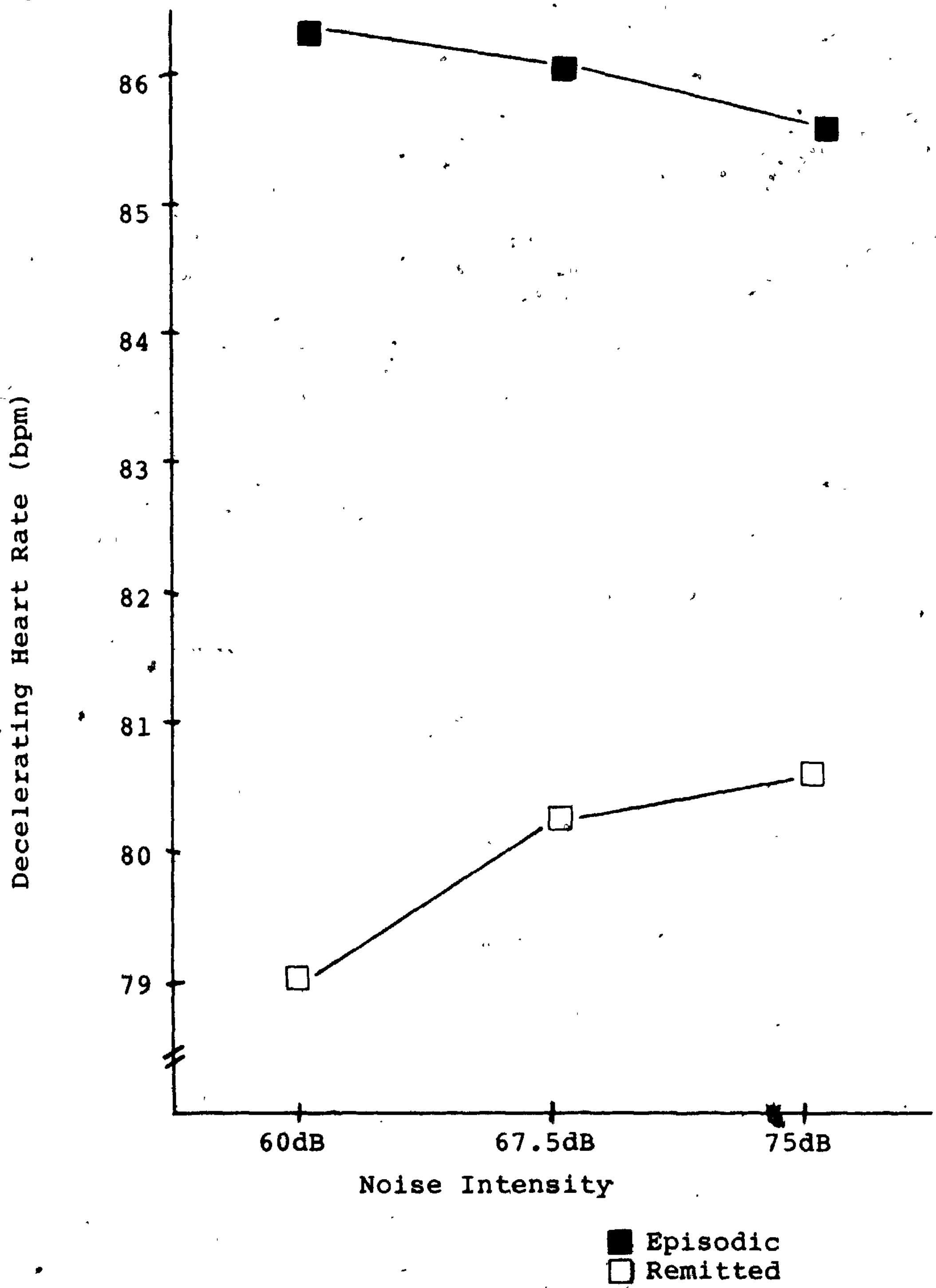

Figure 9: Stage by Intensity Interaction- Stressor Task Decelerating Heart Rate (Covariance Adjusted).

Table 6: Heart Rates for Stressor Task (baseline co-variance adjusted).

	Decelerating		Accelerating	
	Mean	sd	Mean	sd
Ep/Par.	89.48	14.72	100.44	15.63
Ep/Nonpar.	90.17	19.13	104.60	18.86
R/Par.	80.46	10.65	92.72	12.22
R/Nonpar.	79.92	11.22	93.43	12.95
$Normal_1$	78.38	10.15	94.42	11.00
$Normal_2$	79.45	11.61	93.22	11.49

Ep = Episodic

R = Remitted

Par. = Paranoid

Nonpar. = Nonparanoid

this same trial.

Muscle Tension

This variable also yielded a strong pre/post main effect for the univariate ANOVA ($F(1,78)=34.12$, conservative df $(1,78)$, $p <$ at least .01). According to the change scores from pre to post (Table 5), all groups responded to the trials by an increase in the level of muscle tension. The follow up ANCOVA on muscle tension did not yield any significant results.

Auxiliary Analyses

Order Effects

Even though three different randomizations were utilized for the ordering of stressors, there was a tendency for the noises of the lowest intensity to be presented earlier in the sequence than the more intense noises. This problem appeared to influence some of the results, particularly anxiety and difficulty ratings. For these ratings, subjects seemed to rate earlier trials as being more difficult and anxiety arousing and these trials also were less intense, resulting in an effect for intensity which was opposite of what was expected.

The purpose of the present analysis was to examine the effects of order, particularly to investigate whether or not it affected any of the groups or stages differentially. Thus far, the analyses have failed to reveal any interactions between intensity and group. There was a stage by intensity interaction for reaction time in both the ANOVA and ANCOVA, as discussed above. There also was an interaction in the ANCOVA for heart rate. Neither of these interactions were revealed in the MANOVAs for any of the variables.

As it was impossible to investigate intensity (with three repeated measures factors) and order (with nine) in the same analysis, the dependent variables for the stressor task were all analyzed using groups by stages by order (9) analyses of variance for the performance measures and predictions, and groups by stages by order by pre/post analyses for the subjective ratings and physiological variables. Consequently, both intensity and length were ignored, and the order factor was introduced. This procedure was obviously not ideal, but it was possible to reveal any differential effects of order, irrespective of intensity or length.

There were significant order effects for reaction time and taps ($F(8,624)=5.02$, $p<.001$, conservative df (1,78), $p<.05$; $F(8,624)=8.85$, $p<.001$, conservative df (1,78), $p<.01$, RT & taps, respectively), but no interactions with the order factor. Subjects tended to become faster in both their RT and taps over trials, and all groups appeared to react in the same way. There were no significant order effects for the predictions or the ratio composed of them.

There were order effects for the subjective anxiety and difficulty ratings ($F(8,624)=8.26$, $p<.001$, conservative df $(1,78)$, $p<.01$; $F(8,624)=5.49$, $p<.001$, conservative df $(1,78)$, $p<.05$, anxiety & difficulty, respectively). The ratings tended to decrease over trials (i.e. less anxious, less difficult), as was suggested previously.

Each rating also produced an order by pre/post interaction ($F(8,624)=4.03$, $p<.001$, conservative df $(1,78)$, $p<.05$; $F(8,624)=4.01$, $p<.001$, conservative df $(1,78)$; $p<.05$). The Newman Keul's comparisons for both of these indicates that the first pre-trial rating was significantly higher than all of the others. There was also an interaction between groups and order. ($F(16,624)=2.43$, $p<.01$, exact df $(12,461)$, $p<.05$) for anxiety ratings. The multiple comparison showed that the nonparanoid groups' ratings tended to be higher than both other groups in the later trials. Rather than decrease over trials as the other groups did, the nonparanoids ratings actually increased.

For the physiological variables, there were again order effects for each measure except muscle tension ($F(8,624)=8.77$, $p<.001$, conservative df $(1,78)$, $p<.01$; $F(8,624)=6.36$, $p<.001$, conservative df $(1,78)$, $p<.05$; HR & SC, respectively). Both heart rate (accelerating) and skin conductance tended to increase over trials.

There clearly were order effects for most of the dependent variables. All of the effects influenced groups and stages approximately equally, however, as only one interaction (for anxiety ratings) of groups with intensity was significant with either conservative or exact degrees of freedom. No interactions or effects occurred for stage, consequently the above noted results for this factor did not appear to be accounted for by order. If the preceding stage by intensity interactions for reaction time and heart rate (in the overall ANOVA and ANCOVA results) were influenced by order, one would expect parallel results in the order analysis.

Rating Judgments of Stimulus Stressor Properties and Manipulation Checks

Following the LDT and stressor tasks, all subjects made several ratings (see Appendix C), two of which were asked as a check to assess whether or not the subjects believed in the controllability of the stressor. There were group differences in the amount of control subjects felt they had ($F(2,78)=7.42$, $p<.01$). The paranoids and nonparanoids rated that they had significantly more control (for both control ratings) than the normals did (means: .51; .53; .40, paranoid, nonparanoid & normal, respectively). There were no differences between the two patient groups, nor were there any effects for stage.

There was a significant main effect for self/other control ($F(1,78)=3.78$, $p<.05$), indicating that all groups felt that they had more control than others (.51 as opposed to .45). Thus, the task appears to have been believable, as subjects rated that they had control around 50% of the time. In addition, subjects reacted and tapped significantly faster for both louder and longer stimuli, suggesting both that they believed that this behavior would have an impact on the noise and attesting to its aversiveness (as they were attempting to terminate it).

Two additional ratings were made by all subjects, each evaluating the stressfulness of the two tasks. No group or stage effects emerged, indicating that all groups found the tasks comparable. There was a significant main effect for task type ($F(1,78)=60.45$, $p < .001$). The subjects rated the LDT task as being significantly more stressful than the noise task (.58/1.00 as opposed to .28/1.00).

In addition to the above ratings, the normal groups rated the nonstress task as to its stressfulness. Their three ratings were compared using correlated t-tests. All three were significantly different from each other at the .001 level with the order being LDT (.64); Noises (.31); Nonstressor (.07) in terms of stressfulness.

The sample in the present study appeared to perceive of both tasks as stressors, compared to a nonstressful task, with the more cognitively demanding task (LDT) rated as being the most stressful according to the post-experimental and the subjective ratings. In order to compare the two tasks further in terms of stressor properties, the subject's physiological responses were examined. All of the responses (except heart rate for episodic paranoids) indicated that arousal actually decreased during the LDT task. Muscle tension decreased over sets ($F(2,156)= 2.99$, $p<.05$; conservative df (1,78), $p<.10$), and skin conductance and accelerating heart rate decreased significantly from pre to post measures ($F(1,78)=8.26$, $p<.05$, conservative df (1,78), $p<.01$; $F(1,78)=10.59$, $p<.01$, conservative df (1,78), $p<.01$; SC & HR, respectively). With the exception of heart rate for the above mentioned group, there was no indication of a physiological increase in anxiety or tension in the LDT. In fact, all measures decreased from pre to post (see Table 7).

These results stand in contrast to the physiological parameters from the noise stressor task. All measures increased significantly from pre to post trial, clearly indicating physiological arousal during this task (see Table 7).

What results is a discrepancy between the subject's perception of the two tasks and their physiological responses to them. It is beyond the scope of this dissertation to decide upon which type of task is most stressful. The ratings clearly indicate each task to be stressful relative to neutral stimulation. The noise task, judging by this result as well as the physiological data, did have substantial stressor properties, thus serving its purpose. On the other hand, it is possible that subjects subjectively rated the LDT as being stressful because they perceived it as being quite difficult and tended to equate difficulty with stressfulness. Therefore, as might be expected from cognitive demand tasks (e.g.

Table 7: Physiological Measures from Pre to Post for Stressor and Letter Detection Tasks (LDT) (All groups, N = 84)

	Stressor Task				LDT			
	Pre		Post		Pre		Post	
	Mean	sd	Mean	sd	Mean	sd	Mean	sd
HR	92.72	14.70	96.47	14.95	90.46	13.86	88.54	13.63
EMG	19.64	15.43	23.52	15.39	34.03	22.11	33.17	22.68
SC	20.51	14.83	21.44	15.58	20.28	15.66	19.03	14.63

HR = Heart Rate; EMG = Muscle Tension; SC = Skin Conductance.

paced anagrams, speeded problem solving), the LDT was not without stressing properties for all subjects.

Results Summary

The main differences between the stages in terms of the demographic variables were in the indices comprising the competence score. The remitted stage was significantly more competent than the episodic one and paranoid-nonparanoid differences were limited to the latter stage.

In the overall analysis for the LDT, there were no paranoid-nonparanoid differences for the performance scores. There were no effects for stage, and only the normals differed from the paranoids and nonparanoids for both raw and corrected scores. When the normal group was eliminated from the sample, it became apparent that the remitted patients performed better than the episodics, unlike the Asarnow and MacCrimmon studies (1978; 1981; 1982) and this discrepancy was especially pronounced for the paranoids. These differences were greatest at the higher difficulty level (more distractors).

There were physiological differences for the LDT particularly in terms of heart rate, where the episodics had much more rapid rates than the remitted subjects. One of the few significant differences between the episodic paranoids and nonparanoids emerged for this measure. The episodic paranoids reacted differently to the LDT than all the other groups, showing increased arousal in terms of heart rate.

There were differing baseline levels for both reaction time and taps in the stressor task. The paranoids' reaction times were significantly faster than the nonparanoids. There was a stage effect for taps, with the remitted stage faster than the episodic stage only when the normals were excluded.

During the stressor trials, the nonparanoids coped more passively than both of the other groups; however, when a covariance adjustment was made for the differing baselines, all subjects responded similarly (by coping actively) to the task.

It must be noted that all subjects had received the instructions regarding the noise task prior to the baseline trials, even though they had not been subjected to the stressor stimuli. Thus, at this point, they knew about the stressor and possible means of escaping it. It is possible that the baseline data may be a reflection of subjects practicing their predicted strategy, rather than a true baseline measure, as the "behavioral motivation" to cope in a certain way may have already been present. The uncovaried data, therefore, may be somewhat legitimate and removing initial differences may remove real differences in coping propensity.

This interpretation appears to be especially viable when some of the other results are investigated. The coping predictions, for example, were in the expected direction, with the nonparanoids predicting passive coping, however, only the normals tended to be significantly different from the others. Note that the tapping and reaction time results for the stressor trials closely parallel the ratio results, as in each case the normals are only significantly different from the nonparanoid group. The ratio formulations for the paranoid group may indicate an impoverished ratio, rather than decisional uncertainty. This conclusion is based upon the observation that the groups with ratios closest to one, indicative of either impoverishment or uncertainty (both paranoid groups), did not appear to indicate any uncertainty in their coping behavior. Consequently, these results suggest either an impoverished ratio or somewhat passive predictions (the latter possibility for the episodic paranoids only).

Again, there were strong effects for heart rate in the stressor task, with the episodic paranoids and nonparanoids obtaining much higher rates than the other groups. All groups appeared to be responsive to the task, with the remitted paranoids tending to show the least response and the normals the most.

Because all groups rated the LDT and noises as being stressful, it is possible to conceive of both tasks as stressors (although that was not the purpose of the present study). There were no differential group effects for ratings of stressfulness, thus the four schizophrenic groups did not appear to perform more poorly than the controls as a result of differing perception of task demands or stressfulness. Subjects felt that they had control over the stimuli, and the schizophrenics felt that they had significantly more control than the normals did. This rating was in contrast to the actual performance, and could be interpreted as an unrealistic belief in their own personal control for these groups.

What is striking about the present results is the similarity between most of the groups in terms of overall ratings and coping behavior and the disparity of the episodic nonparanoids and all of the other groups in terms of a number of the measures (e.g. LDT performance, heart rate for both tasks, reaction time, tapping). They had the poorest performance and the highest ratings and arousal (as measured by heart rate). The remitted paranoids, on the other hand, appeared to be the most similar to the normal group (e.g. LDT performance, reaction time, taps) and the least responsive physiologically. The two nonparanoid groups (except for competence scores) seemed more similar overall than the two paranoid groups.

Finally, it is illuminating to look at the parallels between some of the results. Even though they are not all individually significant, a consistent pattern emerges. Overall, the paranoid subjects tended to cope more actively than the nonparanoids. Both paranoid groups also had predictive ratios that indicated more of a tendency towards less passive coping than the nonparanoids. The order of the groups is exactly the same when reaction time, taps and the coping ratio are all compared (from active to passive coping) and is normal, paranoid then nonparanoid.

The correspondence of these coping propensities with the arousal indices must also be pointed out. For the Stressor task, it was on these variables, particularly heart rate, that stage effects were attained. The differences on this measure stood in contrast to the two paranoid group's similar methods of coping. The episodic paranoids were highly aroused and tended to respond to the task by actively coping. The remitted paranoids were less responsive, but continued to actively cope as well. On the other hand, the episodic nonparanoids were less active copers as indicated by their reaction time and tapping performance, but had the highest arousal according to heart rate. Furthermore, the remitted nonparanoids were not highly aroused, nor did they appear to cope particularly actively (Note in Figures 7 & 8 that this group changed the least from Baseline to Coping Task).

DISCUSSION

Letter Detection Task--A failure to replicate?

Part of the results for the letter detection task were as predicted: there were no differences between the paranoid and nonparanoid groups, accuracy level decreased with increasing number of distractors for all groups and there was a tendency for certain groups (especially the episodic ones) to perform differentially worse when the task was more difficult. As found in the Asarnow and MacCrimmon studies, there were no overall significant differences between the episodic and remitted patients for the raw score performance.

When the results were investigated in more detail, however, differences did emerge and the replication of their studies was superficial only. The remitted groups were not significantly different from the normals and their performance tended to fall inbetween this group and the episodics. When the normals were excluded from the analysis, the remitted subjects were superior, especially when more distractors were present.

The differences between these studies of schizophrenic letter detection must somehow be reconciled. The methodology in the present study can be seen to be most similar to that of Neale (Neale et al., 1969; Neale, 1971) in terms of apparatus and presentation of stimuli. The only difference was that the stimuli in the present study were shown in a circle rather than a matrix, to equate for visual acuity. The results of this study closely parallel Neale's, except that fewer letters were processed by all groups (e.g. this group of normals processed 2.5 letters in the eight letter display when the correction formula was applied, whereas Neale's (1971) group processed slightly less than four). The overall pattern of findings between controls and episodic schizophrenics was very similar (as Neale did not assess a remitted group).

The main distinction lies in the performance of the remitted patients in the current research and this same group in the Asarnow and MacCrimmon studies. The present group of remitted schizophrenics performed better than expected. In comparing their studies to this one, a number of methodological differences emerge which potentially can help explain the discrepant results. As noted in the Introduction, Asarnow and MacCrimmon's stimuli were projected onto a screen and were relatively large compared to other studies of this type. They also analyzed raw scores only, therefore no corrections for guessing were included. It is possible that these procedures resulted in the task being easier for all subjects. The simplicity of their task is borne out in their subject's scores--in the 1978 study, for one and three letter displays, the normal controls received 100% correct detections. Both other groups (acute and remitted schizophrenics) received between 36/40 and 40/40 correct responses in these conditions. Even with ten letters (nine distractors), the normals obtained over 88%

correct and the schizophrenics about .75%. Psychometric test theory suggests that items of a .50 difficulty level (to the extent that group discriminability characteristics approximate this) are the most discriminating, thus, the items in the Asarnow and MacCrimmon studies may not have been difficult enough to differentiate the two groups of schizophrenics. They found a groups by number of distractors interaction, and the normals were most different from the other groups as complexity increased. Note that in the present study, a similar interaction distinguished the episodic and remitted groups at the highest difficulty level only. Quite possibly, if Asarnow and MacCrimmon had used a more difficult task, the results would have been more similar to the current ones.

Other possible reasons for the differences could lie in the samples used, as their subjects were somewhat older and more were nonparanoid than the present ones. Length of hospitalization was not reported in their studies, thus, it is not known whether or not this variable was important. They present suitable checks to determine that their remitted subjects were relatively symptom free, however, do not indicate the degree of symptomatology of the episodic patients (except for stating that they were tested between one and two weeks after admission). It is feasible that the groups were not radically different in terms of severity of symptoms, hence the similar performance. The use of raw scores may have affected the group's scores differentially as well; for example, the normals may have been "better guessers". In the current study, the group differences were most pronounced when the corrected scores were analyzed.

The most likely explanation for the differences between the studies appears to be the difficulty of the tasks and the discriminating power of the items. On less complex tasks episodic and remitted schizophrenics may obtain similar scores and only be distinguished at higher levels of difficulty. The potential implications of these suggestions to the Chapman's (1973a; 1973b) arguments vis-a-vis psychometric inequalities of the measures must be kept in mind and appropriate checks, as outlined in the Results section should be utilized. The Asarnow and MacCrimmon studies did not include a check for the reliability of the items and it is possible that some of the levels may have been more reliable and more discriminating than others, thus artificially increasing group differences. Recall, for example, that an easier task may have a low discriminating effect between groups, resulting in a lack of group differences for the two schizophrenic groups in their study.

These results imply that for the groups of schizophrenics assessed, symptomatology affected performance when the processing demands were greatest. The remitted patients had only a slight, nonsignificant deficit when compared to normals. According to these findings, a letter detection deficit is not a vulnerability marker for this group of schizophrenics. If Asarnow and MacCrimmon have found a true vulnerability marker, it appears to be very specific to the procedure that they utilized and should not be labelled "span of apprehension".

According to the subjective ratings, all subjects interpreted the task in a similar way as being fairly stressful and difficult. Even though there were clear group differences for the physiological variables, the only significant difference in response to the task itself was the increased heart rate arousal of the episodic paranoids from pre to post sets. All other groups, and all other measures appeared to respond in a similar manner to the task.

Even though these group differences did exist, there was no evidence of a ceiling effect for the schizophrenics (note the greater episodic paranoid change in Figure 6 for heart rate, even though they initially had very high rates) as Schmolling and Lapidus (1972) suggest. There was not any evidence either of schizophrenic hyporesponsiveness to this task as compared to normals. The episodic schizophrenics appeared to be in a state of general overarousal (for heart rate); however, the remitted schizophrenics were not. It is possible that the episodic schizophrenics' arousal interfered with their performance (Schmolling & Lapidus, 1972); it did not, however, appear to affect their ratings of difficulty or stressfulness, as they rated the task similarly to the other groups.

Social Competence

The remitted schizophrenics were significantly more competent than the episodic ones and this difference was accounted for by the large discrepancy between the two non-paranoid groups. Both paranoid groups had similar scores. For the episodics, paranoids tended to be more competent than nonparanoids as predicted; the reverse was true for the remitted stage.

These results indicate that social competence may play a role in remission, although it is not known whether or not the additional competence displayed by the remitted sample was gained after the episode was over or before it began. The indices of the competence measure do change over time, even measured intelligence, usually thought to be constant. A recent study (Kolb & Whishaw, 1983) has re-tested a small number of schizophrenic patients a year or more after discharge and found dramatic improvement on a number of tests, including the WAIS, to within normal limits.

The finding that the remitted nonparanoids were the most competent group is valuable, given the tendency in the literature to equate the nonparanoid group to process, poor premorbid adjustment patients. It may simply be the case that nonparanoids with poor adjustment remain in hospital and those with good adjustment do not. The hospitaliz-ation of paranoid schizophrenics may be independent of their adjustment level and more dependent on symptoms, as these may be more blatant and disruptive than those of the nonpar-anoid. Therefore, if the analysis is limited to inpatients, as has always been the case in past research, the paranoids may appear to be more socially competent.

These findings can be related to past research (Knight et al., 1979; Knight, Roff & Watson, 1981; Roff & Knight, 1978), which suggests that interpersonal or social competence is the best predictor of long term outcome. The present results imply that this hypothesis may be true for nonparanoids, but not for paranoids. Caution must be taken, however, as long term outcome was not investigated in the present research. This question can only be adequately answered by longitudinal research on social competence in paranoid and nonparanoid schizophrenics.

Even though the groups were quite different, a decision was made not to adjust for these differences with covariance analysis. The reason for this resolution was partly outlined in the Introduction in terms of investigating "critical deficit". If naturally occurring competency differences are found in schizophrenics, it is important to assess their influence on performance. In addition, if a researcher covaries a measure such as intelligence, it is unclear what remains, as intelligence has been found to be highly related to a number of other variables. For example, IQ has been found to be negatively correlated with thought disorder (Dobson & Neufeld, 1980; present results), consequently, if IQ is treated as a covariate, then probably some important aspect of the overall symptom picture is being inadvertently equated between groups. This argument was also used in a study on thought disorder by Haynes and Phillips (1973) to justify including groups with differing levels of measured intelligence.

Future research should exercise caution with these variables, particularly intelligence. Most studies in the past have equated control and schizophrenic groups on IQ and this practice may bias studies against finding significant results. This problem is especially relevant if the dependent variables are correlated with intelligence, as the schizophrenics' "true score" appears to be higher than that measured during the episode. In addition, by including only those patients with IQs in the normal range, one is excluding those subjects who are most thought disordered from the study.

It appears that competence and coping, as measured in the current study, are relatively independent (see correlations in Table 8). There are a number of possible reasons for this result, one of which may be the general nature of the Zigler-Phillips measure and the specificity of the coping index (e.g. number of taps in a certain context) used in the present study. Perhaps a measure of competence more precisely aimed at how effectively an individual deals with stress would have shown more of a relationship with the current measure of coping. Another possibility is that coping in this experiment may not be generalizable to coping with other, more personal stressors.

Table 8 : Pearson Correlations between Social Competence and other measures (N=84).

Variables	Correlation
Sex	.472**
WIST	-.339**
Taps[1]	.145
Active Prediction	-.240*
Passive Prediction	.124
Ratio	-.126
Anxiety Rating	-.078
Difficulty Rating	-.091
Heart Rate	-.190
Muscle Tension	.043
Skin Conductance	.053

*$p < .05$

**$p < .01$

[1]All of the measures for the stressor task were averaged across trials for each subject prior to the computation of the correlations.

Another type of coping demand (e.g. interpersonal) may have been more related to social competence as assessed by Zigler and Phillips. Clearly, more research is needed and more specific measures need to be developed before the relationship between social competence and coping with stress is understood.

Stressor Task

Paranoid/Nonparanoid Differences

The baseline difference in performance (RT and taps) is not surprising, considering the vast amount of research indicating a schizophrenic reaction time deficit. The results are at variance with Shakow's (Shakow & Huston, 1936) early studies on finger tapping, possibly due to the introduction of phenothiazines since that time or to differences in recent hospitalization practices. For example, fewer schizophrenics remain in hospital at present due to more effective treatment strategies. The result may be that more severely disordered subjects are now tested, resulting in greater discrepancies between normals and schizophrenics.

The magnitude of the differences between the paranoid and nonparanoid group is important, as the paranoid group's reaction time was virtually the same as the normals. As noted previously, some legitimacy must be attached to the uncovaried performance results, as they may reflect an initial propensity to cope in certain ways. This possibility is made more viable when the paranoid's baselines are considered, as it is very unusual in schizophrenia research to find a schizophrenic group that is so similar to a normal group. In addition, these results parallel a tendency towards active coping in the paranoid group on other measures (taps, predictive ratio judgments for the remitted paranoids).

Both groups of paranoid patients had prediction ratios relatively close to one, but did not appear to exhibit any decisional uncertainty in their coping responses. In fact, their behavioral responses clearly showed an active coping tendency. It thus follows that the ratio judgments were impoverished and the coping decision was made without adequate judgments. As the episodic paranoid's ratios were close to 1.0 (possibly indicating a "regression towards the mean"), their arousal would be expected to be high as a decision made in the absence of appraisals could not be expected to reduce arousal.

It does appear that paranoid schizophrenics may have less efficient anticipatory appraisals and more effective coping mechanisms whereas nonparanoids showed the opposite pattern. The nonparanoid's results indicated that they predicted that passive coping would be the most effective strategy, as they had the highest ratios. If their ratios were impoverished, it would be expected that they would be closer to one than they actually were. This group also tended to have the most passive coping style, which probably would be ineffective in "real life" stressful situations.

These results can be related to response style in paranoid and nonparanoid schizophrenics (Broga & Neufeld, 1981a; McCormick & Broekema, 1978). Recall that in the former study, the authors found that paranoids were more prone to respond ("liberal" response style), and that non-paranoids had a more conservative style. These styles appear to parallel tendencies towards active and passive coping in these groups, and a coping response in the presence or inadequate judgments may reflect a typical "behavioral response style".

In addition, the present findings give some support to the hypothesis that paranoid schizophrenics (particularly the episodic stage) have more difficulty than nonparanoids extracting accurate information from the environment (as their predictions corresponded less with their behavior than the nonparanoids). Nonetheless, past research has shown that paranoids can manipulate existing information adequately and liberally draw inferences from it (Dobson & Neufeld, 1982; Gillis & Blevens, 1978; McCormick & Broekema, 1978). In the present study, the stressor task appeared to elicit delusions which were quite unrealistic for a number of the episodic paranoids, and a consequent heightened coping response appeared to be the result. For example, one patient gradually began to believe that he was at the controls of a space ship and that it was quite likely that he would be electrocuted by the equipment if he did not try hard. Another thought that the experimental equipment was controlling his body and taps and yet another sent Morse code messages via the taps. All three of these subjects reacted and tapped extremely quickly.

The behavioral data of the nonparanoids suggests that they did not withdraw from the situation as Shean (1982) would predict (although they did tend to cope more passively). In addition, the result that all of the schizophrenic groups felt that they had had more control than the normals and as compared to others (according to their ratings at the end of the testing) is an indication that they did not feel as though they had lacked coping resources. In fact, their belief in their own sense of control was somewhat disproportionate and unrealistic when compared to their actual performance. There is also no suggestion in this set of results that the nonparanoid group overrated their physiological responses, if anything, they underrated. If the episodic paranoids and nonparanoids were sensitive to their arousal, they should have had high ratings of anxiety as compared to the other groups. Actually, there were few group differences in subjective ratings of anxiety and very different physiological levels of arousal (between stages). The episodic paranoids, especially, underrated their anxiety compared to their own heart rates.

It was suggested in the Introduction that paranoid/ nonparanoid symptomatology may be relatively episode specific and may reflect ways of coping with the arousal associated with a schizophrenic illness. This hypothesis was not supported by the present study, in fact, overall, the group effects (paranoid/nonparanoid differences) tended to be more pronounced and frequent than those for stage. On most of the measures, especially cognitive appraisals and coping performance, the groups were more similar in terms of symptom type than stage of disorder. Thus, symptoms during an episode may reflect typical tendencies to respond in certain ways, but in an exaggerated fashion. The paranoid/nonparanoid distinction, therefore, is probably not limited merely to the length of the episode.

Episodic/Remitted Differences

Even though the paranoid/nonparanoid effects tended to be stronger than those for stage, a number of results did emerge for this factor. After the occurrence of the episode, the present sample of remitted schizophrenics still showed evidence of their response strategy in terms of coping style, but improved their information extraction in terms of predictions and letter detection. Their arousal, correspondingly, was lower. This change may partially be due to a lack of interfering symptoms or a lessening of general anxiety.

The change from the baseline to the coping task is important--if the slowness of some of the groups, such as the episodic nonparanoids, was due to factors such as medication, hospitalization or motivation, one would expect less change from baseline to coping task, as these factors were identical across tasks. One would also expect the remitted schizophrenics to be faster on all measures than the episodic schizophrenics, as they were not hospitalized, on less medication and not experiencing active symptoms. As was seen in Figure 7, the episodic nonparanoids improved their performance the most and the episodic paranoids tended to be faster than the remitted nonparanoids. Possible explanations could be that the episodic schizophrenics were more motivated to do well, hypothesizing that their performance could somehow reduce their stay in hospital. The episodic patients may have been more susceptible to practice effects or found the noises more aversive, consequently tried harder to reduce their length. This latter explanation seems supported by the heart rate elevation for the episodic patients and the significant order effect for the episodic nonparanoid's anxiety ratings. These results indicated that the episodic groups were most aroused and the nonparanoids tended to rate the trials as causing them more anxiety.

The episodics did have a nonsignificant tendency to rate the trials as more difficult and were significantly more aroused than the remitted subjects. They did respond to stimuli, however, both behaviorally in terms of performance and physiologically. These results, thus, give some support to Silverman's (1964) theory that schizophrenics (referring to those who are currently ill) are overaroused. They also agree with past findings that schizophrenics have a high resting degree of arousal under little stimulation (Crooks & McNulty, 1966; Magaro, 1973). As in past studies, the normals did show a greater physiological reaction to stressful stimuli (Crooks & McNulty, 1966, 1966; Fenz & Velner, 1970; Van Zoost & McNulty, 1971), but this response difference was most pronounced between the normals and remitted paranoids. The episodic nonparanoids did tend to be even more aroused than the paranoids (significantly so only for heart rate on the LDT), as suggested by Berkowitz (1981). Overall, both episodic groups tended to be overaroused and engaged in active coping compared to their own baselines. There was no indication, however, that this strategy decreased their anxiety.

The findings of a lower responsivity in the remitted groups, especially the paranoids, and the differences between the episodic and remitted stages can also be seen to be an important contribution of the present study. The most consistent difference over tasks between those schizophrenics in an episode of illness and those not in an episode were the heart rate findings. The remitted subjects' heart rates were indistinguishable from normal, and the remitted paranoids had less response to the task than either the episodic paranoids or nonparanoids or normals. These results are similar to those found by Iacono (1982) with remitted subjects, except that the skin conductance responder/nonresponder category was not investigated in the present study. As hypothesized, it appears that elevated heart rate may be a potential episode marker, whereas skin conductance or muscle tension changes are not. A decreased responsivity to stimuli may be more true of both chronic schizophrenics (most of the studies reporting this result utilized this group) and remitted subjects, but not acute patients. Remitted subjects may have less response than others due to decreased symptomatology and possibly as a way of coping with a more demanding environment. Acutely disturbed patients, on the other hand, are usually highly symptomatic, report anxiety and are generally in a state of agitation. Their usual coping responses have recently broken down in some way, as attested to by a recent hospitalization, thus, it is not surprising that they are highly aroused.

Overall Similarities

There was no indication that any of the schizophrenic groups were less efficient at coping with the more intense stimuli--the results showed that all groups responded to intensity and length increases by accelerating their responses. It did appear that increasing the aversiveness of stimuli did correspondingly increase the coping demands required, however, the results of a groups by complexity (or intensity) interaction were not found as in past studies of cognitive difficulty (Dobson & Neufeld, 1982).

There are several possible explanations for these results. It appears that schizophrenics can cope with some stressful stimuli in a similar fashion as normals (evidenced by a lack of overall differences in covariance analysis for RT and taps). It may not seem reasonable to generalize these results to other types of stress, as it seems obvious that schizophrenics cope differently with "real life" situations than normal. However, they may have similar coping styles in their repertoire, but simply may not utilize them in certain situations. Given the right situation and instructions, schizophrenics may be capable of implementing these strategies, but may need specific coaching. There was indication that the present groups of episodic schizophrenics, however, were not able to effectively appraise the situation, had unrealistic beliefs about their capabilities and had high arousal. Consequently, if a person possesses the coping behaviors, but not the cognitive strategies to know when to use the behaviors, and these coping methods do not reduce arousal, their utility is probably quite limited.

The other explanation for the lack of a groups or stages by intensity effect for most of the measures is that the stressors in the present study may not have been similar enough to "real" stressors to be able to make a generalization (as in the trade off between external and internal experimental validity) or were not aversive enough to approximate some real life stressors. There was some indication of this latter point in the results as none of the groups indicated by their ratings that they found the noises highly aversive. It is possible that with the use of more intense tones, an interaction between groups and/or stages and intensity in terms of coping style would have been uncovered. This question remains unanswered at present. Thus, the results need to be replicated and extended to include more ecologically realistic and intense stressors.

Implications and Methodological Considerations

In attempting to look at the present results overall, the implications for the vulnerability model need to be examined. Virtually all of the research prior to the current study has tried to locate vulnerability markers and has found deficits when comparing remitted subjects to normals (Asarnow & MacCrimmon, 1978; 1981; Miller, Saccuzzo & Braff, 1979; Iacono, Tuason & Johnson, 1981). Most of this research has looked at attentional deficits and not all studies have used a group of currently episodic subjects as a comparison group.

Future research may indicate that it is relatively easy to locate attentional and cognitive deficits in remitted schizophrenics as compared to controls. The question as to whether or not these are vulnerability markers must be asked, and caution must be exercised. It may be, for example, that remitted subjects have lower cognitive abilities than controls on any number of tasks and most studies have not adequately dealt with this possibility (an exception is Iacono, Tuason & Johnson, 1981). One way of controlling for this problem is the use of a control task where the remitted patients perform as normal. The present study suggests a number of possibilities for such a task, especially heart rate when looking at physiological variables, certain cognitive ratings, etc.

Another consideration is the use of appropriate control groups--it is important that both a normal group and an actively symptomatic group be included when testing remitted schizophrenics. Ideally, on a control task, the three group's performances will all be equal; on a vulnerability marker task, the remitted and episodic groups will be the same, whereas the controls will not and on an episode marker task, the normals and remitted subjects will be similar and the episodic patients will be distinguished.

This ideal probably is an unrealistic goal. In reality, future research is quite likely to find fairly subtle differences rather than clear distinctions. In most cases, there will be some improvement in remitted schizophrenics' functioning, so that this group will fall in between the normals and episodics in terms of performance. This result was found for many of the variables in the present study, as well as in two recent reports (Frame & Oltmanns, 1982; Kolb & Whishaw, 1983). Frame and Oltmanns found that a group of schizophrenic patients improved their memory performance as they became less symptomatic, although they continued to evidence a deficit. Thus, even vulnerability markers may show change over time, but still indicate continuing impairment compared to controls.

The obvious reason for these changes is the effect of symptom severity on performance. It is perhaps naive to expect remitted patients to perform exactly as actively disturbed schizophrenics. Almost all test results are likely to be affected in some way, measurable or not, by symptoms. To further complicate matters, different types of symptoms may affect different tests in different ways (e.g. hallucinations and delusions versus thought disorder). For example, in the current study, the episodic paranoids did more poorly on the letter detection task than the episodic nonparanoids, but fairly well in comparison on most of the other tasks. It is possible that their symptoms interfered more with viewing on a tachistoscope than the nonparanoids. When their symptoms were alleviated, the performance of the paranoids was nonsignificantly different from normal.

Research should not only include the appropriate groups, but must have checks to be sure that the remitted patients are indeed remitted and the episodic ones are currently symptomatic. This point sounds obvious, but inpatients in hospital are often not acutely disturbed. Recovery can occur quite rapidly. Likewise, when one is comparing different symptom groups, such as paranoid and nonparanoid, ideally they should be equated as much as possible in terms of symptom severity. This equation would be quite difficult to do, given the differing nature of symptoms, but rough estimates could be made. The Maine scale is promising in this respect, as its scales can be directly compared.

Summary and Conclusions

In summary, according to these results, the letter detection deficit does not appear to be a clear and stable marker of vulnerability to schizophrenia. Schizophrenic performance does appear to improve with symptom decrease, particularly for paranoid subjects. Judging from the results, the best areas to pursue for vulnerability markers may be cognitive appraisals of situations and possibly reaction time and general speed of response in stressful or challenging situations. These markers are likely to be different for paranoid and nonparanoid schizophrenics, as suggested by the present sample. As there is so much data in the literature on schizophrenic cognitive and reaction time deficit, it seems reasonable to expect some of these characteristics to carry over into the remitted phase of illness. It is probably naive, however, to expect no change from a very symptomatic to a nonsymptomatic phase.

Following from the last statement, most of the variables in this study showed some improvement, though not always significant change, between the episodic and remitted patients. This change probably reflects the influence of symptoms and/or present hospitalization on performance. If a researcher wishes to investigate stable vulnerability markers, it is wisest to choose measures which are unlikely to be influenced by current symptoms. These measures may include some psychophysiological or biochemical markers, although it is unlikely that these are totally uninfluenced. The physiological lack of response in remitted paranoids, especially for skin conductance, may be a potential marker, as suggested previously. (This measure may change during episodes, and return to its premorbid state with improvement).

The present remitted subjects tended to be much more socially competent than the episodic ones, and this finding was especially true of the nonparanoids. There were differences in coping strategy and predictions between paranoids and nonparanoids, as discussed above, however coping as assessed in this study did not distinguish episodic and remitted patients as competence did. It appears that some schizophrenic subjects can cope quite actively and in similar ways to normals, in some situations.

Several potential episode markers emerged from this study. For assessment purposes, the best indication of phase of illness is symptoms (or lack thereof) and changes in measured intelligence. Heart rate, and arousal in general deserves more research and may be a fairly clear correlate of symptomatology. Anxiety level is another potential avenue for investigation as an episode marker.

It appears as though there are a number of problematic areas with research of this type and several considerations need to be kept in mind for the future. These include the use of appropriate control groups and the consideration of the influence of symptoms on the dependent variables utilized. When looking for vulnerability markers, it is probably wise to include a measure where group differences are expected so that the researchers can contrast the two measures to see if one is differentially more affected than the other. A great deal needs to be done in this area--this edict is not surprising as this research is the first study to attempt to locate both episode and vulnerability markers in the same sample of subjects.

Appendix A

Letter to Physicians

Date:________________________

To: Dr.______________________

As you may know, I am currently conducting a research project where I am comparing remitted (outpatient) schizophrenics to episodic (inpatient) schizophrenics on a number of assessment procedures. In order for me to make a meaningful comparison, I must be sure that the outpatients that I am assessing are relatively symptom free. I must also be sure that they are a similar group to the inpatients in terms of cooperation and so on. In order to make these judgments, I would appreciate it if you could answer the following questions.

According to your opinion, is __________________________ currently showing symptoms of an episode of schizophrenia.

Yes No

In your opinion, when the patient was in hospital, would he/she:

a) have been capable of participating in the current research project? Yes No

b) have been too psychotic to participate in the current research project? Yes No

c) have agreed to participate in the current research project? (were they relatively cooperative while hospitalized?

Yes No

d) been unable to participate because of any other reason?

Yes No

(If you did not know the patient while he/she was hospitalized, please use your current knowledge of the patient to make these judgments).

Thank you very much.

Deborah Dobson, M.A.

Appendix B

Consent Form

POST EXPERIMENTAL QUESTIONNAIRE II

Because it was necessary that everyone in the study receive an equal amount of noise, the speed of your finger tapping did not actually reduce the length of the noise. The lengths of the noises had been decided upon in advance. It was, however, important that you think that you had some control over the noise, so that you made some attempt to do something about it. I am interested in how people view situations and what they try to do about them, so obviously it is important to have to try to control the stimuli.

1) In your own words, why was it necessary to "fix" the lengths of the noise?

2) Do you have any comments or concerns about this aspect of the study?

Appendix C

Post Experimental Questionnaire

POST EXPERIMENTAL QUESTIONNAIRE

The purpose of the study that you have just participated in was to compare the reactions of different people--those currently in hospital, those who are no longer in hospital and those who have never been in hospital. Two types of task were used, one of which looked at how accurately you see letters that are flashed very quickly and the other looked at how you react to stimuli, such as noise.

If you have any questions or concerns about any of the procedures used, please feel free to ask the experimenter.

1) In your own words, what was the general purpose of the study?

2) How much control did you believe that you had over the noise when you were doing the finger tapping task?

0% ———————————————— 100%

3) How much control do you believe that other people had over the noise when they were doing the finger tapping task?

0% ———————————————— 100%

4) How stressful did you find the task involving the detecting of letters?

0 ———————————————— 100

Not at all Stressful ... Very Stressful

5) How stressful did you find the task involving listening to loud noises?

0 ———————————————— 100

Not at all Stressful ... Very Stressful

6) How stressful did you find the task involving viewing pictures of household objects? (given to normals only)

0 ——————————————————— 100

Not at all Stressful — Very Stressful

7) Do you have any comments or concerns about any aspect of the study?

POST EXPERIMENTAL QUESTIONNAIRE II

Because it was necessary that everyone in the study receive an equal amount of noise, the speed of your finger tapping did not actually reduce the length of the noise. The lengths of the noises had been decided upon in advance. It was, however, important that you think that you had some control over the noise, so that you made some attempt to do something about it. I am interested in how people view situations and what they try to do about them, so obviously it is important to have to try to control the stimuli.

1) In your own words, why was it necessary to "fix" the lengths of the noise?

2) Do you have any comments or concerns about this aspect of the study?

Appendix D

Estes's Technique

Estes's Technique

Estes' (1965; Estes & Taylor, 1964) technique for estimating span of apprehension assumes that the subject is using serial information processing. It requires a display in which one of two critical elements (signal) appears amidst irrelevant or noise elements, making the procedure analogous to signal-detection. The procedure is a forced-choice one, where the subject is required to state which element has appeared on any given trial. There is, therefore, a 50% chance on any given trial that the subject will be correct by guessing and Estes' technique of estimation takes this guessing factor into account.

Over a series of trials the estimated number of scanned letters is:

$$d = |2P(C) - 1| \; D$$

where:

d = the estimated number of letters processed

P(C) = percentage of correct recognitions

D = number of letters in the display

The algebraic derivation for this simple formula is given in Estes (1965).

In the present study, three estimates of d were obtained for each block of trials, where D = 1, 4 and 8 letters, respectively. Because there were three blocks of trials, there were 3(3) or 9 estimates of d. This result enabled the experimenter to investigate practice effects across blocks.

Appendix E

Subject Instructions

Subject Instructions

1. Explanation of Physiological Apparatus

This machine is called a polygraph and I will be using it to measure three things--your heart rate or the speed of your heart beating, which will be measured by cups or electrodes placed on your forearms. The second thing that I will be monitoring is your skin response, measured by electrodes placed on the index and third fingers of your nonpreferred hand. The third response that I am interested in is your muscle tension--this will be measured using an electrode placed just above each of your eyebrows.

The reason that I am interested in measuring these responses is because, as you know, your body responds in different ways when you are in different situations. I want to see and understand how you respond in this situation.

2. Letter Detection Task

In the following task, I would like you to look through this viewer. A slide will come on every so often and on each slide, there will be either a capital "T" or a capital "F", but never both. For each slide, your job will be to state whether or not you saw a "T" or an "F". You will have to pay close attention, as the slides will flash fairly quickly.

On some of the slides, there will only be one letter, the "T" or "F" present. On others, additional letters will be present. None of these will be "T"'s or "F"'s. Some trials will have four letters (including the "T" or "F"), others will have eight. Your job in all of these situations is simply to identify the "T" of "F".

There will be three blocks or sets of trials. Before each set begins, I want you to complete two ratings:

1) How tense or relaxed will you be during the upcoming series of trials?

2) How difficult do you think that you will find the upcoming series of trials?

These ratings are to be made by slashing the line anywhere between 0 and 100, remembering to read the end-points carefully.

Following each set of trials, I will again have you make two ratings on the ones that you have just finished.

1) How relaxed or tense were you during the series of trials that you have just completed?

2) How difficult did you find the series of trials that you have just completed?

Therefore, you have two basic tasks to do--one is to state during each trial if you have seen a "T" or an "F", the other is to make several ratings before and after each set of trials. Do you have any questions?

Practice trials.

3. Stress-Appraisal Task

During the next task, I am interested in seeing how you respond to noise. There are three different levels or intensities of noise that you will hear. One level is moderately quiet, the second is medium and the third is fairly loud. None of these noises are harmful to you in any way.

The experimenter will tell you when the machine is ready to begin a new trial by saying the word "ready" to you. When you hear the word "ready", put your forefinger on this tapping instrument, here, and get ready to tap your finger. Let your forearm rest on the table in a comfortable position, and let your other arm and hand rest on the arm of the chair.

After a short interval, a green light will come on, which will be the "go" signal. When you see this signal, you are to begin tapping your finger quickly. Also, when the green light comes on, you will hear the noise begin in your headphones at the same time. Your tapping will not prevent the noise from beginning, but you may be able to reduce the length of the noise. The more quickly you tap, the more likely the length of the noise will be reduced. So, in order to reduce the length of time that you hear the noise, you should try your best to tap as rapidly as you can. You will not be able to control the length of the noise all of the time, but you will be able to influence it some of the time. Your task is to try to control the length of the noise as much as you can. At times, you may be able to shorten the length of the noise on the next or upcoming trial if you tap very quickly--that is why some noises may seem very brief to you when you think that you may not be doing too well.

When the noise stops, a red light will come on and you can stop tapping. One trial is then completed.

Just before each trial or noise, I would like you to complete several ratings regarding what you think will happen on the upcoming trial"

1) What are the chances that the noise will continue if you do not do your best to try to stop it quickly?

2) What are the chances that the noise will continue if you do your best to try to stop it quickly?

3) How tense or relaxed do you think you will be during the upcoming situation?

4) How difficult do you think you will find the upcoming situation?

Be sure to read each of the questions very carefully, as the order of the first two will sometimes be reversed. Also, the endpoints of the rating lines are changed around at times to be sure that you are paying close attention. Make each rating by making a slash on the line underneath it.

After each noise, I will also have you complete two ratings on the trial that you have just finished:

1) How relaxed or tense were you during the trial that you have just completed?

2) How difficult did you find the trial that you have just completed?

Do you have any questions? (Frequently, subjects had questions about the two probability ratings, and these required additional explanation).

Practice trials

Appendix F

Between Variable Correlations

Stressor Task

Table 9: Between variable correlations for stressor task (Normals) n = 28

	AR	DR	HR	SC	EMG	Taps	A	P	R
AR	--	.515*	-.107	.067	.084	.104	.307	.149	.042
DR		--	.160	.178	-.036	.031	.358*	-.136	.166
HR			--	-.146	.232	.059	.054	-.031	-.010
SC				--	-.241	-.027	.161	.260	-.083
EMG					--	.031	.055	-.269	.241
Taps						--	.115	.190	-.106
A							--	.188	.685*
P								--	-.713*
R									--

*$p < .05$

AR = Anxiety Rating; DR = Difficulty Rating; A = Active Coping Prediction; P = Passive Coping Prediction; R = Coping Ratio.

Table 10: Between variable correlations for stressor task (Episodic/Paranoids) n = 14

	AR	DR	HR	SC	EMG	Taps	A	P	R
AR	--	.706*	-.613*	-.077	.052	-.515*	-.064	.224	.409
DR		--	.379	-.028	-.231	-.495*	.422	-.327	.483*
HR			--	.125	.173	.066	.177	-.452	-.065
SC				--	-.376	.183	.303	.081	-.178
EMG					--	-.213	-.297	.187	.162
Taps						--	-.172	.062	-.354
A							--	-.440	.278
P								--	-.082
R									--

*$p < .05$

AR = Anxiety Rating: DR = Difficulty Rating; A = Active Coping Prediction; P = Passive Coping Prediction; R = Coping Ratio.

Table 11 : Between variable correlations for stressor task (Episodic/Nonparanoids) n = 14

	AR	DR	HR	SC	EMG	Taps	A	P	R
AR	--	.758*	.002	-.425	-.081	-.118	-.101	-.460*	.255
DR		--	-.228	-.285	-.204	-.182	.218	-.260	.231
HR			--	.206	.420	.106	-.253	.186	-.373
SC				--	.128	.273	-.327	.334	-.177
EMG					--	-.143	-.143	-.297	-.006
Taps						--	-.029	.071	-.004
A							--	-.183	-.109
P								--	-.704*
R									--

*$p < .05$

AR = Anxiety Rating; DR = Difficulty Rating; A = Active Coping Prediction; P = Passive Coping Prediction; R = Coping Ratio.

Table 12 : Between variable correlations for stressor task (Remitted/Paranoids) n = 14

	AR	DR	HR	SC	EMG	Taps	A	P	R
AR	--	.851*	.265	-.352	-.316	.128	.538*	.102	.312
DR		--	.299	-.491*	-.348	.115	.650*	.195	.421
HR			--	-.066	.054	-.117	.448	.420	.135
SC				--	-.006	-.296	-.376	-.111	-.365
EMG					--	-.089	-.259	-.149	-.055
Taps						--	.211	.224	.004
A							--	.608*	.513*
P								--	-.189
R									--

*$p < .05$

AR = Anxiety Rating; DR = Difficulty Rating; A = Active Coping Prediction; P = Passive Coping Prediction; R = Coping Ratio

3 OF/DE 3

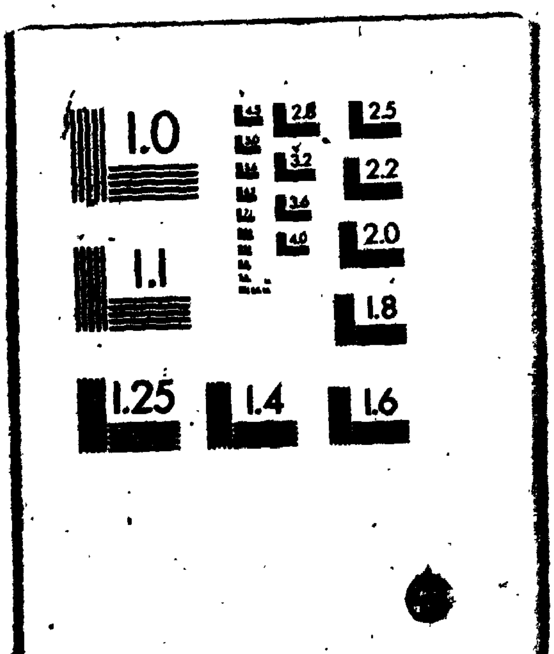

Table 13: Between variable correlations for stressor task (Remitted/Nonparanoids) n = 14

	AR	DR	HR	SC	EMG	Taps	A	P	R
AR	--	.375	-.145	-.133	-.267	-.196	-.187	.250	.031
DR		--	.339	.204	-.109	-.346	-.023	-.387	-.227
HR			--	.494*	-.245	.166	-.134	-.101	-.279
SC				--	.499*	.531*	-.392	-.161	-.277
EMG					--	.155	-.454*	-.310	-.017
Taps						--	-.274	.203	-.387
A							--	.010	.335
P								--	.248
R									--

*$p < .05$

AR = Anxiety Rating; DR = Difficulty Rating; A = Active Coping Prediction; P = Passive Coping Prediction; R = Coping Ratio.

Table 14: Between variable correlations for stressor task

Overall N = 84 (Predictions only)

Predictions	A and Taps	r = -.120
	P and Taps	r = .242*
	R and Taps	r = -.255*
	A and P	r = -.163
	A and R	r = .224*
	P and R	r = -.267*

*$p < .05$

A = Active Coping Prediction; P = Passive Coping Prediction;

R = Coping Ratio.

Appendix G

Subjective Rating Forms

Rating Form for Letter Detection Trials

Block # ____

HOW DIFFICULT DO YOU THINK YOU WILL FIND THE UPCOMING SERIES OF TRIALS? (Put a slash on the line according to your prediction)

0 ———————————————————— 100

Not at all Difficult | Very Difficult

HOW TENSE OR RELAXED DO YOU THINK YOU WILL BE DURING THE UPCOMING SERIES OF TRIALS?

0 ———————————————————— 100

Very Relaxed | Very Tense

HOW DIFFICULT DID YOU FIND THE SERIES OF TRIALS THAT YOU HAVE JUST COMPLETED?

0 ———————————————————— 100

Very Difficult | Not at all Difficult

HOW TENSE OR RELAXED WERE YOU DURING THE SERIES OF TRIALS THAT YOU HAVE JUST COMPLETED?

0 ———————————————————— 100

Very Tense | Very Relaxed

Rating Form for Noise Trials

Trial # ____

WHAT ARE THE CHANCES THAT THE NOISE WILL CONTINUE IF YOU DO NOT DO YOUR BEST TO TRY TO STOP IT QUICKLY? (Please put a slash on the line according to your prediction)

.01% ________________________________ 100%

WHAT ARE THE CHANCES THAT THE NOISE WILL CONTINUE IF YOU DO YOUR BEST TO TRY TO STOP IT QUICKLY?

.01% ________________________________ 100%

HOW TENSE OR RELAXED DO YOU THINK YOU WILL BE DURING THE UPCOMING SITUATION?

0 ________________________________ 100
Very Relaxed — Very Tense

HOW DIFFICULT DO YOU THINK YOU WILL FIND THE UPCOMING SITUATION?

0 ________________________________ 100
Very Difficult — Not at all difficult

HOW TENSE OR RELAXED WERE YOU DURING THE SITUATION (NOISE) THAT YOU HAVE JUST ENCOUNTERED?

0 ________________________________ 100
Very Tense — Very Relaxed

HOW DIFFICULT DID YOU FIND THE SITUATION (NOISE) THAT YOU HAVE JUST ENCOUNTERED?

0 ________________________________ 100
Not at all Difficult — Very Difficult

Appendix H

ANOVA Summary Tables

Letter Detection Task

Table 15: ANOVA Summary Table (Letter Detection Task)

Dependent Variable = Raw Scores (performance)

Source	df	MS	F
Group (G)	2	93.218	5.910*
Stage (St)	1	21.147	1.341
G X St	2	43.933	2.785
Subjects within G X St	78	15.774	
Difficulty (D)	2	36.266	6.725*
G X D	4	2.177	0.404
St X D	2	3.861	0.716
G X St X D	4	4.950	0.918
D X Subjects within G X St	156	5.392	

*$p < .05$

Table 16: ANOVA Summary Table (Letter Detection Task)

Dependent Variable = Corrected Scores (Performance)

Source	df	MS	F
Group (G)	2	5.473	4.684*
Stage (St)	1	2.470	2.113
G X St	2	4.196	3.591*
Subjects within G X St	78	1.169	
Difficulty (D)	2	51.590	80.293**
G X D	4	1.560	2.427*
St X D	2	1.150	1.789
G X St X D	4	0.918	1.429
D X Subjects within G X St.	156	0.643	

*p <.05

**p <.001

Table 17: ANOVA Summary Table (Letter Detection Task) Dependent Variable = Corrected Scores (Performance), not multiplied by D.

Source	df	MS	F
Group (G)	2	.297	4.640*
Stage (St)	1	.077	1.206
G X St	2	.229	3.58*
Subjects within G X St	78	.064	
Difficulty (D)	2	.180	7.08**
G X D	4	.023	0.90
St X D	2	.008	0.33
G X St X D	4	.028	1.11
D X Subj. within G X St	156	.025	

*$p < .05$

**$p < .01$

Table 18: ANOVA Summary Table (Letter Detection Task)

Dependent Variable = Heart Rate (decelerating)

Source	df	MS	F
Group (G)	2	2227.752	2.400
Stage (St)	1	6357.340	6.850*
G X St	2	3667.121	3.951*
Subjects within G X St	78	928.105	
Set (Se)	2	1.633	0.053
G X Se	4	55.942	1.797
St X Se	2	2.526	0.081
G X St X Se	4	34.056	1.094
Se X Subj. within G X St	156	31.128	
Pre/Post (P)	1	14.000	0.422
G X P	2	100.541	3.032
St X P	1	6.222	0.188
G X St X P	2	122.538	3.670*
Se X P	2	41.518	1.885
G X Se X P	4	28.935	1.314
St X Se X P	2	19.133	0.869
G X St X Se X P	4	40.698	1.848
P X Subjects within G X St	78	33.161	
Se X P X Subj. within G X St	156	22.010	

*$p < .05$

Table 19: ANOVA Summary Table (Letter Detection Task)

Dependent Variable = Heart Rate (accelerating)

Source	df	MS	F
Group (G)	2	2324.399	2.783
Stage (St)	1	6615.625	7.922*
G X St	2	2209.347	2.646
Subjects within G X St	78	835.144	
Set (Se)	2	8.792	0.264
G X Se	4	34.682	1.041
St X Se	2	14.050	0.422
G X St X Se	4	58.725	1.76
Se X Subj. within G X St	156	33.323	
Pre/Post (P)	1	468.643	10.588*
G X P	2	85.042	1.[illegible]21
St X P	1	2.571	0.058
G X St X P	2	99.577	2.250
P X Subj. Within G X St	78	44.264	
Se X P	2	42.339	1.626
G X Se X P	4	35.890	1.379
St X Se X P	2	25.256	0.970
G X St X Se X P	4	53.199	2.043
Se X P X Subj. within G X St	156	26.035	

*$p < .05$

Table 20: ANOVA Summary Table (Letter Detection Task)

Dependent Variable = Muscle Tension

Source	df	MS	F
Group (G)	2	3123.3389	1.805
Stage (St)	1	1474.292	0.852
G X St	2	1465.453	0.847
Subjects within G X St	78	1730.142	
Set (Se)	2	658.251	2.999*
G X Se	4	207.329	0.945
St X Se	2	211.942	0.966
G X St X Se	4	318.125	1.450
Se X Subj. within G X St	156	219.495	
Pre/Post (P)	1	93.431	0.272
G X P	2	114.204	0.333
St X P	1	10.286	0.030
G X St X P	2	89.452	0.261
P X Subj. within G X St	78	343.040	
Se X P	2	437.150	1.842
G X Se X P	4	257.009	1.083
St X Se X P	2	9.542	0.040
G X St X Se X P	4	515.806	2.173
Se X P X Subj. within G X St	156	237.359	

*p = .05

Table 21: ANOVA Summary Table (Letter Detection Task)

Dependent Variable = Skin Conductance

Source	df	MS	F
Group (G)	2	4311.625	4.031*
Stage (St)	1	8296.211	7.755*
G X St	2	2256.473	2.109
Subjects within G X St	78	1069.760	
Set (Se)	2	6.783	0.161
G X Se	4	27.242	0.650
St X Se	2	46.441	1.108
G X St X Se	4	62.237	1.485
Se X Subj. within G X St	156	41.899	
Pre/Post (P)	1	198.603	8.262*
G X P	2	1.695	0.071
St X P	1	23.977	0.997
G X St X P	2	19.816	0.824
P X Subj. within G X St	78	24.038	
Se X P	2	2.426	0.276
G X Se X P	4	2.551	0.290
St X Se X P	2	27.654	3.143*
G X St X Se X P	4	11.690	1.329
Se X P X Subj. within G X St	156	8.798	

*$p < .05$

Appendix I

ANOVA Summary Tables

Stressor Task

Table 22 ANOVA Summary Table (Stressor Task)
Dependent Variable = Reaction Time (Practice Trials)

Source	df	MS	F
Group (G)	2	.088	3.605*
Stage (St)	1	.031	1.271
G X St	2	.057	2.306
Subjects within G X St	78	.025	

*$p < .05$

Table 23: ANOVA Summary Table (Stressor Task)

Dependent Variable = Taps (Practice trials)

Source	df	MS	F
Group (G)	2	40.916	10.701**
Stage (St)	1	8.422	2.203
G X St	2	8.315	2.175
Subjects within G X St	78	3.824	

** $p < .001$

Table 24: ANOVA Summary Table (Stressor Task)

Dependent Variable = Reaction Time

Source	df	MS	F
Group (G)	2	1.074	4.145*
Stage (St)	1	0.099	0.384
G X St	2	0.029	0.118
Subjects within G X St	78	0.259	
Intensity (I)	2	0.119	7.141**
G X I	4	0.014	0.838
St X I	2	0.057	3.435*
G X St X I	4	0.011	0.660
I X Subj. within G X St	156	0.017	
Length (L)	2	0.084	3.083*
G X L	4	0.024	0.873
St X L	2	0.009	0.330
G X St X L	4	0.034	1.253
L X Subj. within G X St	156	0.027	
I X L	4	0.023	0.821
G X I X L	8	0.021	0.741
St X I X L	4	0.072	2.558*
G X St X I X L	8	0.024	0.801
I X L X Subj. within G X St	312	0.028	

*$p < .05$

**$p < .001$

Table 25: ANOVA Summary Table (Stressor Task)

Dependent Variable = Taps

Source	df	MS	F
Group (G)	2	519.946	8.741**
Stage (St)	1	58.890	0.990
G X St	2	26.716	0.449
Subjects within G X St	78	59.481	
Intensity (I)	2	27.041	11.690**
G X I	4	1.021	0.442
St X I	2	5.065	2.190
G X St X I	4	4.438	1.919
I X Subj. within G X St	156	2.313	
Length (L)	2	109.370	41.592**
G X L	4	3.17	1.206
St X L	2	2.958	1.125
G X St X L	4	0.331	0.126
L X Subj. within G X St	156	2.630	
I X L	4	1.249	0.535
G X I X L	8	1.988	0.852
St X I X L	4	3.222	1.380
G X St X I X L	8	2.705	1.159
I X L X Subj. within G X St	312	2.334	

* $p < .05$

** $p < .001$

Table 26: ANOVA Summary Table (Stressor Task)

Dependent Variable = Active Coping Prediction

Source	df	MS	F
Group (G)	2	0.138	3.905*
Stage (St)	1	0.006	0.157
G X St	2	0.035	0.986
Subjects within G X St	78	0.035	

*$p < .05$

Table 27: ANOVA Summary Table (Stressor Task)

Dependent Variable = Passive Coping Prediction

Source	df	MS	F
Group (G)	2	0.240	6.812*
Stage (St)	1	0.010	0.293
G X St	2	0.001	0.039
Subjects within G X St	78	0.035	

*$p < .05$

Table 28: ANOVA Summary Table (Stressor Task)

Dependent Variable = Coping Ratio

Source	df	MS	F
Group (G)	2	54.554	3.256*
Stage (St)	1	0.844	0.050
G X St	2	12.668	0.756
Subjects within G X St	78	16.754	

*$p < .05$

Table 29: ANOVA Summary Table (Stressor Task)

Dependent Variable = Anxiety Ratings

Source	df	MS	F
Group (G)	2	0.592	0.967
Stage (St)	1	0.202	0.330
G X St	2	0.949	1.551
Subjects within G X St	78	0.612	
Intensity (I)	2	0.590	19.898**
G X I	4	0.013	0.430
St X I	2	0.048	1.608
G X St X I	4	0.065	2.192
I X Subj. within G X St	156	0.030	
Length (L)	2	0.131	2.568
G X L	4	0.036	0.661
St X L	2	0.145	2.854
G X St X L	4	0.029	0.576
L X Subj. within G X St	156	0.051	
I X L	4	0.025	0.712
G X I X L	8	0.057	1.610
St X I X L	4	0.147	4.163*
G X St X I X L	8	0.035	0.991
I X L X Subj. within G X St	312	0.035	--
Pre/post (P)	1	0.014	0.399
G X P	2	0.011	0.306

Table 29: continued

St X P	1	0.064	1.810
G X St X P	2	0.008	0.224
P X Subj. within G X St	78	0.035	
I X P	2	0.076	2.263
G X I X P	4	0.020	0.589
St X I X P	2	0.065	1.938
G X St X I X P	4	0.0417	1.241
I X P X Subj. within G X St	156	0.034	
L X P	2	0.178	4.158*
G X L X P	4	0.049	1.138
St X L X P	2	0.077	1.790
G X St X L X P	4	0.053	1.241
L X P X Subj. within G X St	156	0.043	
I X L X P	4	0.095	2.409*
G X I X L X P	8	0.028	0.721
St X I X L X P	4	0.030	0.7[illegible]4
G X St X I X L X P	8	0.032	0.809
I X L X P X Subj. within G X St	312	0.039	

*p < .05

**p < .001

Table 30: ANOVA Summary Table (Stressor Task)

Dependent Variable = Difficulty Ratings

Source	df	MS	F
Group (G)	2	0.860	1.871
Stage (St)	1	1.516	3.299
G X St	2	1.286	2.799
Subjects within G X St	78	0.460	
Intensity (I)	2	0.213	5.086*
G X I	4	0.018	0.419
St X I	2	0.071	1.698
G X St X I	4	0.050	1.184
I X Subj. within G X St	156	0.042	
Length (L)	2	0.086	1.914
G X L	4	0.022	0.499
St X L	2	0.049	1.095
G X St X L	4	0.042	0.946
L X Subj. within G X St	156	0.045	
I X L	4	0.079	2.104
G X I X L	8	0.070	1.860
St X I X L	4	0.023	0.610
G X St X I X L	8	0.028	0.757
I X L X Subj. within G X St	312	0.037	
Pre/post (P)	1	0.206	5.858*
G X P	2	0.030	0.855
St X P	1	0.0004	0.013

Table 30: Continued

G X St X P	2	0.012	0.349
P X Subj. within G X St	78	0.035	
I X P	2	0.181	6.219*
G X I X P	4	0.016	0.543
St X I X P	2	0.052	1.785
G X St X I X P	4	0.051	1.731
I X P X Subj. within G X St	156	0.292	
L X P	2	0.176	6.112*
G X L X P	4	0.034	1.167
St X L X P	2	0.032	1.102
G X St X L X P	4	0.008	0.307
L X P X Subj. within G X St	156	0.029	
I X L X P	4	0.061	2.268
G X I X L X P	8	0.003	0.109
St X I X L X P	4	0.034	1.267
G X St X I X L X P	8	0.033	1.233
I X L X P X Subj. within G X St	312	0.027	

*$p < .05$

Table 31: ANOVA Summary Table (Stressor Task)

Dependent Variable = Decelerating Heart Rate

Source	df	MS	F
Group (G)	2	10216.668	3.663*
Stage (St)	1	19321.441	6.928*
G X St	2	10027.645	3.596*
Subjects within G X St	78	2788.916	
Intensity (I)	2	247.841	7.622**
G X I	4	31.870	0.980
St X I	2	90.828	2.793
G X St X I	4	53.688	1.651
I X Subj. within G X St	156	32.516	
Length (L)	2	83.577	2.220
G X L	4	18.532	0.492
St X L	2	62.227	1.653
G X St X L	4	27.096	0.720
L X Subj. within G X St	156	37.640	
I X L	4	16.285	0.440
G X I X L	8	42.306	1.143
St X I X L	4	21.154	0.571
G X St X I X L	8	67.302	1.818
I X L X Subj. within G X St	312	37.029	
Pre/Post (P)	1	7.858	0.103
G X P	2	6.116	0.080
St X P	1	108.482	1.427

Table 31: Continued

G X St X P	2	192.407	2.531
P X Subj. within G X St	78	76.026	
I X P	2	15.717	0.734
G X I X P	4	31.436	1.469
St X I X P	2	18.699	0.874
G X St X I X P	4	29.459	1.377
I X P X Subj. within G X St	156	21.402	
L X P	2	22.044	0.770
G X L X P	4	26.034	0.909
St X L X P	2	3.966	0.139
G X St X L X P	4	19.319	0.674
L X P X Subj. within G X St	156	28.648	
I X L X P	4	20.198	0.944
G X I X L X P	8	19.386	0.906
St X I X L X P	4	37.340	1.746
G X St X I X L X P	8	13.257	0.620
I X L X P X Subj. within G X St	312	21.389	

* $p < .05$

** $p < .001$

Table 32: ANOVA Summary Table (Stressor Task)

Dependent Variable = Accelerating Heart Rate

Source	df	MS	F
Group (G)	2	6120.348	0.1013
Stage (St)	1	20837.148	7.952*
G X St	2	6203.367	2.367
Subjects within G X St	78	2620.279	
Intensity (I)	2	857.366	16.820**
G X I	4	35.660	0.700
St X I	2	57.220	1.123
G X St X I	4	99.172	1.946
I X Subj. within G X St	156	50.972	
Length (L)	2	499.177	6.693*
G X L	4	120.106	1.790
St X L	2	23.722	0.354
G X St X L	4	28.879	0.430
L X Subj. within G X St	156	67.107	
I X L	4	40.541	0.761
G X I X L	8	49.991	0.939
St X I X L	4	48.957	0.919
G X St X I X L	8	51.924	0.975
I X L X Subj. within G X St	312	53.158	
Pre/Post (P)	1	5315.621	37.708**
G X P	2	197.621	1.402
St X P	1	113.905	0.808

Table 32 : Continued

G X St X P	2	132.433	0.940
P X Subj. within G X St	78	140.968	
I X P	2	15.042	0.319
G X I X P	4	6.273	0.133
St X I X P	2	10.822	0.230
G X St X I X P	4	31.043	0.658
I X P X Subj. within G X St	156	47.162	
L X P	2	16.198	0.279
G X L X P	4	58.474	1.008
St X L X P	2	82.431	1.421
G X St X L X P	4	40.411	0.697
L X P X Subj. within G X St	156	58.029	
I X L X P	4	38.076	0.973
G X I X L X P	8	29.409	0.752
St X I X L X P	4	50.494	1.291
G X St X I X L X P	8	37.355	0.955
I X L X P X Subj. within G X St	312	39.126	

*p <.05

**p <.001

Table 33: ANOVA Summary Table (Stressor Task)

Dependent Variable = Muscle Tension

Source	df	MS	F
Group (G)	2	5737.582	1.862
Stage (St)	1	136.921	0.044
G X St	2	794.770	0.258
Subjects within G X St	78	3082.078	
Intensity (I)	2	24.566	0.264
G X I	4	99.206	1.067
St X I	2	120.242	1.293
G X St X I	4	127.238	1.369
I X Subj. within G X St	156	93.033	
Length (L)	2	53.286	0.639
G X L	4	233.358	2.798*
St X L	2	41.472	0.497
G X St X L	4	75.587	0.906
L X Subj. within G X St	156	83.416	
I X L	4	8.061	0.098
G X I X L	8	73.093	0.891
St X I X L	4	98.826	1.204
G X St X I X L	8	63.307	0.771
I X L X Subj. within G X St	312	82.069	
Pre/Post (P)	1	5677.840	34.115**
G X P	2	96.383	0.579
St X P	1	116.667	0.701

Table 33 Continued

G X St X P	2	19.358	0.116
P X Subj. within G X St	78	166.431	
I X P	2	86.314	1.765
G X I X P	4	25.612	0.524
St X I X P	2	33.495	0.685
G X St X I X P	4	7.987	0.163
I X P X Subj. within G X St	156	48.916	
L X P	2	70.862	1.308
G X L X P	4	19.015	0.351
St X L X P	2	59.164	1.092
G X St X L X P	4	90.724	1.675
L X P X Subj. within G X St	156	54.177	
I X L X P	4	12.070	0.240
G X I X L X P	8	77.103	1.534
St X I X L X P	4	100.992	2.010
G X St X I X L X P	8	57.896	1.152
I X L X P X Subj. within G X St	312	50.255	

*$p < .05$

**$p < .001$

Table 34: ANOVA Summary Table (Stressor Task)

Dependent Variable = Skin Conductance

Source	df	MS	F
Group (G)	2	19201.609	5.793*
Stage (St)	1	19006.223	5.734*
G X St	2	12430.672	3.750*
Subjects within G X St	78	3314.633	
Intensity (I)	2	76.784	8.512**
G X I	4	25.061	2.778*
St X I	2	0.646	0.072
G X St X I	4	1.702	0.189
I X Subj. within G X St	156	9.020	
Length (L)	2	32.973	4.058*
G X L	4	8.807	1.084
St X L	2	15.072	1.855
G X St X L	4	7.039	0.866
L X Subj. within G X St	156	8.126	
I X L	4	13.300	1.244
G X I X L	8	6.125	0.573
St X I X L	4	6.322	0.591
G X St X I X L	8	17.781	1.663
I X L X Subj. within G X St	312	10.691	
Pre/Post (P)	1	329.758	42.013**
G X P	2	50.006	6.371*
St X P	1	1.157	0.147

Table 34: Continued

G X St X P	2	34.318	4.372*
P X Subj. within G X St	78	7.849	
I X P	2	2.429	2.715
G X I X P	4	0.280	0.313
St X I X P	2	1.222	1.366
G X St X I X P	4	0.487	0.545
I X P X Subj. within G X St	156	0.895	
L X P	2	0.885	0.537
G X L X P	4	2.722	1.651
St X L X P	2	2.218	1.345
G X St X L X P	4	0.651	0.395
L X P X Subj. within G X St	156	1.649	
I X L X P	4	1.490	1.300
G X I X L X P	8	2.488	2.171*
St X I X L X P	4	0.432	0.377
G X St X I X L X P	8	0.504	0.440
I X L X P X Subj. within G X St	312	1.146	

*$p < .05$

**$p < .001$

Appendix J

ANCOVA Summary Tables

Letter Detection Task

Table 35: ANCOVA Summary Table (Letter Detection Task)

Dependent Variable = Heart Rate (Decelerating)

Source	df	MS	F
Group (G)	2	931.115	8.664**
Stage (St)	1	1750.355	16.287**
G X St	2	1216.817	11.322**
Subjects within G X St	77	107.471	
Set (Se)	2	34.706	2.248
G X Se	4	7.504	0.486
St X Se	2	7.599	0.492
G X St X Se	4	6.990	0.453
Se X Subjects within G X St	155	15.440	

*$p < .05$

**$p < .001$

Table 36: ANCOVA Summary Table (Letter Detection Task)
Dependent Variable = Heart Rate (Accelerating)

Source	df	MS	F
Group (G)	2	1182.981	9.036**
Stage (St)	1	1952.784	14.916**
G X St	2	1001.042	7.646**
Subjects within G X St	77	130.921	
Set (Se)	2	37.425	2.221
G X Se	4	8.772	0.521
St X Se	2	3.128	0.186
G X St X Se	4	12.735	0.756
Se X Subjects within G X St	155	16.852	

*$p < .05$

**$p < .001$

Table 37: ANCOVA Summary Table (Letter Detection Task)

Dependent Variable = Muscle Tension

Source	df	MS	F
Group (G)	2	1763.119	3.495*
Stage (St)	1	806.072	1.598
G X St	2	691.133	1.370
Subjects within G X St	77	504.477	
Set (Se)	2	829.647	2.772
G X Se	4	384.106	1.284
St X Se	2	157.171	0.525
G X St X Se	4	663.054	2.216
Se X Subjects within G X St	155	299.263	

*$p < .05$

**$p < .001$

Table 38 ANCOVA Summary Table (Letter Detection Task)

Dependent Variable = Skin Conductance

Source	df	MS	F
Group (G)	2	325.975	6.086*
Stage (St)	1	370.613	6.920*
G X St	2	161.786	3.021*
Subjects within G X St	77	53.560	
Set (Se)	2	0.747	0.080
G X Se	4	5.088	0.541
St X Se	2	17.980	1.913
G X St X Se	4	8.813	0.938
Se X Subj. within G X St	155	9.397	

*$p < .05$

**$p < .001$

Appendix K

ANCOVA Summary Tables

Stressor Task

Table 39: ANCOVA Summary Table (Stressor Task)

Dependent Variable = Heart Rate (Decelerating)

Source	df	MS	F
Group (G)	2	1578.361	7.419*
Stage (St)	1	3806.516	17.892**
G X St	2	1276.860	6.002*
Subjects within G X St	77	212.753	
Intensity (I)	2	23.450	1.070
G X I	4	17.592	0.803
St X I	2	72.684	3.318*
G X St X I	4	28.034	1.280
I X Subj. within G X St	155	21.909	
Length (L)	2	0.565	0.019
G X L	4	24.896	0.820
St X L	2	34.046	1.121
G X St X L	4	17.354	0.571
L X Subj. within G X St	155	30.375	
I X L	4	16.123	0.656
G X I X L	8	26.714	1.086
St X I X L	4	16.086	0.654
G X St X I X L	8	24.521	0.997
I X L X Subj. within G X St	311	24.597	

*$p < .05$

**$p < .001$

Table 40: ANCOVA Summary Table (Stressor Task)

Dependent Variable = Heart Rate (Accelerating)

Source	df	MS	F
Group (G)	2	1159.466	3.606*
Stage (St)	1	4838.594	15.048**
G X St	2	1046.056	3.253*
Subjects within G X St	77	321.535	
Intensity (I)	2	171.345	2.648
G X I	4	22.766	0.352
St X I	2	4.168	0.064
G X St X I	4	88.539	1.368
I X Subj. within G X St	155	64.713	
Length (L)	2	229.072	3.072*
G X L	4	92.969	1.247
St X L	2	41.288	0.554
G X St X L	4	41.106	0.551
L X Subj. within G X St	155	74.577	
I X L	4	26.028	0.490
G X I X L	8	59.235	1.114
St X I X L	4	24.898	0.468
G X St X I X L	8	50.076	0.942
I X L X Subj. within G X St	311	53.168	

*p < .05

**p < .001

Table 41: ANCOVA Summary Table (Stressor Task)

Dependent Variable = Muscle Tension

Source	df	MS	F
Group (G)	2	874.973	2.039
Stage (St)	1	8.474	0.020
G X St	2	134.373	0.313
Subjects within G X St	77	429.086	
Intensity (I)	2	28.426	0.368
G X I	4	29.515	0.382
St X I	2	92.407	1.195
G X St X I	4	68.021	0.880
I X Subj. within G X St	155	77.325	
Length (L)	2	23.737	0.365
G X L	4	75.136	1.157
St X L	2	101.450	1.562
G X St X L	4	108.854	1.676
L X Subj. within G X St	155	64.967	
I X L	4	10.617	0.183
G X I X L	8	88.756	1.532
St X I X L	4	97.672	1.686
G X St X I X L	8	49.414	0.853
I X L X Subj. within G X St	311	57.928	

Table 42: ANCOVA Summary Table (Stressor Task)

Dependent Variable = Skin Conductance

Source	df	MS	F
Group (G)	2	17.142	1.235
Stage (St)	1	3.075	0.222
G X St	2	19.230	1.385
Subjects within G X St	77	13.884	
Intensity (I)	2	3.638	2.026
G X I	4	0.576	0.321
St X I	2	2.417	1.346
G X St X I	4	0.907	0.505
I X Subj. within G X St	155	1.796	
Length (L)	2	2.038	0.709
G X L	4	5.114	1.780
St X L	2	4.539	1.579
G X St X L	4	1.310	0.456
L X Subj. within G X St	155	2.874	
I X L	4	2.813	1.226
G X I X L	8	4.781	2.083*
St X I X L	4	0.733	0.320
G X St X I X L	8	1.059	0.461
I X L X Subj. within G X St	311	2.295	

*$p < .05$

**$p < .001$

Footnotes

1. Whenever effects with repeated measures factors are reported, either conservative or exact tests (where the liberal & conservative df tests disagree) will be reported.
2. An exact test for repeated measures factors was calculated utilizing a combination of the Huynh & Feldt (1976) and Collier et al. (1967) procedures (Breiter, Note 9; Gary, 1981).

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