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Psychophysiological and Attentional Response Patterns in Hypothetically Psychosis-Prone Adolescents

André M. Bergeron

A Thesis

in

The Department

of

Psychology

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ABSTRACT

Psychophysiological and Attentional Response Patterns in Hypothetically Psychosis-Prone Adolescents

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Concordia University, 1990

Although the evidence for genetic transmission of schizophrenia is persuasive, behaviors of the affected individuals are the basis for diagnosis of this disorder. Investigators have therefore argued for the use of a behavior-based risk marker. Chapman and his colleagues have developed a number of scales designed to assess the behaviors and experiences reported by adolescents and young adults which are likely to be associated with increased risk for schizophrenia. Using two of those scales, Simons has hypothesized that individuals at risk by virtue of their high scores on the Chapman Scales of Anhedonia and Perceptual Aberration would exhibit the same deviant patterns of orienting response (OR) as those shown by individuals already diagnosed as schizophrenic.

The purpose of the present study was to extend the work of Simons by examining first, baseline and reactive arousal, and then, the effect of conditions of incentive, unpredictability and controllability on the orienting response of adolescents deemed at risk for schizophrenia. Third, the attentional performance of the participants was assessed in order to determine whether an attentional

deficit was present, and associated with OR-hyporesponsiveness and OR-hyperresponsiveness. Participants were first tested on three autonomic measures: Resting heart rate, skin conductance level and number of spontaneous skin conductance responses to assess their basal arousal level. Then, the skin conductance OR was measured under four conditions: Neutral, incentive, unpredictability and controllability. Anhedonic adolescents were expected to be hypoaroused and hyporeactive, even under an incentive condition, while perceptually aberrant students were expected to be hyperaroused and hyper-reactive, especially under an unpredictability condition. Anhedonics were expected to make more omission errors and perceptual aberration participants more commission errors. The general tenor of the results did not point to any relation between psychiatric risk as defined by the Chapman Scales and the psychophysiological and attentional parameters assessed under the four conditions. The negative findings may best be viewed in the context of issues relating to the age of the adolescents and the measures used.

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INTRODUCTION

In the past three decades, prevention has become a major theme of research in schizophrenia. Typically, researchers in this area study children who are judged to be at-risk for schizophrenia in order to identify the early precursors of the disorder and its premorbid developmental course (Watt, 1984). The task of the investigator is to select a marker of risk which will permit identification of a target group for follow-up study so that, ultimately, appropriate preventive interventions can be developed. "What we are looking for is a marker with sensitivity (present in a high proportion of cases) and specificity (present in a low proportion of controls)" (Zahn, 1986, p. 509).

Three paradigms have been used to identify at-risk populations, including the "genetic" paradigm, which focusses on the offspring of biological parents with the disorder; the "exophenotypic" paradigm, which uses a behavioral index of vulnerability, such as aggression or withdrawal (Depue, Slater, Wolfstetter-Kausch, Lein, Goplerud, & Farr, 1981); and the "endophenotypic" paradigm which uses a biological index such as psychophysiological status. Most at-risk studies have adhered to the genetic paradigm, on the assumption that genetic factors are an essential etiological component in the development of schizophrenia. A family

history of schizophrenia is a risk marker: the incidence rate of schiophrenia increases from one per cent in the general population to 10-12 percent in a population of children with a schizophrenic parent (Gottesman & Shields, 1972; Faraone & Tsuang, 1985). There is evidence, however, which suggests that there are constraints on the generalizability of data based on this criterion of risk alone. Only 10 percent of hospitalized schizophrenics have a parental history of schizophrenia (Heston, 1966), and those offspring who do develop the disorder, typically present a clinical profile of chronic nonparanoid symptomatology (Nameche, Waring & Ricks, 1964; Kety, Rosenthal Wender, Schulsinger & Jacobson, 1978; and Tsuang & Winokur, 1974).

Although the evidence for genetic transmission of schizophrenia is persuasive (Gottesman & Shields, 1982; Faraone & Tsuang, 1985), it is the behaviors of the affected individual that provide the basis for the diagnosis of the disorder (George & Neufeld, 1985; Holzman, 1988). A number of investigators (Depue et al., 1981; Ledingham, 1981; L.J. Chapman, J.P. Chapman, & Raulin, 1976) have therefore argued for the use of a behaviour-based risk marker. In line with this approach, Chapman and his colleagues (L.J. Chapman, et al., 1976; 1978; Eckblad & L.J. Chapman, 1983) developed a number of scales designed to assess behaviors and experiences reported by adolescents and young adults which

are likely to be associated with increased risk for schizophrenia. Clinicians consider these behaviors and experiences as attenuated forms of psychotic symptoms (Bleuler, 1911/1950; J. Chapman, 1966; Gillies, 1958; Strauss, 1969) because they usually are not disruptive and because they occur as brief, isolated episodes (Allen, L.J. Chapman, J.P. Chapman, Vuchetich & Frost, 1987). The measures of psychosis-proneness which Chapman and his colleagues developed were based on Meehl's (1964) concept of schizotypy; Hoch & Cattell's (1959) formulation of pseudoneurotic schizophrenia; descriptions of "early schizophrenia" offered by psychoanalysts (Fenichel, 1945); and Schneider's first rank symptoms (Schneider, 1959). Chapman and colleagues concentrated on three schizophrenia-related patterns of behavior: Anhedonia, perceptual aberration, and magical ideation.

Anhedonia, the inability to experience pleasure, has long been described as a major feature of schizophrenia (e.g. Kraeplin, 1913/1919; Bleuler, 1911/1950). Rado (1956, 1962) viewed anhedonia as a genetically transmitted defect that blocks or retards the development of normal healthy sexual functioning, reduces zest for life, impairs the capacity to relate to others, and weakens feelings of joy, affection, love, pride and self-esteem. Anhedonia has also been implicated in biological theories of schizophrenia. Stein and Wise (1971) hypothesized that schizophrenic

individuals, as a result of a genetic defect, produce excessive 6-hydroxidopamine, which interferes with the brain's neural reward-associated mechanisms.

Perceptual aberration, which refers to distortions in the perception of one's body and of objects in the environment, is often reported by schizophrenic patients, and is believed to result from the schizophrenic individual's incapacity to establish and maintain boundaries (Blatt & Wild, 1976). Magical ideation has also been frequently noted in schizophrenia-prone individuals (Eckblad & L.J. Chapman, 1983). Magical ideation refers to a "belief, quasi-belief, or semi-serious entertainment of the possibility that events which, according to the causal concepts of this culture, cannot have a causal relation with each other, might somehow nevertheless do so" (Meehl, p. 54, 1964). Spitzer, Endicott, and Gibbon (1979) found magical ideation to be a prominent symptom of borderline schizophrenic individuals. The DSM-III lists magical ideation as one of the diagnostic criteria for schizotypal personality disorder and as a prodromal or residual symptom for schizophrenia (American Psychiatric Association, 1980).

While the rationale for the development of these scales is oriented specifically to schizophrenia, most studies by Chapman and his colleagues implicate a broader spectrum of psychotic disorders. Follow-up data on a large group of university students indicated that those rating high on one

or more of those scales were at risk for psychosis, including schizophrenia, as well as for other types of psychological problems (L.J. Chapman and J.P. Chapman, 1987). The students who received high scores on the combined perceptual aberration-magical ideation Scale (Per-Mag Scale) were reported to be particularly prone to psychotic-like symptomatology and hospitalizations for psychotic episodes. Those students who attained high scores on the Anhedonia Scale showed especially poor social adjustment on follow-up. In earlier studies, high scorers on either the perceptual aberration Scale or the Anhedonia Scale evidenced more schizophrenic-like thought disorder on the Rorschach Inkblot Test (Edell & L.J. Chapman, 1979) and reported more schizotypal symptoms than control students in interview (L.J. Chapman, Edell & J.P. Chapman, 1980). Using the Social Anhedonia Scale, Mishlove and L.J. Chapman (1985) also noted more schizotypal features and psychoticlike experiences in female students who were deviant on this scale.

To summarize, the findings reported by Chapman and his colleagues indicate that the Anhedonia and the Perceptual Aberration Scales may identify individuals at risk for schizophrenia-spectrum disorders. In addition, the scales appear particularly suitable for screening large groups of adolescents and young adults entering the peak period of risk for schizophrenia.

As noted, endophenotypic markers are associated with internal events, such as central or autonomic nervous system activity. The endophenotypic paradigm is difficult to use in screening large populations. It requires that individuals be tested separately under laboratory conditions to assess peripheral or central nervous system functioning. Typically, this approach has been used as an adjunct sampling criterion or correlative dimension in studies that adhere to the genetic or exophenotypic paradigm, (Simons, 1981; 1982; Simons, MacMillan III, & Ireland, 1982a; Simons, Losito, Rose & MacMillan III, 1983; Lutzenberger, Elbert, Rockstroh, Birbaumer & Stegano, 1981).

Mednick and his colleagues, however, (Mednick, Venables, Schulsinger, Dalais & Van Dusen, 1984) were able to use electrodermal hyperresponsivity and non-responsivity as their two basic criteria for risk for schizophrenia in their longitudinal study of 1800 children living in Mauritius. These risk markers were selected because hyperresponsive peripheral autonomic system functioning had been found to discriminate children at genetic risk for schizophrenia who would later be diagnosed as schizophrenic from other children also at genetic risk for schizophrenia but who did not succumb to the disorder, and from control children (Mednick, 1978). Both hyporesponsivity and hyperresponsivity have also been observed in adult schizophrenics (Gruzelier & Venables, 1972; Ohman, 1981).

Simons (1981) combined two types of markers, the endophenotypic and exophenotypic. He found that individuals scoring high on the Chapman Scale of Anhedonia were hyporesponders on a commonly used index of the relationship between arousal and the allocation of attentional resources, the orienting response.

Thus, there are certain features of autonomic psychophysiology by which potential endophenotypic risk markers or correlates of behavioral criteria of risk for schizophrenia can be identified. Some of these features, such as basal and reactive arousal and the orienting response are examined in the following sections.

Basal and Reactive Arousal

Zahn (1986) observed that "consideration of the autonomic psychophysiology of psychiatric disorders should logically start with the question of whether there are differences from normal physiologic activity in the patients as a group under baseline or resting conditions" (p. 513). Dawson and Nuechterlein (1984) concluded their review of current literature by stating that resting tonic overarousal is predominant in most unmedicated schizophrenic patients. This anomaly has been assessed using as autonomic parameters heart rate, skin conductance level, and number of spontaneous skin conductance fluctuations. They also concluded that reactive arousal differentiates high-risk individuals from controls; genetically-defined high-risk

samples tend to exhibit hyperresponsiveness. Although not significant, Simons' (1981) results for skin conductance suggest that anhedonic individuals are hypoaroused. No differences were found for perceptually aberrant participants. One should note that some schizophrenics are characterized by hypoarousal, while others are found to be hyperaroused; this could correspond to the recent division of patients into those with positive symptoms and those with negative symptoms, e.g., delusions and hallucinations vs anhedonia and withdrawal. It is too early to tell whether at-risk individuals can also be dichotomized in this way.

Orienting Response

The orienting response (OR) is another indicator of individual differences that has been frequently studied. When a novel, unexpected, or significant stimulus is presented, it typically elicits a constellation of motor, autonomic and central nervous system responses, referred to as the "orienting response". These responses represent a phasic increase in sympathetic arousal that is associated with the individual's attending to and processing of the novel stimulus. It is suggested that they are also related to faster processing of subsequent stimuli (Sokolov, 1963; Ohman, 1979; Zahn, 1986).

The orienting response and its rapid habituation are seen in most normal individuals. Complete absence of the orienting response is found in about 50% of individuals with

a diagnosis of schizophrenia (Ohman, 1981; Dawson & Nuechterlein, 1984; Bernstein, Riedel, Pava, Schnur & Lubowsky, 1985). As well, a large proportion of responders diagnosed as schizophrenics fail to habituate (Gruzelier & Venables 1972; Rubens & Ladipus,1978; Gruzelier, 1981). To date, we are not aware of any study of orienting response behavior in children considered to be at genetic risk for schizophrenia. The orienting response of individuals at risk using behavioral risk criteria has been studied by Simons (1981), who hypothesized that individuals at risk (by virtue of their high scores on the Chapman Scales) would exhibit the same patterns of orienting response as those already diagnosed as schizophrenic. He presented a series of neutral tones to college students scoring high on the Physical Anhedonia Scale and to other students scoring high on the Perceptual Aberration Scale. Consistent with his hypothesis, Simons found that the anhedonics were hyporesponsive on the cardiac and skin conductance measures. Contrary to his hypothesis however, perceptually aberrant individuals did not evidence a hyperresponsive orienting pattern.

Simons used neutral stimuli in his study to elicit orienting responses. In recent studies (Zahn, 1986; Ohman, Nordby, & d'Elia, 1986; Bernstein and Riedel, 1987), the nature and significance of the orienting stimulus have been manipulated experimentally. The standard procedure for

measuring the orienting response involves the repeated presentation of a neutral, non-signal tone without instructional set while the participant's peripheral autonomic activity is being recorded (e.g. heart rate, skin conductance, finger pulse volume). The usual response pattern consists of a marked autonomic response to the first presentation, and rapid habituation to those that follow. This procedure serves as an anchor point to determine the effect of experimental manipulations (e.g. type of stimulus, instructional set).

Investigators have manipulated the experimental conditions under which the orienting stimulus is presented by using different sets of instructions or by pairing stimulus tones with meaningful words (Bernstein, Schneider, Juni, Pope & Starkey, 1980). Bernstein and Riedel (1987) manipulated significance and controllability of stimuli by requiring participants to press a pedal in response to target stimuli. These investigators were trying to determine whether a particular instructional set, the inclusion of a stimulus that has particular meaning, or adding a sense of control over the task would change the response of schizophrenic individuals who fail to show the typical orienting response or fail to habituate. In short, are there particular conditions which influence the orienting response of individuals who are either schizophrenic or at risk for schizophrenia? If such

conditions are found to have a normalizing or exacerbating effect, the question of their etiological and therapeutic relevance will warrant further study.

Attentional Measures

In addition to the psychophysiological dependent variables discussed above, and because of the inclusion of a perceptually aberrant group in the present study, another type of variable was considered: Attention. We wanted to explore the relation between psychophysiological imbalance and attentional deficit. An association between these two types of variables has often been reported for schizophrenics, and for children at risk for schizophrenia. A generalized attentional deficit, involving preattentive processes as well as focal attention, is seen by researchers both as a clinical symptom of schizophrenia and as an underlying mechanism of other cognitive dysfunctions (Levin & Yurgelun-Todd, 1989). Merritt and Balogh (1989) have argued that "gaining an increased understanding of the processes that may underlie or produce specific information processing deficits is needed to assess how these processes may be related to risk factors and symptom expression" (p. 573). Ohman and associates (Ohman, 1981; Ohman et al., 1986) have argued that orienting response aberrations seen in schizophrenics suggest difficulties in efficient allocation of controlled information processing resources to external stimuli. Non-responding schizophrenics appear

unable to tap advanced processing resources, such as filtering for environmental events, while responding schizophrenics seem to waste processing resources by continuing to call on limited-capacity mechanisms to deal with irrelevant stimuli. If it is the case that abnormal responding in at risk individuals (hypo-responding in the case of anhedonics and hyperresponding in the case of perceptually aberrants) is also a manifestation of controlled processing difficulties, then there should be a deficit as well in performance on tasks requiring sustained attention and close monitoring of sensory stimuli.

Results of several studies (e.g., Green & Walker, 1986) suggest that measures of attentional systems discriminate between schizophrenics with positive and negative symptomatology. Would students who obtain deviant scores on a measure of anhedonia (a major negative symptom) and others who obtain deviant scores on a measure of perceptual aberration (a major positive symptom) show different types of attentional deficit?

The Present Study

In this three-part study, the author asks whether hypothetically psychosis-prone adolescents demonstrate unusual patterns of psychophysiological responses, and if these patterns help clarify our understanding of the anhedonia and perceptual aberration constructs. More specifically, the first part was designed to evaluate basal

and reactive arousal in two exophenotypically defined adolescent risk groups. The participants were therefore individually measured under resting conditions. Then, the second part was introduced to extend the work of Simons (1981) by examining the orienting response. In view of the nature of the hypothesized vulnerability markers, high anhedonia and perceptual aberration scores, specific conditions were developed for the present study: An incentive condition, an unpredictability condition, and a controllability condition were included in the present study. The choice of these conditions will be discussed next.

A neutral condition, comparable to that used in Simons' study had to be introduced prior to these three conditions, to provide a reference point. To be consistent with Simons' results, anhedonics under this condition should have demonstrated OR-hyporesponsiveness, while perceptually aberrant students should demonstrate OR-hyperresponsiveness.

An incentive condition was then targeted at those adolescents who were anhedonic. The instructional set for this condition was designed to place emphasis on the anticipation of pleasure in achieving success and satisfaction derived from team effort, including therefore an individual and a social dimension.

Perceptually aberrant students and controls were

expected to show increased reactivity to this condition, as they are normally sensitive to the incentive nature of these instructions. The question here was whether such instructions would have no equivalent effect on the anhedonics because of their deficit in anticipating and experiencing pleasure in typically incentive-oriented situations; if so, such instructions would have no effect on their autonomic OR-hyporesponsivity.

An unpredictability condition was targeted especially at those adolescents who reported aberrant and unusual perceptual experiences such as hallucinatory episodes. The question here was whether reducing significance and increasing stimulus unpredictability in an orienting response task would increase hyperresponsiveness in that group, consequent to their difficulties in dealing with perceptual material. Stimulus significance was reduced by not providing participants a stimulus target before the task, and unpredictability was further increased by not letting students know in advance the nature of the questions that would be asked after stimulus presentation. It could be argued that varying two parameters of perceptual complexity at the same time can obscure the results; however, it was believed that this condition best reflected the more complex nature of perceptual aberration, as measured by the Chapman scale.

Finally, a controllability condition was directed at

both types of atypical individuals. It required that participants monitor the stimuli and press a pedal as soon as a target stimulus was identified. Bernstein and his associates (1985) reported that under a controllability condition, defined as pressing a pedal when a specific target is presented, a schizophrenic group showed normal initial orienting response, followed by fast habituation. The question here was whether the added requirement of pressing for specific targets would have elicited normal responding in both anhedonic and perceptually deviant individuals, with the anhedonics showing the fast habituation observed by Bernstein.

A stimulus monitoring task was repeated four times with each different instruction set while psychophysiological recording was continued. Finally, a third part was included to evaluate the attentional performance of the participants during the last part of the monitoring task, in order to determine whether there was an attentional deficit associated with OR-hyporesponsiveness and OR-hyperresponsiveness. Following Zahn's (1986) and Dawson and Nuechterlein's (1984) suggestions, measures of baseline, resting arousal, and global reactive arousal were obtained from participants before the four OR conditions were presented.

Three measures of autonomic activity were collected as dependent variables for basal arousal and global reactivity:

Heart rate (HR), skin conductance level (SCL), and number of spontaneous skin conductance responses (SSCRs). These dimensions are the most frequently used in psychophysiological investigations of schizophrenic patients and high risk individuals (Zahn, 1986). Skin conductance is the most frequently studied feature of the orienting response (Zahn, 1986; Bernstein et al., 1982). Certain measures associated with skin conductance are of interest: Frequency of responding, that is, the number of responses produced before habituation; amplitude of the first response in an orienting task; and finally, the percent of individuals in the target group who are non-responders or hyperresponders.

Four measures of attention were computed as dependent variables throughout the experimental procedure. For each condition, participants were asked questions regarding the nature and number of target stimuli; this was considered to reflect how good the monitoring had been. During the last condition (pedal press), omission and commission errors were recorded as well as reaction time and pedal press rising time. This last measure was thought to reflect participant's confidence in his or her response.

Objectives and Hypotheses

The present study was designed to examine psychosis-prone adolescents on three dimensions of psychophysiological activity: Resting arousal, global reactivity and orienting response using as indicators, heart rate, skin conductance,

and number of skin conductance responses. Different instruction sets were used to examine the orienting response under conditions of increased incentive, unpredictability and controllability. Our objective was to demonstrate a relation between behavior-based markers, such as anhedonia and perceptual aberration and psychophysiological imbalance. Not only did we hope to demonstrate the possibility of using multiple markers in the identification of adolescents at risk (endophenotypic and exophenotypic), but we were also interested in demonstrating that the two exophenotypic vulnerable groups were opposed in their psychophysiological profiles, anhedonics tending toward hypoarousal (including tonic hypoarousal, decreased reactivity and hyporesponding under different OR conditions) and perceptually aberrant individuals tending toward hyperarousal (including tonic hyperarousal, hyperreactivity and OR hyperresponding and non-habituating).

For the first part of the study, therefore, it was hypothesized that (a) anhedonic participant would demonstrate reduced heart rate and skin conductance level, and produce less spontaneous skin conductance responses, all indicators of hypoarousal. As well, it was hypothesized that (b) perceptual aberration participants would show higher than control heart rate and skin conductance level, as well as produce more spontaneous skin conductance responses. (c) Anhedonics would show lower amplitude of

their skin conductance responses for the global reactivity measure, while (d) perceptually aberrant individuals would show higher amplitude of their skin conductance responses than controls for the global reactivity measures. For the second part of the study, focusing on the OR, it was hypothesized that (a) under a neutral condition, anhedonic participants would demonstrate hyporesponding, and (b) perceptually aberrant participants the opposite. (c) Under a condition of encouragement (incentive), anhedonic hyporesponsive students would not show the increased reactivity manifested by members of the other groups. (d) Under a condition of unpredictability, more perceptually aberrant individuals would exhibit hyper-responsivity. (e) Under a condition of increased controllability, requiring increased vigilance and a motor response, both anhedonic and perceptually aberrant individuals would respond normally, with the anhedonics showing relatively fast habituation.

In addition to these hypotheses, the third part of the study was designed to explore the possibility that attentional deficit would be observed in at-risk participants who showed a deviant orienting response when required to monitor and respond appropriately to stimulus presentations. Would perceptually aberrant individuals in particular demonstrate an attentional deficit that could be related to their hyperreactive state? Specifically, it was hypothesized that

(a) anhedonic participants would show a generalized deficit in attention which would translate into inaccurate monitoring of the number of targets, an increase in omission errors, and longer reaction times. It was also hypothesized that (b) perceptually deviant participants would make more commission errors, as an indication of their inability to discontinue attending to non-target stimuli.

METHOD

Sample

Five hundred and thirteen French-speaking student volunteers in grade 11 (mean age= 16.0 years, SD= 0.87) completed the screening procedure (237 males and 276 females). The students were attending a comprehensive high school serving a middle class suburb of Montreal.

These students were screened with French translations of the Physical Anhedonia Scale, the Revised Social Anhedonia Scale, the Perceptual Aberration Scale, the Magical Ideation Scale developed by L.J. Chapman and associates (L.J. Chapman, J.P. Chapman & Raulin 1976; 1978; Eckblad & L.J. Chapman, 1983), and the L and K validity Scales of the Minnesota Multiphasic Personality Inventory (MMPI). The items of these scales were merged in random order and presented as a single inventory. Volunteers were excluded from participation in the study if they endorsed more than three L Scale items. Only three candidates were rejected for this reason.

The French forms of the Physical Anhedonia Scale and the Perceptual Aberration Scale were developed and tested for psychometric equivalence to the original scales by Duhamel (1982). The Revised Social Anhedonia Scale and the Magical Ideation Scales were translated into French for the

present study using the following procedure. Items were first translated by the author and then independently back-translated to English by a research assistant. Items judged to be ambiguous were revised (see Appendix A for French version of four Chapman Scales).

The Physical Anhedonia Scale has 61 true-false items about the individual's abilities to derive pleasure from physical experiences. Illustrative items are: "I have always had a number of favorite foods" (false), and "sex is okay but not as much fun as most people claim it is" (true). It yields a maximum score of 61. A coefficient alpha of .83 for males and .78 for females has been reported for the English version (L.J. Chapman, J.P. Chapman & Miller, 1982). Coefficients alpha of .82 for males and .79 for females have been reported for the French version (Duhamel, 1982). Test-retest reliability for the English version is .79 for males and .78 for females. The interval between testing was about six weeks. The Revised Social Anhedonia Scale is made up of 40 items assessing inability to derive pleasure from social situations. The items were selected to tap schizoid withdrawal (Eckblad, L.J. Chapman, J.P. Chapman and Mishlove, 1982). Illustrative items are: "Having many friends is not as important as people think" (true), and "When something bothers me, I like to talk about it with other people" (false). It yields a maximum score of 40. A coefficient alpha value of .79 for both males and females

has been reported (Mishlove & L.J. Chapman, 1985). No test-retest has been reported. A correlation of .24 is reported between the Physical Anhedonia Scale and the Social Anhedonia Scale (Mishlove and L.J. Chapman, 1985).

The Perceptual Aberration Scale (L.J. Chapman et al., 1978) consists of 35 items, 28 of which deal with transient aberrations in the perception of one's body, and seven items with perceptual aberrations in the environment. Items are keyed either true of false, so that a maximum score of 35 can be obtained. Illustrative items are: "Occasionally, it has seemed as if my body had taken the appearance of another person's body" (true), and "My hearing is sometimes so sensitive that ordinary sounds become uncomfortable" (true). Using the English version yields a coefficient alpha of .88 for male college students and .90 for female college students (L.J. Chapman et al., 1978). The French version yielded a coefficient alpha of .87 for males and .88 for females (Duhamel, 1982). Test-retest reliability for the English version was .76 for males and .75 for females. The Magical Ideation Scale is composed of 30 items which pertain to the belief in forms of causality that, according to the norms of our culture, cannot be valid. Illustrative items are: "Good luck charms don't work" (false), and "Some people can make me aware of them just by thinking about me" (true). The maximum score is 30. Coefficient alpha was .82 for male college students and .85 for female college

students (Eckblad & L.J. Chapman, 1983). This scale correlated .70 with the Perceptual Aberration Scale in a college student population (L.J. Chapman et al., 1982).

Because of the robust .70 correlation between the Perceptual Aberration and the Magical Ideation Scales, they are often used, as was the case in the present study, in combination. Thus the scales in combined form yield a maximum "Per-Mag" score of 65. The conceptual overlap between the Physical and Social Anhedonia Scales also led to the decision to combine these scales despite the modest .24 correlation between the two scales. In combination, the scales yield a maximum Total Anhedonia score of 101.

Three groups were formed based on Total Anhedonia and Per-Mag scores: Males were assigned to the Anhedonia group if their Anhedonia scores were 1.5 standard deviation or more above the mean for the boys and their Per-Mag scores at least one standard deviation below the mean for males on the Per-Mag Scale. Some researchers (e.g., Merritt & Balogh, 1986; Jutai, 89) recommend the exclusion of individuals who score more than 2.5 SD on any of the scales; they do so in order to decrease the likelihood that actively psychotic individuals would be included in their study. In view of the younger age of our sample, it was deemed unnecessary to apply such stringent criteria.

Females were assigned to the Anhedonic group if their Anhedonia scores were 1.5 standard deviations or more above

the mean for the girls and their Per-Mag score was at least one standard deviation below the female mean on the Per-Mag Scale.

Those males scoring 1.5 standard deviations or more above the mean for boys on the Per-Mag Scale and at least one standard deviation below the mean on the Anhedonia Scale were assigned to the Per-Mag group. The same procedure was followed for girls in relation to the means for females on the two scales. Those males and females who scored no more than one standard deviation above their respective group mean on both the Anhedonia and Per-Mag Scales were assigned to the control group. Mean scores for each group can be found in Table 1.

The final sample therefore was made up of 22 adolescents in the Anhedonia group, 14 males and 8 females; 22 adolescents in the Per-Mag group, 9 males and 13 females; and 29 adolescents in the control group, 15 males and 14 females. All participants who made up the final sample completed the experimental procedures of the study with the exception of one member of the Per-Mag group who had to be excluded because of his persistent difficulty in staying awake.

Dependent measures

There were two sets of dependent measures: psychophysiological and attentional. (See Appendix E for summary of independent and dependent variables). For the psychophysiological measures, recording of heart activity

Table 1

Mean Scores (and Standard Deviations) for Total Anhedonia (ANHTOT) and Perceptual Aberration (PER-MAG) for Anhedonic, Perceptually Aberrant and Control Groups

Group		n	Chapman Scale	
			ANHTOT	PER-MAG
ANH	M	14	48.21 (7.21)	18.93 (7.38)
	F	8	39.00 (7.54)	16.25 (9.24)
PA	M	9	19.55 (6.33)	52.44 (6.31)
	F	13	14.38 (5.38)	47.70 (3.86)
CO	M	15	21.13 (6.72)	14.56 (5.50)
	F	14	15.42 (4.70)	16.75 (6.61)

yielded one basal measure of heart rate (HR), while the recording of skin conductance yielded two basal measures: skin conductance level (SCL) and number of spontaneous non-specific skin conductance responses (SSCRs). These measures were recorded in the initial segment of the procedure, at the end of a ten-minute rest period. Resting heart rate was obtained by averaging heart beats over a 20-second period at the very end of the rest period. Similarly, skin conductance was obtained by averaging the lowest levels obtained during a 20-second period at the end of the rest period. If interferences in the signal were detected, an equivalent 20-second time sample directly preceding the last one, was scored instead. The number of non-specific skin conductance responses (SSCRs) was computed for the full ten-minute rest period. A response had to be at least 0.05 microsiemens and show a distinct recovery curve.

Frequency of response as well as latency, amplitude, and recovery time of individual responses served as measures of reactivity for the different orienting conditions. Frequency of responding was computed for each condition, using the first 13-tone string as orienting stimuli. Each response was hand-scored for its absence/presence. These data provided measures of orienting response characteristics, habituation and dehabituation. A response had to be at least 0.05 microsiemens to be considered an acceptable orienting response, with a time window of 1-3 seconds

following tone onset.

Reactivity specific to target and non-target stimuli was determined by hand-scoring skin conductance responses immediately following onset of the first tone in each tone string. Latency, rising time, amplitude, and half-recovery time were scored for the first, twenty-first, and fortieth non-targets as well as for the first, second, and third targets.

Two measures of attentional accuracy in the monitoring of stimuli (participants had to press a pedal in response to a target stimulus presentation) were computed: errors of omission and errors of commission. Reaction time was recorded as a measure of efficiency in identifying those same targets, and pedal press rising time was recorded to assess level of confidence in the participant's decision to respond. Omission error score refers to the number of targets not accompanied by a pedal press. Commission error score refers to number of pedal presses in response to a non-target. The reaction time measure was the mean number of milliseconds from onset of target stimulus to the onset of the pedal press for total number of target stimuli. Pedal press rising time, that is, how long it took before the pedal reached the maximum depressed position, was computed in milliseconds.

Stimuli

Two orienting paradigms were used for this study. The

first consisted of a series of 15 pure tones of 65db intensity, 1,000 Hz, one-second duration, except for the 14th tone, which had a 2,000 Hz frequency in order to assess dehabituation. The tones were presented binaurally, via headphones, with randomized inter-stimuli intervals of 15 seconds (range 10-20 s.).

The second paradigm was used for the four reactivity conditions. It consisted of a string of 40 tone sequences, each made up of three pure tones of 65 db intensity, of either 500 or 1,000 Hz with a duration of 0.33 second, presented in succession. A complete tone sequence therefore lasted one second. Ten target sequences (500, 1000, 500) were randomly mixed with 30 non-target sequences (1,000, 500, 500). It was specified however, that the first, twenty-first and fortieth sequence of each presentation had to be non-target. Sound intensity and level of difficulty in differentiating between a target and a non-target sequence were piloted using volunteer university students. All subjects reported feeling comfortable with the sound intensity [which has to be kept below a level that could elicit defensive or startle responses (Graham, 1979)]. As well, all subjects readily differentiated between target and non-target sequences.

Experimental Conditions

Participants were tested under six conditions. The baseline or resting condition always came first in the

procedure and was defined for the participant as a rest period. No stimuli were presented during this 10-minute period. The orienting response condition followed. The student was instructed not to pay attention to the stimuli. The exact wording of each instructional set can be found in Appendix B. Following a brief rest period of approximately five minutes, a series of tones was presented, patterned after the first orienting paradigm, as described above. This procedure lasted six minutes. After another brief rest period of approximately five minutes, four reactivity conditions were introduced, all of which used the same orienting paradigm, but varied with regard to instructional set and task demand.

In the first condition, the "neutral" condition, the participant had to listen to a target tone sequence and then try to monitor the number of such targets in a series of 40 tone sequences (see Appendix B for the wording of each instruction set). Instructions for the second condition, the "incentive" condition, made ample use of social reinforcers, emphasizing group comparison and identification with one's group, and encouraging participant to do his or her best. Condition Three, the "unpredictability" condition, presented the instruction that participant had to pay attention to upcoming tone string and that questions would follow. However, no indication was given as to what constituted a target or a non-target sequence, or what

questions would be asked. Condition Four, the "controllability" condition was similar to Condition One, except that participants were also asked to press a pedal as soon as they identified the target. They were asked to press as fast as they could and to return the pedal to its original position. Condition One and Four always came first and last respectively in the string. The order of Condition Two and Three was counterbalanced across participants.

Experimental Setting

Two adjoining rooms in the high school were made available for the present study. The experimenter's room contained a four-channel Grass 79D polygraph used for physiological recording; an IBM-PC microcomputer and a Bell and Howell cassette tape recorder, both of which were used to automate procedures, including stimulus presentation. A two-way intercom system was set up to permit communication between the experimenter and participant. The two rooms were separated by a one-way mirror, to allow for unobtrusive observation.

The presentation of stimuli was controlled by an IBM-PC microcomputer adapted to provide an attenuated direct voltage (DC) output to a pair of micro-headphones, producing the 65db tones. The micro-headphones were implanted in a pair of larger, enveloping-type headphones, used to minimize extraneous noises. The larger headphones were connected to a multiple-output cassette tape recorder and were used to

present all instructions and questions to the participant. All instructions were pre-recorded. A male voice was recorded to give instructions to male students and a female voice was recorded to give instructions to the female students.

Physiological Recording

Skin conductance was recorded by means of Beckman silver-silver chloride electrodes attached to the medial phalanges of the first and second fingers of the left hand. Electrodes, electrode placement, electrolyte and all other aspects of skin conductance recording were in accordance with the recommendations of the Psychophysiology report published by a special committee chaired by D.C. Fowles (Fowles, Christie, Edelberg, Grings, Lykken & Venables, 1981). Skin conductance was recorded using one channel of the Grass model 79 polygraph. A constant voltage system (Venables & Christie, 1973) was used in configuration with a Grass 7P1 preamplifier and 7DA driver-amplifier. Gain was set originally at .1 mV/cm and readjusted if required. Chart speed was set at 2.5mm/s.

Heart rate was recorded using Medi-Trace 1801 disposable electrodes placed symmetrically across the rib cage. Signal was processed via a 7P3 preamplifier and a 7DA driver-amplifier. This provided beat-to-beat output recorded at 2.5mm/s. on chart paper.

Respiration was monitored using a Grass PRDT pneumatic

coupler with a strain gauge attached across the chest of the subject. The signal was processed via a 7P1 preamplifier and a 7DA driver-amplifier in order to discard heart rate and skin conductance responses when accompanied by respiratory irregularity.

Procedure

Screening. The experimenter and a research assistant met twice with twenty-one groups of students in their classroom. They were asked to complete the Chapman Scales and MMPI, which were presented as questionnaires on adolescent development and stress. The teacher was always present. All questionnaires were number-coded so that the identity of participants remained unknown throughout the 6-week laboratory testing phase.

Laboratory procedure. Participants were tested individually in the laboratory during school hours. Each student was contacted in his or her classroom. The individual was escorted by the experimenter to the laboratory and explained the procedure. A consent form for laboratory testing was signed before the testing session began. (Prior to laboratory testing, both student and his or her parent had signed a general consent form; see Appendix C). The individual was seated in an upright position after electrodes and strain gauge were installed. Headphones were adjusted until he/she reported feeling comfortable with them. The participant was then told to

relax for an initial time period after which specific instructions would be heard through the headphones. He or she was shown a pedal in front of the right foot and told to put his or her foot on it only during the last part of the procedure. Student was asked not to move and was told that the experimenter could see him or her through the one way mirror. Experimenter then entered adjoining room and proceeded with the entire procedure unless some readjustment of transducers was needed. The complete procedure began with a rest period, during which student was not presented with any tones or instructions. Then, a brief introduction was played in the headphones, and 14 tones were presented. Following this, four identical conditions followed, but each with a different instruction set. For each, a brief instruction set was heard, then a series of tone sequences was presented, followed by two questions. Physiological recording was carried out throughout this whole procedure. At the end of the fourth condition, student was asked to relax again for a while, and then experimenter went back in the room and proceeded with the removal of all sensors. The complete procedure lasted approximately 55 minutes. Each volunteer was paid seven dollars for his or her participation in the study. At any time during the procedure, participant was free to discontinue, and be paid the seven dollars. No participant chose to discontinue.

In order to rule out any possible contamination from

motor activity (pedal pressing during the last part of the procedure), each participant was asked to press the pedal a few times before that part of the procedure began. This had no effect on the psychophysiological signals being recorded. This is in accordance with previous findings reported by Bernstein, Taylor and Weinstein (1975) and Bernstein et al., (1985).

All male students were tested by a male experimenter (the author). All female students were tested by a trained female assistant. Complete setting up and recording procedures were previously rehearsed with the female assistant under supervision by the experimenter during pilot testing phase. Both experimenter and assistant were blind to student's group classification.

Data Collection

Three channels of psychophysiological signals were recorded on chart paper, and sampled, digitized and stored on diskettes. Onset of stimulus presentations as well as pedal press onset and rising time were recorded on a separate polygraph channel. Annotations were made throughout the session. Any sign of movement, excessive breathing, or extraneous noise was indicated on the chart paper and used later to discard invalid responses. In view of the high percentage of such invalid responses (mostly from movement and extraneous noises outside the lab), hand-scoring was used for all physiological measures. The research assistant

who tested the female subjects was trained and supervised in hand-scoring the data. Hand-scoring was validated by having the research assistant and the author score pilot subject files and comparing results. Once complete agreement was reached, all hand-scoring was done by the research assistant and reviewed by the author. Equivocal responses were discussed until agreement was reached.

Analyses

Baseline. A 3 x 2 ANOVA was the basic procedure used in the statistical treatment of baseline and reactive data. The independent variables were the between group factors of Group Classification (Anhedonic, Perceptually Aberrant and Control) and Sex (male, female). For global reactivity, a 3 x 2 x (4) repeated measures ANOVA was used. The independent variables were the between group factor of Group Classification and sex. The four reactivity conditions (neutral, incentive, unpredictability, and controllability) constituted the within-subject factor. Scores were adjusted using square root transformation; results of evaluation of assumption of normality and homogeneity of variance-covariance matrices were then satisfactory. The Tukey HSD test was used in all post hoc comparisons when significant main effects were obtained. When simple main effects were significant, the Tukey HSD test was used for further pairwise comparisons of means using an alpha level of .05 as the criterion of significance. All tests of significance

were two-tailed.

Orienting response. Extreme skewness of frequency distributions (even after transformations; this is a consequence of having many non-responders giving zero responses in each group and under each condition) made non-parametric tests appropriate when examining the number of responses under each condition (Bernstein & Riedel, 1987). The number of orienting responses produced by each of the three groups was therefore first compared by a Kruskal-Wallis non-parametric test for each of the five conditions: OR, and four reactivity conditions. Friedman non-parametric tests were then used to compare number of responses across conditions for each group of participants to determine whether there was a condition effect.

A 3 x 2 ANOVA was conducted on the amplitude of the first orienting response, while a 3 x 2 x (4) repeated measures ANOVA was used to examine differences in skin conductance response amplitude to the first orienting stimulus in each succeeding condition, using the same between-group factor and within-subject factor as in the analysis of global reactivity. Again, square root transformations of skin conductance response amplitudes were carried out to reduce skewness.

Attention. Attentional measures were examined using four separate group by sex ANOVAS, for number of omission errors, number of commission errors, mean reaction time and

mean rising time.

RESULTS

The results are reported in three sections. The first section corresponds to the first part of the study, and deals with basal heart rate, basal and reactive level of skin conductance, and number of spontaneous skin conductance responses. The second section examines results of the second part of the study, focusing on the orienting response under one non-signal and four signal conditions. Skin conductance response frequencies and amplitudes are presented. The third section deals with attentional measures obtained in the third part of the study: Omission and commission errors, reaction time and pedal press rising time are the dependent variables presented.

Unless otherwise specified, baseline data are reported by group and sex for 72 participants, and reactivity and attentional data are reported for 68 participants. Four adolescents were not included because of incomplete or unusable polygraph records.

Basal and Reactive Arousal

Basal Heart rate. The group by sex ANOVA showed no significant group or sex differences in resting heart rate. Female anhedonics tended to exhibit a higher heart rate (M = 81.3; SD = 11.26) but the difference was not significant. Presented in Table 2 are group means for basal heart rate,

level of skin conductance, and number of spontaneous skin conductance responses.

Basal Skin conductance. The group by sex ANOVA for skin conductance level showed no significant group difference, but a sex difference emerged, with male students presenting a higher resting level (M = 5.31; SD = 2.23) than female students (M = 4.31; SD = 1.54), (F (1,71) = 4.21, $p<.04$). There was no group by sex interaction. Table 2 shows mean SCL and SSCRs for males and females.

A group by sex ANOVA for spontaneous skin conductance responses showed no group differences after transformation of the data to reduce skewness. It showed a significant sex difference F (1,71) = 6.527, $p<.013$, with male students having more SSCRs (M = 12.94, SD = 12.87) than female students (M = 5.76, SD = 6.61). Table 2 shows mean SSCRs for males and females.

It might be argued that psychosis-proneness, as a trait, cannot be normally distributed in the population-at-large, and further, that adjustments for skewed distributions of scores on the dependent measures in an extreme-groups design would reduce the generalizability of results. Just to explore the implications of such a position, a group by sex Anova was therefore conducted on non-transformed data, to determine whether the findings would differ from those based on the transformed data.

Table 2

Group Means (and Standard Deviations) for Basal Heart Rate, Skin Conductance Level and Spontaneous Skin Conductance Responses for Anhedonic, Perceptually Aberrant and Control Students

Group		n	Autonomic Measure		
			HR	SCL	SSCR
ANH	M	14	73.3 (12.1)	4.77 (1.95)	8.57 (9.59)
	F	8	81.3 (11.3)	4.35 (1.55)	8.75 (10.90)
PA	M	9	73.1 (10.5)	5.72 (5.72)	19.56 (19.27)
	F	13	74.9 (15.8)	4.40 (1.78)	5.85 (5.18)
CO	M	15	76.6 (12.7)	5.44 (1.80)	10.69 (9.75)
	F	14	74.3 (7.9)	4.18 (1.30)	2.67 (3.75)

We do not intend to use these results as a basis for our discussion, but would like the reader to appreciate the differences associated with this position. There would have been a significant main effect for group, F (2,71) = 3.34, $p<.03$, and for sex, F (1,71) = 7.89, $p<.007$, as well as a group by sex interaction F (2,71) = 3.34, $p<.04$. The perceptually aberrant group presented more spontaneous skin conductance responses and greater variance (M = 11.45, SD = 14.29) than either the anhedonia group (M = 8.64, SD = 9.83) or the control group (M = 7.25, SD = 8.65). This was especially true for the male perceptual aberration group (M = 19.56, SD = 19.27).

Reactive Skin conductance. No significant group differences in global reactivity were found for skin conductance except for condition. Means and standard deviations are reported in Table 3 and presented graphically in Figure 1. A 3 x 2 x (4) repeated measures ANOVA with the four conditions' skin conductance levels entered as dependent variables revealed a significant effect for sex F (1,60) = 6.32, $p<.01$, with male participants (M = 7.32, SD = 3.03) showing higher levels of SCL than female participants (M = 5.76, SD = 2.29), and condition, F (3,240) = 3.111, $p<.001$. Post-hoc pairwise comparisons indicated that each condition was different from the next, except for the difference between the incentive and unpredictability conditions.

Table 3

Means (and Standard Deviations) for Skin Conductance Level in Each Condition for Males and Females

Sex	n	Condition			
		Neutral	Incentive	Unpredict.	Control.
Males	38	7.00	7.92	7.71	8.84
		(2.78)	(3.35)	(3.05)	(3.76)
Females	35	5.37	6.17	5.84	7.07
		(1.89)	(2.91)	(2.37)	(2.77)

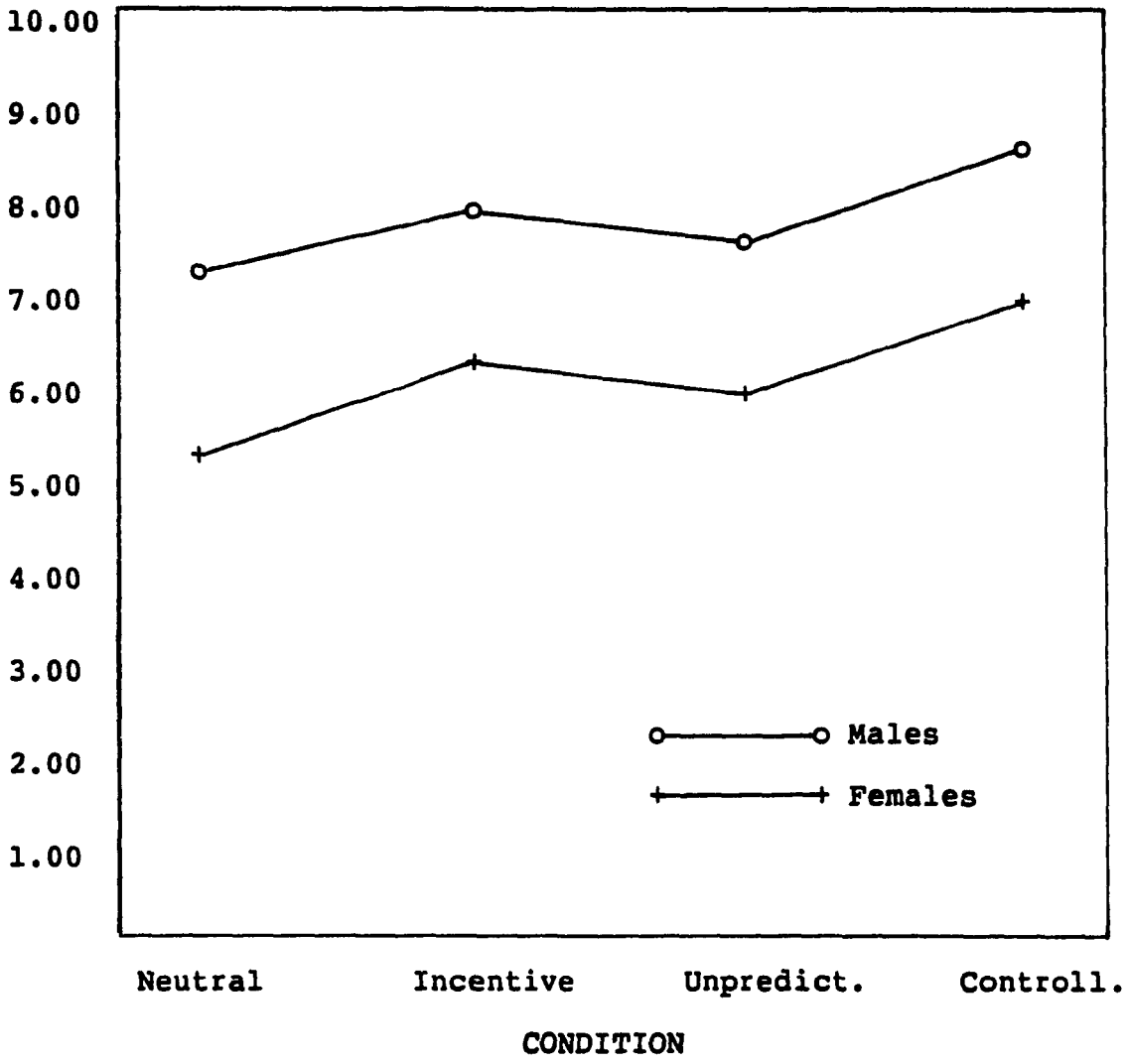

Figure 1. Mean Skin Conductance Level for Males and Females, at the Start of Each Condition.

Reactive Heart rate. Heart rate was stable across the four reactivity conditions for all three groups. A group by sex repeated measures ANOVA revealed no significant effect for group, sex, or condition.

Orienting Response

Number of responses. There were no significant group differences in the number of orienting responses under the non-signal condition. Furthermore, no group or sex difference emerged from the four signal-conditions. A significant condition effect for each of the three groups was verified, using one Friedman non-parametric test for each group: $\underline{X}^2 = 9.45$, $\underline{p}<.024$ for the Anhedonic group; $\underline{X}^2 = 16.65$, $\underline{p}<.001$ for the perceptual aberration group; and $\underline{X}^2 = 14.22$, $\underline{p}<.003$ for the control group). Table 4 shows number of responses for neutral condition, and for incentive, unpredictability and controllability condition.

OR Amplitude. An examination of the group by sex ANOVA for amplitude of the first orienting response in the non-signal condition indicated a significant effect for sex, $\underline{F}$ (1,71) = 4.473, $\underline{p}<.04$, using the square root transformed amplitudes and a non-significant effect $\underline{F}$ (2,71) = 2.75, $\underline{p}<.07$, for group. (See Table 5 for means and standard deviations and appendix D for ANOVA summary Table). Using the same rationale, and caution, described earlier, if non-adjusted amplitudes had been used, the group by sex ANOVA would have shown a significant effect for group, $\underline{F}$ (2,71) =

Table 4

Group Means (and Standard Deviations) for Number of Orienting Responses Under Neutral Condition, and Incentive, Unpredictability and Controllability Condition.

Group	Condition				
	OR	Neutral	Incentive	Unpredict.	Control.
ANH (22)	5.14 (3.73)	7.77 (4.31)	6.43 (3.52)	5.05 (3.58)	7.18 (3.69)
PA (22)	6.55 (5.60)	9.29 (3.85)	6.50 (4.49)	5.45 (4.51)	9.95 (3.36)
CO (29)	6.79 (4.89)	8.11 (4.44)	5.82 (4.44)	6.41 (4.28)	8.46 (4.48)

3.35, $p<.04$, an almost-significant trend for sex, F (1,71) = 3.08, $p<.054$, and a non-significant trend, F (1,71) = 2.77, $p<.07$ for the group by sex interaction. Post-hoc pairwise comparisons showed that the response amplitude was higher for the perceptual aberration group (M = 1.21, SD = 1.15) than for either the anhedonic group (M = 0.78, SD = 0.75) or the control group (M = 0.69, SD = 0.77).

A group by sex repeated measure ANOVA on amplitude of the first response in each of the four signal-conditions only revealed a significant effect for condition, F (3, 198) = 6.25, $p<.001$.

Attention

Errors. A group by sex ANOVA on omission and commission errors yielded no significant main effect or interaction.

In both omission and commission errors, most students obtained a zero score so that, even with adjusted scores to reduce skewness, only a non-significant trend towards a group effect for commission errors, F (2,66) = 2.08, $p<.064$, emerged. The anhedonics produced on average 2.67 (SD = 4.27) commission errors, compared to 1.00 (SD = 2.9) for the perceptual aberration group and 0.79 (SD = 2.43) for the control group. Although it is not statistically significant, we believe it worth to point out that many anhedonics produced many more omission and commission errors than perceptually aberrant students or controls. Table 6

Table 5

Group Means (and Standard Deviations) for Amplitude of First Orienting Response.

Group	n	Sex	
		Males	Females
ANH	22	6.61 (5.64)	10.08 (10.12)
PA	22	16.53 (14.53)	9.07 (8.57)
CO	29	9.94 (8.67)	2.93 (3.50)

Table 6

Group Means (and Standard Deviations) for Omission and Commission Errors.

Group		n	Omission Errors	Commission Errors
ANH	M	12	1.46 (3.57)	2.38 (4.35)
	F	8	2.50 (4.34)	3.13 (4.39)
PA	M	9	0.45 (1.53)	0.11 (0.33)
	F	13	0.54 (1.94)	1.62 (3.73)
CO	M	15	0.86 (2.66)	1.29 (3.12)
	F	11	0.40 (0.97)	0.10 (0.32)

presents means and standard deviations for omission and commission errors.

Reaction time and rising time. Reaction time and rising time did not differentiate the groups. Group x Sex ANOVAs yielded no significant results.

DISCUSSION

The results in general did not indicate any relation between psychiatric risk as defined by the Chapman Scales and the psychophysiological and attentional variables measured in the present study. Anhedonic and perceptually aberrant participants were not distinguishable from one another or from the control group on any of the measures. For the first two parts of the study, on basal and reactive arousal and the OR, significant findings could have emerged if non-transformed data had been analyzed, for one basal measure, SSCRs, and one OR measure, skin conductance amplitude of the first response. However, excessive skewness and variability characterized almost all psychophysiological variables, for the experimental groups as well as for the control group. These problems, although shared by all groups, were most evident in the anhedonic group, especially for basal arousal measures. In addition, male participants, even those from the control group, almost always exhibited more variability than females, on basal and reactive arousal measures. Whatever contributed to the unusual distribution of these autonomic variables cannot be attributed only to the extreme group - design. In addition, heart rate, which was not affected by our manipulations, was normally distributed within each group.

The negative skin conductance findings for the anhedonics of our sample therefore stand in contrast to those reported by Simons (1981). He reported low tonic and reactive skin conductance levels for his anhedonic college students. Bernstein and Riedel (1987) recently reported results similar to those of Simons for their group of anhedonics. In a subsequent study, Simons, MacMillan III and Ireland (1982a) also noted that their anhedonic sample did not respond differentially to hedonically charged versus neutral stimuli. They interpreted their psychophysiological finding as support for the view that the anhedonic individual is not only hypo-aroused but is also impervious to positive incentive conditions.

Both the Simons and Bernstein and Riedel studies, however, reported inconsistent findings regarding autonomic measures, as is so often the case with multiple autonomic measures (Neiss, 1990). Simons' groups (1981) did not differ on his cardiac measures. Moreover, both the cardiac and skin conductance measures failed to differentiate his perceptually aberrant group from controls. Bernstein and Riedel's (1987) perceptually aberrant group also displayed a mixed pattern of autonomic responses. Thus it would appear that the present findings are discrepant with those of the above authors' studies specifically with regard to the autonomic functioning of the anhedonic group on the parameters of skin conductance. The fact that cardiac

measures remained stable while skin conductance measures varied greatly suggests that we look at the relative contribution of the sympathetic and parasympathetic systems in at-risk individuals. It may well be that vulnerability to psychosis differs from the actual disorder in the relative contribution of these systems, or in the magnitude of the effect on the autonomic nervous system in general. A more sophisticated measure of the respiratory - heart rate interaction (respiratory sinus arrhythmia, Porges, Mccabe & Yongue, 1982) might help evaluate whether the cardiac response is already affected in adolescents at risk.

In the third part of the study, focusing on attentional measures, attentional deficit was not observed in either target group. Few individuals in the total sample made more than two errors or delayed their response. Again, skewness and variability were a major problem, obscuring what initially looked like important differences between groups. No clear pattern emerged: Whereas anhedonic and control males showed more variability than their female counterparts, it is the perceptually aberrant female group that showed the largest variability. It will be recalled that the task was designed to be undemanding in order to assess the orienting response without the confound of a startle or defensive response. It is possible that the attentional task was not sufficiently demanding to elicit attentional difficulty. Studies of anhedonic and

perceptually aberrant individuals have demonstrated certain types of information processing anomalies that are seen in schizophrenic patients. Simons, MacMillan III, and Ireland (1982b) observed reaction time crossover, characteristic of process schizophrenic patients, in psychosis-prone individuals, particularly in perceptually aberrant individuals. Jutai (1989) reported that both anhedonic and perceptually aberrant individuals were deviant in their search patterns while appraising random arrays of non-verbal stimuli. He concluded from his results that right-hemispheric mechanisms of attentional control are implicated in the poor performance of these individuals. Studies by Merritt and Balogh (1986; 1989) also singled out the perceptual aberration group for deficient performance in a visual backward masking paradigm.

The negative findings of the present study may best be viewed in the context of issues relating to the age of the sample and the measures used. As stated earlier, there are good reasons for screening an adolescent population for risk for major forms of adult psychopathology. Adolescents are at a point in their development where their capacity to handle the stresses of transition from child to adult in our society can really be put to the test. In addition, our original objective was to investigate potential trait markers of risk for future schizophrenia, and not episode markers of the disorder. The use of the Chapman Scales with

older college students allows for the possible inclusion of an unknown number of individuals already experiencing thought disorders or other psychotic or schizophreniform symptomatology (Edell & L.J. Chapman, 1979; L.J. Chapman et al., 1980; Merritt et al., 1986; Merritt & Balogh, 1989). Adolescence should therefore be an optimal time in which to identify trait markers of psychosis proneness.

By the same token, however, the rapid biopsychosocial changes that are characteristic of adolescence make for large intra- and inter-individual variations. The normal adolescent spans a broad spectrum of functioning, including intellectual, bio-sexual and psycho-social components, that is not particularly stable. If this is so, it would explain, at least in part, the lack of positive findings in the present study. Between-subject variance and skewness in distribution of scores were considerable in each group and across all dependent measures. Certain between-group differences in the expected direction were statistically significant only when distributions remained uncorrected for skewness. Males and females do not go through adolescence at exactly the same time, and undergo different biological changes. Even though we could report only one significant sex difference (for mean skin conductance level at the start of each condition), there was evidence of greater variability for males on most psychophysiological measures.

Given these considerations, it may be that an extreme-

groups research design is not appropriate for this age group. Although reasonably good short-term stability is reported for the Chapman Scales, the criterion of risk in the present study, the stability of these scales over longer time intervals has not been sufficiently examined. In a recent unpublished pilot study, we obtained stability coefficients of between .33 and .50 (N = 267) for a two-year interval. We cannot be assured, therefore, that the anhedonia and perceptual aberrations reported by adolescents on the Chapman Scales are nothing more than normative transitory episodes associated with developmental changes.

A further consideration is the possibility that the Chapman Scales in themselves are not suitable for use with adolescents. Although L.J. Chapman (personal communication, January 1984) recommended the use of the Revised Social Anhedonia Scale along with the Physical Anhedonia Scale, the scales may tap related but distinctive dimensions of anhedonia in adolescents. Social anhedonia, in adolescents at least, may not be equivalent to the social anhedonia experienced by young adults, or may not be as readily measured. Adolescent boys in our culture, for example, may not be comfortable declaring their appreciation of friendships and their love of nature. It should be noted in this regard that both Simons (1981) and Bernstein and Riedel (1987) used only the Physical Anhedonia Scale in the studies referred to earlier; and Chapman and his associates (e.g.,

L.J. Chapman and J.P. Chapman, 1987) more recently dropped the Social Anhedonia Scale in their follow-up studies. The same may be said of the combined Perceptual Aberration - Magical Ideation Scale. Adolescents in particular may be reluctant to describe or to admit to having experiences that are regarded as "different" or stigmatizing by the peer culture.

Group administration of the Chapman Scales in the classroom may also be problematic. The students screened in the present study reacted with boisterous laughter to certain items on these scales. These reactions may have influenced the attitude of classmates to the screening exercise and their freedom to endorse particular items, thereby introducing a response bias that might not have been present had the scales been individually administered.

The fact that the present sample was not only four to six years younger (16 years old compared to 22 on average) than the samples studied by Simons (1981) and Bernstein and Riedel (1987), but also appeared more heterogeneous with respect to SES and intelligence (comprehensive high school students as opposed to university undergraduates) constitutes another possible reason for the discrepant findings. The comparison studies examined psychosis-prone college students. The generalizability of their findings is likely to be limited. Being older anhedonic or perceptually aberrant, relatively bright and probably economically

advantaged, in combination, may constitute a more extreme degree of deviance, and therefore a more powerful predictor of major psychopathological disturbance than would being anhedonic or perceptually aberrant as a high school student. Finally, if the scales assess a state rather than a trait marker, it may be premature to screen adolescent populations for the precursive acute signs of psychotic disturbance. College students are within peak risk age range for psychotic breakdown; high school students are not.

The stimuli and the task demands of the present study represent another possible source of difficulty. The data on non-responders suggest that the tone sequence and task demands for each of the four signal OR conditions had prevented habituation from occurring. Very few participants remained non-responders across all conditions. There is also some indication that the condition effect found for amplitude and number of responses was caused by the task demands and not by the nature of the stimulus itself. The tone intensity was kept deliberately low to prevent the occurrence of a defensive or startle response. However, the complexity of the tone sequence was such that each tone sequence can be viewed as a stimulus array in which the first tone serves as a warning stimulus for the upcoming discriminative stimuli. If this interpretation is correct, each tone sequence carries much more information than would a simple neutral non-signal tone, and would have the effect

of facilitating a high rate of responding that precluded detection of group differences on the habituation parameter in the present study. By contrast, as mentioned earlier, the attentional task proved too undemanding to elicit group differences.

Future Directions

Most studies of individuals at risk for schizophrenia have been affected by two problems: First, a lack of intercorrelation between psychophysiological measures and, second, extreme variability in their sample's responses. The present study was not spared from these problems. We were hoping that examining younger adolescents would reduce such difficulties, especially by reducing the problem of having already symptomatic individuals in our at-risk samples. It may be that the young age of the present sample made the above mentioned problems even more acute. We believe it contributed significantly to the distribution problems mentioned previously. Other statistical methods that could be considered more appropriate to deal with this kind of data were investigated, only to reinforce our impression that variability was a central problem that could not simply be removed statistically from the data set. Rather, it stands out as the main defining characteristic of this group of participants. In addition, participation in the study was associated with total lack of interest for some students while others were highly motivated. Future

studies should therefore consider whether the benefits of testing an adolescent population really outweigh the problems associated with that age group. It may well be that a somewhat older group would be a realistic compromise between the present study and studies that included participants in their early twenties.

Once an appropriate age group has been chosen, suggestions for improving future studies include repeated individual administration of the Chapman scales for screening purposes; the search for a multiple indicator of risk; and ways to secure better OR and attentional measures.

Stability coefficients obtained in our pilot study suggest the possibility of a distinct sub-group of individuals for whom anhedonia or perceptual aberrations constitutes more than just a transitory episode. To insure temporal stability, we suggest keeping only individuals who obtain deviant scores on repeated administrations of the Chapman scales for further psychophysiological investigations. An examination of the correlations between sub-scales suggests that future studies should include the Physical Anhedonia Scale alone, without the controversial Revised Social Anhedonia Scale. The combined use of the Perceptual Aberration - Magical Ideation Scale seems on the other hand warranted by increasing evidence of its predictive power in recent studies.

Considering the probable multifaceted etiology of

schizophrenia, more recent studies rely on more than one risk marker. Studies combining a genetic marker of risk with either an endophenotypic marker - such as autonomic hyperreactivity - or an exophenotypic marker - such as deviant Chapman Scales scores - have already been mentioned. There exist other promising behavioral markers, such as deviant scores on peer rated aggression and withdrawal (Schwartzman, Ledingham & Serbin, 1985). These could easily be used in conjunction with deviant Chapman Scales scores, since both can be obtained via group questionnaire administration.

To increase the reliability of the dependent variables examined in the present study, OR and attentional measures, some of the study's methods should be changed. Each participant was required to come to the lab only once. This had two advantages: avoiding loss of data from subjects failing to return for further participation and obviating the problem of temporal effects (Merritt and Balogh, 1989). It appears however, that the repeated-measures design used resulted in too many stimulus strings being presented in a short span of time. This may have resulted in some practice or fatigue effect. Each condition should be evaluated independently, with separate laboratory sessions, and only after repeated baseline measurements. It would then be possible to match participants on the basis of their resting arousal level before each condition. Finally, we need a

better measure of the hypothesized attentional deficit. This could be obtained by comparing high and low levels of difficulty in the stimulus monitoring task, or alternately, by making use of a standardized measure of attentional deficit, such as the Continuous Performance Test (CPT; Rosvold, Mirsky, Sarason, Bransome & Beck, 1956; Erlenmeyer-Kimling and Cornblatt, 1987). This would add the benefit of between-studies comparison. Implementation of these suggestions should greatly improve our chances of shedding some much needed light on the relationship between psychophysiological and attentional response patterns in at-risk adolescents.

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APPENDIX A

The French Version of Four Chapman Scales

Physical Anhedonia Scale
Social Anhedonia Scale
Perceptual Aberration Scale
Magical Ideation Scale

Inventaire des attitudes et des expériences

Dans les pages qui suivent se trouvent des énoncés portant sur des attitudes et des expériences. Il s'agit pour vous de juger si chacun de ces énoncés décrit quelque chose qui est vrai ou faux de vous-même.

Répondez à toutes les questions. Si vous hésitez devant un énoncé, essayez de répondre en fonction de la façon dont vous vous percevez la plupart du temps.

Inventaire des attitudes et des expériences/S

		Vrai	Faux
1.	Avoir plusieurs amis n'est pas si important que les gens le disent.	____4.5____	
2.	J'attache peu d'importance au fait d'avoir des amis(es) intimes.	____ 6 ____	
3.	J'aime mieux écouter la télévision que de sortir avec des gens.	____ 7 ____	
4.	C'est bien plus agréable d'aller faire un tour de bicyclette si quelqu'un m'accompagne.	____ 8 ____	
5.	J'aime faire des appels longue distance à des amis ou de la parenté.	____ 9 ____	
6.	Jouer avec des enfants est une véritable corvée.	____ 10____	
7.	J'ai toujours pris plaisir à regarder des photos de mes amis.	____ 11____	
8.	Même si je préfère faire certaines choses tout seul, d'habitude j'ai plus de plaisir quand je fais des choses avec d'autres	____ 12____	
9.	Je m'attache souvent beaucoup aux gens avec qui je passe beaucoup de temps.	____ 13____	
10.	Les gens pensent souvent que je suis gêné alors que, dans le fond, je veux juste rester tout seul.	____ 14____	
11.	Je me sens bien quand les choses vont vraiment bien pour mes bons amis.	____ 15____	
12.	Quand quelqu'un qui m'est cher est déprimé, je le suis moi aussi.	____ 16____	
13.	Ma façon de réagir émotivement semble très différente des autres personnes.	____ 17____	
14.	Quand je suis seul(e) à la maison, souvent je n'aime pas que les gens me téléphonent ou frappent à la porte.	____ 18____	
15.	Je me sens bien juste par le fait d'être avec des amis(es).	____ 19____	
16.	Quand quelque chose me dérange, j'aime en parler à d'autres personnes.	____ 20___	

		Vrai	Faux
17.	J'aime mieux les passes-temps et les loisirs qui n'impliquent pas d'autres personnes.	____	21____
18.	C'est le fun de chanter avec d'autres personnes.	____	22____
19.	Le fait de savoir que j'ai des amis(es) qui tiennent à moi me donne un sentiment de sécurité.	____	23____
20.	Si je déménage dans un autre quartier, j'ai besoin de me faire des nouveaux amis(es).	____	24____
21.	Les gens sont pas mal mieux s'ils ne s'impliquent pas émotivement avec la plupart du monde.	____	25____
22.	Même si je sais que je devrais ressentir de l'affection pour certaines personnes, je n'en ressens pas.	____	26____
23.	Les gens s'attendent souvent à ce que je passe plus de temps à parler avec eux que j'ai ai le goût.	____	27____
24.	Je me sens content et flatté quand on m'en apprend plus sur ce que mes amis vivent émotivement.	____	28____
25.	Quand les autres essayent de me parler de leurs problèmes ou de leurs bibittes, j'écoute d'habitude attentivement et avec intérêt.	____	29____
26.	Je n'ai vraiment jamais eu d'ami(e) intime à la polyvalente.	____	30____
27.	Je n'en demande pas davantage que de rester assis tout seul à rêver et penser	____	31____
28.	Je suis bien trop indépendant pour m'impliquer avec d'autres personnes.	____	32____
29.	Il n'y a pas grand chose de plus fatiguant que d'avoir une longue discussion personnelle avec quelqu'un.	____	33____
30.	Ca va me rendre triste de voir tous mes amis(es) de la polyvalente s'en aller chacun son chemin à la fin du secondaire.	____	34____
31.	J'ai souvent trouvé ça dur de ne pas m'arrêter pour jaser avec un bon ami(e), même si j'avais autre chose à faire.	____	35____
32.	Se faire de nouveaux amis ne vaut pas tout l'effort qu'il faut y mettre.	____	36____

		Vrai	Faux
33.	Il y a des choses plus importantes pour moi que l'intimité.	___ 37	___
34.	Les gens qui essayent de mieux me connaître se tannent après un bout de temps.	___ 38	___
35.	Je pourrais être heureux à vivre, tout seul dans un camp dans le bois ou dans les montagnes.	___ 39	___
36.	Si j'ai le choix, j'aime mieux être avec d'autres personnes que d'être tout seul.	___ 40	___
37.	Je trouve trop souvent que les gens s'attendent à ce que je m'intéresse à leurs opinions ou à ce qu'ils font tous les jours.	___ 41	___
38.	Je ne me sens pas vraiment proche de mes amis.	___ 42	___
39.	Mes relations avec d'autres personnes ne deviennent jamais très fortes.	___ 43	___
40.	D'une façon générale, je préfère être avec des animaux que d'être avec du monde.	___ 44	___

		Vrai	Faux	
1.	On surestime beaucoup la beauté des couchers de soleil.	___	___	2-(5)
2.	J'ai parfois dansé seul uniquement pour sentir mon corps suivre la musique.	___	___	(6)
3.	J'ai rarement eu envie de chanter dans la douche.	___	___	(7)
4.	De temps à autre, je pense à des choses trop vilaines pour en parler.	___	___	(8)
5.	J'ai parfois eu la sensation de faire corps avec un objet près de moi.	___	___	(9)
6.	Il m'est déjà arrivé qu'un de mes bras ou qu'une de mes jambes soit détaché du reste de mon corps.	___	___	(10)
7.	Après une grosse journée, j'ai souvent apprécié la détente qu'offre une marche lente.	___	___	(11)
8.	J'ai fréquemment apprécié une poignée de main ferme et sincère.	___	___	(12)
9.	J'ai parfois envie de sacrer.	___	___	(13)
10.	Je n'ai jamais trouvé la musique de fanfare excitante.	___	___	(14)
11.	A l'occasion, il m'arrive de devoir me pincer pour m'assurer que je suis toujours là.	___	___	(15)
12.	En mangeant un plat favori, j'ai souvent essayé de le déguster longuement pour faire durer le plaisir.	___	___	(16)
13.	A la vue d'un tapis moelleux, j'ai déjà eu envie de retirer mes chaussures et d'y marcher pieds nus.	___	___	(17)
14.	A mon avis, quant au goût, tous les aliments se valent.	___	___	(18)
15.	J'ai parfois eu la sensation qu'une partie de mon corps était plus grande que d'habitude.	___	___	(19)

		Vrai	Faux	
16.	Je me suis déjà demandé si mon corps m'appartenait vraiment.	___	___	(20)
17.	Je ne dis pas toujours la vérité.	___	___	(21)
18.	Je ne lis pas tous les jours les éditoriaux du journal.	___	___	(22)
19.	Il m'arrive parfois de me fâcher.	___	___	(23)
20.	Des parties de mon corps me semblent parfois mortes ou irréelles.	___	___	(24)
21.	Je n'ai jamais pris beaucoup de plaisir à des activités physiques comme la marche, la natation, ou d'autres sports.	___	___	(25)
22.	En passant à côté de fleurs, je me suis souvent arrêté pour les sentir.	___	___	(26)
23.	J'ai déjà eu l'impression passagère que quelque partie de mon corps était en train de pourrir.	___	___	(27)
24.	Il m'est déjà arrivé d'éprouver la sensation que mon corps n'existait pas.	___	___	(28)
25.	J'ai souvent pris des marches pour me délasser et me distraire.	___	___	(29)
26.	De temps à autre, je remets au lendemain ce que je devrais faire aujourd'hui.	___	___	(30)
27.	J'aime la sensation de me trouver dans un endroit élevé et d'observer le panorama.	___	___	(31)
28.	La critique ou la réprimande me blesse profondément.	___	___	(32)
29.	Je me rappelle avoir déjà eu l'impression de ne pouvoir discerner mon corps des autres objets autour de moi.	___	___	(33)
30.	Goûter des plats différents m'a toujours plu.	___	___	(34)
31.	Je n'ai jamais trouvé qu'un orage puisse être exitant.	___	___	(35)
32.	Il m'est arrivé à l'occasion de sentir mon corps se fondre dans l'espace environnant.	___	___	(36)

		Vrai	Faux	
33.	Parfois, j'ai la nette impression d'être inutile.	___	___	(37)
34.	Les lumières de la ville sont excitantes à regarder le soir.	___	___	(38)
35.	Je me suis souvent senti(e) mal à l'aise quand des amis m'ont touché(e).	___	___	(39)
36.	Je n'ai jamais senti que mes bras ou mes jambes étaients momentanément devenus plus longs.	___	___	(40)
37.	Au jeu, j'aime mieux gagner que perdre.	___	___	(41)
38.	Je ne me suis jamais préoccupé de la texture des aliments.	___	___	(42)
39.	En passant devant une boulangerie, l'odeur du pain frais m'a souvent ouvert l'appétit.	___	___	(43)
40.	Les poètes exagèrent toujours la beauté et les joies de la nature.	___	___	(44)
41.	Les frontières de mon corps m'ont toujours semblées claires.	___	___	(45)
42.	J'ai déjà éprouvé beaucoup de joie à admirer un paysage majestueux.	___	___	(46)
43.	Je me rappelle avoir senti un des mes membres prendre une forme étrange.	___	___	(47)
44.	Je prends toujours plaisir à être touché(e) par quelqu'un(e) que j'aime.	___	___	(48)
45.	Je ne me suis jamais senti aussi bien de ma vie que maintenant.	___	___	(49)
46.	J'ai souvent ressenti un certain bien-être en massant mes muscles fatigués ou endoloris.	___	___	(50)
47.	J'ai parfois eu l'impression que mon corps était anormal.	___	___	(51)
48.	J'ai déjà eu la sensation que l'intérieur de mon corps se décomposait.	___	___	(52)
49.	J'aime connaître des gens importants parce que cela me donne le sentiment d'être important.	___	___	(53)

		Vrai	Faux	
50.	J'ai toujours aimé me faire masser le dos.	___	___	(54)
51.	La musique d'orgue m'a souvent fait vibrer intérieurement.	___	___	(55)
52.	J'ai toujours trouvé que la première chute de neige de l'hiver était jolie.	___	___	(56)
53.	Il m'est arrivé d'avoir la sensation passagère que les choses que je touchais restaient colées après moi.	___	___	(57)
54.	Je suis indifférent(e) à ce que les gens pensent de moi.	___	___	(58)
55.	Faire voler un cerf-volant est stupide.	___	___	(59)
56.	Le bruissement des feuilles ne m'a jamais particulièrement charmé(e).	___	___	(60)
57.	Il m'a déjà semblé que mon corps avait pris la forme de celui de quelqu'un d'autre.	___	___	(61)
58.	J'ai parfois l'impression que la pièce autour de moi est en train de pencher.	___	___	(62)
59.	Règle générale, j'ai toujours trouvé la musique douce plus ennuyante que reposante.	___	___	(63)
60.	J'ai déjà eu une impression de bien-être et de sécurité en entendant le crépitement de la pluie sur le toit.	___	___	(65)
62.	Les odeurs qui s'échappent d'une cuisine à l'heure des repas ont rarement éveillé mon appétit.	___	___	(66)
63.	Faire des blagues dans une soirée me rend mal à l'aise même lorsque les autres font la même chose.	___	___	(67)
64.	Je n'aime pas tous ceux que je connais.	___	___	(68)
65.	Parfois, je fais un peu de commérage.	___	___	(69)
66.	Je prends habituellement mon bain ou ma douche de façon à en finir au plus vite.	___	___	(70)

		Vrai	Faux	
67.	Il m'arrive de trouver les couleurs ordinaires beaucoup trop éclatantes. (sans être dû à l'effet d'aucune drogue.)	___	___	(71)
68.	Je n'ai jamais eu l'impression que mes pieds ou mes mains étaient étrangement loin de moi.	___	___	(72)
69.	J'aime caresser et jouer avec des chatons ou des chiots.	___	___	(73)
70.	Il est arrivé qu'une partie de mon corps semblait ne plus m'appartenir.	___	___	(74)
71.	De temps à autre, les histoires sales me font rire.	___	___	(75)
72.	Quand je me sens triste, chanter m'a quelquefois remonté le moral.	___	___	(76)
73.	J'ai déjà eu la sensation qu'un objet, en réalité distinct de moi, faisait partie de mon corps.	___	___	(77)
74.	J'ai rarement eu envie d'essayer de nouveaux mets.	___	___	(78)
75.	Je ne comprends pas pourquoi les gens ont du plaisir à observer les étoiles le soir.	___	___	(79)
76.	A certains moments, je me sens plus gai que d'habitude sans raison apparente.	___	___	(80)
77.	J'ai toujours eu un certain nombre de mets favoris.	___	___	(3-5)
78.	Il y a des périodes où mon esprit semble fonctionner plus lentement que d'habitude.	___	___	(6)
79.	S'étendre au soleil n'est pas vraiment plus agréable que s'étendre à l'intérieur.	___	___	(7)
80.	Il m'a déjà semblé que mon corps et celui d'une autre personne ne formait qu'un seul et même corps.	___	___	(8)
81.	De temps à autre lorsque je me regarde dans un miroir, mon visage semble différent de l'ordinaire.	___	___	(9)

		Vrai	Faux	
82.	J'ai toujours détesté la sensation d'épuisement après un exercice vigoureux.	___	___	(10)
83.	Je ne sais pourquoi les gens aiment tant la musique.	___	___	(11)
84.	J'ai déjà eu le sentiment que, pour une raison ou pour une autre, ma tête ou mes membres ne m'appartenaient plus.	___	___	(12)
85.	On exagère beaucoup la beauté des fleurs.	___	___	(13)
86.	J'ai parfois senti que les difficultés s'accumulaient au point que je ne pourrais pas les surmonter.	___	___	(14)
87.	La chaleur d'un feu de foyer ne m'a jamais vraiment apporté apaisement et quiétude.	___	___	(15)
88.	Certains objets tels une chaise ou une table, me paraissent parfois étrange, lorsque je les regarde.	___	___	(16)
89.	Je n'ai jamais éprouvé la sensation dans mes bras ou mes jambes que ces membres étaient devenus plus longs que d'habitude.	___	___	(17)
90.	Je me suis rarement préoccupé de la couleur dont les choses sont peintes.	___	___	(18)
91.	J'ai parfois eu l'impression que différentes parties de mon corps n'étaient pas toutes rattachées à la même personne.	___	___	(19)
92.	Entendre une bonne chanson m'a rarement incité à la chanter en même temps.	___	___	(20)
93.	J'ai déjà senti, le temps d'un instant, que mon corps était devenu difforme.	___	___	(21)
94.	J'ai souvent aimé palper de la soie, du velours, ou de la fourrure.	___	___	(22)
95.	Une partie de mon corps m'a jéjà semblée plus petite que d'habitude.	___	___	(23)
96.	J'ai souvent rencontré de supposés experts qui n'étaient pas meilleurs que moi.	___	___	(24)

		Vrai	Faux	
97.	Je n'ai jamais voulu monter dans les manèges à la Ronde.	___	___	(25)
98.	Mon ouie est parfois si sensible que les sons usuels deviennent incommodants.	___	___	(26)
99.	Je n'ai jamais eu l'impulsion d'ôter mes souliers et de marcher nu-pieds dans une flaque d'eau.	___	___	(27)
100.	Il y a des fois où des gens que je connais bien commencent à apparaître comme des inconnus.	___	___	(28)
101.	En vérité, il y peu de choses que j'ai réellement pris plaisir à faire.	___	___	(29)
102.	Je trouve difficile de mettre de côté, même pour très peu de temps, une tâche que j'ai entreprise.	___	___	(30)
103.	J'ai parfois aimé sentir la puissance de mes propres muscles.	___	___	(31)
104.	J'ai déjà ressenti une certaine confusion, ne sachant plus si mon corps m'appartenait vraiment.	___	___	(32)
105.	Parfois j'ai le goût de saccager des objets.	___	___	(33)
106.	Il y a des jours où la lumière d'une pièce est si vive qu'elle m'agace les yeux.	___	___	(34)
107.	J'ai toujours trouvé la musique d'orgue plate et ennuyante.	___	___	(35)
108.	J'ai parfois trouvé qu'un bon savonnage en prenant mon bain était rafraîchissant et soulageant.	___	___	(36)
109.	Il m'est arrivé que durant plusieurs jours de suite, je ressentais sons et lumières avec une telle intensité que je ne pouvais pas m'en défaire.	___	___	(37)
110.	J'aime que les gens sachent à quoi s'en tenir avec moi.	___	___	(38)
111.	Une marche vive et rapide m'a parfois donné la sensation de bien-être.	___	___	(39)

	Vrai	Faux	
112. Les flammes qui dansent dans un foyer m'ont toujours fasciné(e).	____	____	(40)
113. J'ai toujours attaché de l'importance au goût des aliments.	____	____	(41)
114. Quand je vois une statue, j'ai souvent envie de la toucher.	____	____	(42)
115. Danser, ou même la pensée de danser, m'ont toujours paru ennuyant.	____	____	(43)

Inventaire des perceptions et expériences

		Vrai	Faux
1.	Certaines personnes peuvent me faire sentir leurs présences en pensant à moi.	___5.5___	
2.	J'ai déjà eu la sensation passagère que peut-être je n'étais pas humain.	___ 6 ___	
3.	J'ai déjà eu peur de amrcher sur les lignes sur le trottoir.	___ 7 ___	
4.	Je pense que je pourrais apprendre à lire la pensée des autres si je le voulais.	___ 8 ___	
5.	Les horoscopes ont trop souvent raison pour que ce ne soit des coincidences.	___ 9 ___	
6.	Des fois quand je reviens chez moi, et même si personne n'est venu, j'ai l'impression que les objets dans la maison se sont déplacés.	___ 10___	
7.	Des chiffres comme 13 et 7 n'ont aucun pouvoir spécial.	___ 11___	
8.	J'ai déjà eu la sensation ridicule qu'un animateur à la T.V. ou à la radio savait que je l'écoutais.	___ 12___	
9.	Je me suis inquiété de ce que des gens sur d'autres planètes pouvaient avoir une influence sur ce qui se passe sur la terre.	___ 13___	
10.	Le gouvernement refuse de nous dire la vérité à propos des soucoupes volantes.	___ 14___	
11.	J'ai déjà eu l'impression qu'un message m'était adressé à travers la façon dont les objets étaient disposés, par exemple, dans une vitrine de magasin.	___ 15___	
12.	Je n'ai jamais douté que mes rêves sont le produit de ma propre pensée.	___ 16___	
13.	Les portes-bonheur, ça ne marche pas.	___ 17___	
14.	J'ai détecté sur mes disques des sons qui ne sont pas là à d'autres moments.	___ 18___	
15.	Des fois des inconnus font des signes de la main qui semblent m'influencer.	___ 19___	
16.	Je n'ai à peu près jamais rêvé à quelque chose avant que ça arrive.	___ 20___	

		Vrai	Faux
17.	J'ai déjà eu la sensation passagère qu'un sosie avait pris la place de quelqu'un.	____	21____
18.	Ce n'est pas possible de faire du mal à quelqu'un simplement en pensant des mauvaises choses à son égard.	____	22____
19.	J'ai déjà senti une présence mauvaise autour de moi, mais je ne pouvais pas la voir.	____	23____
20.	Des fois quand les gens me regardent ou me touchent, j'ai l'impression de recevoir ou de perdre de l'énergie.	____	24____
21.	J'ai déjà eu un pensée passagère que des étrangers sont en amour avec moi.	____	25____
22.	Je n'ai jamais eu l'impression que certaines de mes pensées appartenaient en réalité à quelqu'un d'autre.	____	26____
23.	Quand on me présente une personne inconnue, c'est rare que je me demande si je ne l'ai pas connue avant.	____	27____
24.	Si la réincarnation était vraie, ça expliquerait quelques expériences étranges que j'ai eues.	____	28____
25.	Les gens agissent souvent si drôlement que je me demande s'ils ne sont pas en train de participer à une expérience.	____	29____
26.	Ca m'arrive des fois de faire certains petits gestes rituels pour éloigner des influences négatives.	____	30____
27.	J'ai déjà ressenti que je pourrais causer l'arrivée de quelque chose rien qu'à trop y penser.	____	31____
28.	Je me suis déjà demandé si les esprits des morts pouvaient influencer les vivants.	____	32____
29.	Des fois, j'ai eu l'impression qu'un professeur donnait un cours spécialement pour moi.	____	33____
30.	J'ai déjà ressenti que des étrangers lisaient ma pensée.	____	34____

APPENDIX B

Instructional Sets for Orienting Condition and Neutral, Incentive, Unpredictability and Controllability Conditions

Instructional Sets

Instructional Set for Orienting Response Condition

"Bonjour. C'est ainsi qu'on va te communiquer les instructions. Profite de ces quelques moments de détente pendant que nous préparons notre équipement. Tu vas sans doute entendre des bruits dehors ou des sons dans les écouteurs; ça fait partie de nos ajustements. Fais comme si tu n'entendais rien. Nous te reparlerons dans quelques minutes."

Instructional Set for Neutral Condition

"Bonjour, nous revoilà. On va te faire entendre plusieurs séquences faites de trois timbres, qui sonne comme ceci: [example of target tone sequence is presented]. Ou encore: [example of non-target tone sequence is presented]. Certaines de ces séquences vont sonner comme notre cible, qui est: [example of target is presented]. Les autres séquences vont sonner différemment. Nous voulons que tu compte dans ta tête le nombre de séquences qui sonnent comme notre cible. Attention! Voici encore une fois notre cible: [target is presented]. La présentation des séquences va commencer bientôt."

Instructional Set for Incentive Condition

"Nous continuons avec une autre tâche. Tu vas entendre plusieurs autres séquences, et tu dois encore identifier une cible. Nous savons que les étudiants ici sont bons dans ce genre de tâche; les jeunes de ton âge réussissent presque tous cette tâche-là. Voyons comment tu vas réussir cette fois-ci. La cible va sonner comme ceci: [example of target is presented]. Encore une fois: [example of target is presented]. Compte dans ta tête le nombre de séquences qui sonnent comme notre cible. La présentation va commencer bientôt."

Instructional Set for Unpredictability Condition

"Voici une tâche différente, maintenant. Nous allons te faire entendre une nouvelle présentation de séquences faites de trois timbres. Nous allons changer le contenu et l'ordre dans lequel sont présentées ces séquences. Attention! Nous ne te donnons pas de cible à l'avance. A la fin, nous aurons deux questions sur cette présentation; porte bien atttention à ce qui se passe."

Instructional Set for Controllability Condition

"Nous allons faire quelque chose de différent pour terminer. Tu vas y jouer un rôle actif. Tu vois la pédale devant ton pieds droit? Elle bouge de haut en bas. Vas-y, essaie-la. Maintenant, tu vas entendre une présentation de séquences, avec comme cible, ceci: [example of target is presented]. Encore une fois: [example of target is presented]. Tu vas garder la pédale en haut tout le temps, sauf si tu détecte une cible. Quand tu entends une cible, tu appuies vers le bas le plus vite possible, et relève aussitôt la pédale. On essaie? [target is presented, participant is expected to press pedal]. Tu appuies donc vers le bas, très vite, et relève aussitôt la pédale. Tu tiens maintenant la pédale levée, et attends la première cible. Attention! Tu appuies seulement pour une cible. La présentation commence bientôt."

APPENDIX C

Parent's and Student's Consent Forms

Mardi, le 4 novembre

Cher parent,

Dans le cadre d'un vaste projet de recherche en psychophysiologie en cours à l'UNIVERSITÉ CONCORDIA et à la polyvalente JEAN-BAPTISTE-MEILLEUR, nous étudions le développement psychologique des jeunes, comment ceux-ci s'adaptent aux multiples stress associés au passage vers l'âge adulte, et comment le système nerveux facilite ou rend difficile cette adaptation. On veut ainsi arriver à mieux les aider à vivre cette adaptation.

Déjà avec l'approbation des directeurs de l'école et un accueil enthousiaste tant des professeurs, professionnels, et représentants des parents, nous avons administré un ensemble de sept inventaires mesurant le tempérament et les profils de fonctionnement individuel et social de plus de 500 jeunes, en 1984 et 1986.

Comme la dernière et plus importante partie de la recherche sera faite auprès de jeunes individuellement, nous tenons à vous mettre personnellement au courant pour obtenir votre appui. Voici en quoi consiste cette partie de la recherche:

120 jeunes de 5e secondaire ont été choisis, selon les résultats des tests et une sélection au hasard, pour représenter toutes sortes de personnalité et de profil de fonctionnement social. Le nom de votre jeune figure parmi cette liste, et nous comptons lui demander de participer. Bien sûr, la confidentialité des données est préservée en tout temps.

Le jeune se rend dans notre laboratoire de psychophysiologie installé dans la polyvalente même. On l'assoit confortablement, on applique des senseurs (mini-électrodes sans danger et ceinture souple) pour mesurer le rythme cardiaque, la respiraton et la conductance électro-dermale (changement d'humidié de la peau). Tout cela est fait discrètement, sans douleur ni gêne, et le jeune complète quatre courtes tâches demandant de l'attention. Toute l'expérimentation est sous constante supervision d'un psychologue. Les filles sont toujours testées par UNE ASSISTANTE de recherche.

Nous tenons à être sûr de votre accord: voudriez-vous signer cette lettre que votre enfant doit nous rapporter à JBM. Sentez-vous à l'aise: si vos préférez que votre jeune ne participe pas, retournez la lettre non-signée. Pour nous, ce qui compte d'abord, c'est de travailler dans un climat de bonne entente et de communication claire. Nous présenterons les résultats au public dans quelques mois, et tous seront

page 2.

conviés. SI VOUS VOULEZ RECEVOIR LE PROFIL DES RESULTATS DE VOTRE JEUNE, APPELEZ-NOUS APRES SA PARTICIPATION, AU NUMERO CI-BAS.

ANDRÉ M. BERGERON, Psychologue,
responsable du projet

J'ACCEPTE QUE MON ENFANT PARTICIPE A CE PROJET, TEL QUE PRESENTE ICI:

Signature: _____ Date: _____

JE PRÉFERE QUE MON ENFANT NE PARTICIPE PAS: ___ NOM: _____

Pour tout renseignement, appelez le 848-2253, et demandez M. André Bergeron.

le 4 novembre, 1986

Cher/e étudiant/e,

Comme tu le sais, nous sommes allés dans ta classe l'an passé pour un important projet de recherche en psychologie. Nous avons maitenant besoin de ton aide pour compléter la dernière et plus importante phase du projet. Nous voulons mesurer en laboratoire, à JBM, la façon de réagir des jeunes de ton âge, en mesurant le rythme cardiaque, la respiration et la conductance de la peau, lors d'une série de tâches faciles mais demandant de l'attention. C'est intéressant, sans danger ni désagrément, et va nous permettre de mieux comprendre comment l'organisme s'adapte au stress. Un montant de $7.00 te seras remis en guise de remerciement.

Nous devons, pour garantir une méthode de recherche rigoureuse, sélectionner nous-même des étudiants de plusieurs types de personnalité, selon l'enbsemble de nos tests et le hasard. Cela veut dire que ton nom a été choisi, comme un exemple de personnalité, parmi 75 autres de tous genres.

Nous aimerions que tu acceptes de participer de la façon suivante:

1. Tu signes cette feuille et la rapportes à JBM, en même temps que celle de tes parents dans notre boite à lettre spéciale, près des classes.

2. Nous te contacterons pour venir au laboratoire, en classe ou par téléphone quelques jours avant.

Au moment approprié, un assitant de recherche viendra te chercher, t'installera confortablement dans le laboratoire près des locaux de classes; tu complèteras alors quatre courtes tâches demandant de l'attention, pendant qu'on enregistre le fonctionnement cardiaque, respiratoire et électrodermal. Cela dure en tout trois quarts d'heure, et on produira pour chacun un profil de tes réponses avec des suggestions sur comment mieux gérer tes stress.

Tous les résultats sont strictement confidentiels (personne de JBM n'a accès à nos données). Tu demeures libre d'arrêter en tout temps.

Nous te remercions de ta participation. C'est la meilleure façon de nous aider à vous aider.

ANDRÉ M. BERGERON, Psychologue,
responsable du projet

J'ACCEPTE DE PARTICIPER AU PROJET: _____ DATE: ____
signature de l'étudiant/e

JE PRÉFERE NE PAS PARTICIPER AU PROJET: ___

TON NOM: _____

CONSENTEMENT

Le but de cette recherche est d'exminer le lien entre des fonctions du corps (rythme cardiaque, respiration et conductance de la peau) et les résultats de tâches demandant de l'attention.

Pour enregistrer ces fonctions, nous attachons quelques senseurs (petites électrodes sans danger et ceinture souple) sur chaque côté du corps, et sur deux doigts. C'est sans danger, et ne marque pas la peau du tout. Les connections sont reliées à une machine qui enregistre le tout.

Tu as le droit d'interrompre la procédure n'importe quand si tu le préfères.

Toutes les données sont strictement confidentielles; même le chercheur ne connait pas tes résultats individuels.

Pour que notre travail soit bien fait et clair, nous demandons à chaque sujet d'approuver en signant cette formule. Merci.

Un montant de $7.00 t'est versé en guise de remerciement.

J'ai bien compris les conditions de la recherche et accepte d'y participer,

signé: _____

date: _____

Signature de l'expérimentateur:

_____
pour le département de psychologie (CRDH)

UNIVERSITÉ CONCORDIA
DÉPARTEMENT DE PSYCHOLOGIE (CRDH)

J'ai reçu la somme de $7.00 lors de ma participation à une recherche en psychologie dirigée par M. A.M. Bergeron, de l'Université Concordia.

Signé _____

Date jour _____ mois _____ 1987

APPENDIX D

ANOVA Summary Tables

ANOVA Summary Table for Resting Skin Conductance Level

Source of Variance	SS	n	DF	MS	F	
Main Effects	.500		3	.167	1.471	
Group	.079		2	.039	.707	
Sex	.477		1	.477	4.211	*
Group X Sex	.223		2	.112	.986	
Explained	.831		5	.166	1.467	
Residual	7.474		66	.113		
Total	8.304		71	.117		

* $p<.05$

ANOVA Summary Table for Spontaneous SCRs

Source of Variance	SS	DF	MS	F
Main Effects	10.450	3	3.483	.061
Group	2.739	2	1.370	.369
Sex	8.835	1	8.835	.013 *
Group X Sex	3.720	2	1.860	.260
Explained	15.360	5	3.072	2.270
Residual	89.334	66	1.354	
Total	104.694	71	1.475	

* $p<.05$

ANOVA Summary Table for Amplitude of First Orienting Response

Source of Variance	SS	DF	MS	F
Group	1.246	2	.623	.071
Sex	1.013	1	1.013	.038 *
Group X Sex	.886	2	.443	.149
Explained	2.960	5	.592	2.616
Residual	14.939	66	.226	
Total	17.899	71	.252	

* $p<.05$

APPENDIX E

Dependent and Independent Variables Summary Table

Independent and Dependent Variables Summary Table

Variables			
INDEPENDENT		DEPENDENT	
GROUP	SEX	PSYCHOPHYSIOLOGICAL	ATTENTIONAL
		Heart Rate	Errors
Anhedonic	Male	Resting HR (bas)	Number of Omission errors
	Female	Reactive HR (4 cond.)	
		Skin Conductance	
Perceptual Aberration	Male	Resting SCL (Bas)	Number of commission errors
	Female	Reactive SCL (4 cond.)	
		Amplitude of first OR	Mean reaction time
		Mean amplitude of 13 ORs	
Control	Male	Number of SCRs (OR)	Mean rising time
	Female	Latency, rising time, amplitude, and half-recovery time of 1st, 2nd, and 3rd Rs	
		Latency, rising time, amplitude, and half-recovery time of 1st, 21st, and 40th Rs	