Schizotypy and Extroversion-Introversion:

Correlation and Electrodermal Activities in Emotions

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Author

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Glenn D. Shean, Ph.D.

Peter L. Derks, Ph.D.

Harvey J. Langholtz, Ph.D.

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ABSTRACT

This study first examined the correlations between schizotypy and extroversion-introversion, which were respectively measured by abbreviated Chapman and Eysenck scales on college students. Students who had positive and negative schizotypy scores in the top 10% were selected and asked to have self-induced emotions of happiness and fear while electrodermal activity was measured. The main hypotheses were: (a) scores of extroversion and schizotypy-negative, introversion and schizotypy-positive would be significantly correlated; (b) schizotypy-negative subjects would evidence significantly faster habituation of orienting responses of skin conductance than schizotypy-positive subjects; (c) schizotypy-negative subjects would evidence faster habituation in the emotion of happiness than in fear, whereas schizotypy-positive subjects would evidence the opposite pattern.

Correlational analysis and repeated MANOVA were completed, however, results did not confirm the predicted group differences.

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Introduction

Electrodermal Activities & Orienting Response

Electrodermal activities. There are various measures of electrodermal activities, e.g., electrodermal potential, alternate current measures, etc. Among them skin conductance is the most convenient and reliable one. Electrical conductance is the reciprocal of electrical resistance. Skin conductance is the electrical conductance between two sites on the skin, usually it is on the palmer surface of the distal phalanx of the index and ring fingers on the same hand. There are three components: (a) Skin Conductance Level (SCL), which does not change in a short period of time, but displays slow, tide-like changes due to diurnal variation and the demands of the environment (Lykken & Venanbles, 1971). (b) Skin Conductance Orienting Response (SCOR), which occurs when a novel psychologically significant stimulus (e.g. a tone or a light) is presented. SCOR is usually a rise and fall of conductance after a short latent time (about 2 seconds) and lasts about 10 or more seconds. (c) Skin Conductance Non-specific Response (SCNSR), which is almost the same as SCOR, the only difference is that it does not correspond to any specific external stimulus, i.e., it is the response which corresponds to the internal stimulus or simply the uncontrolled environmental stimulus ("noise").

Other orienting responses. SCOR is just one of the orienting responses. In addition to SCOR, there are other orienting responses, e.g., finger pulse volume, pupillary dilation, cardiac deceleration, alpha wave blockage in the EEG, skeletal muscle activity, respiratory pattern (Bernstein, 1987). However it should be noted that SCOR is generally the most dependable, accurate, and inexpensive measurement of orienting responses.

Habituation. Most of the study on orienting responses goes back to Sokolov's (1963) model. According to the model, (a) Characteristics of stimulus input, such as frequency, intensity, and duration, are stored in a neuronal comparator; (b) An orienting response is elicited when the neuronal model of previous stimulation and that of currently occurring stimulation do not match; (c) Habituation is achieved (on subsequent presentation of the stimulus) when there is a match between current and previous stimulation.

Orienting responses are closely related to the activity of the reticular formation that maintains activation levels of the cortical neurons (Van Olst, 1971) and prepares the person for "fight or flight" through the autonomic nervous system (Straube, Barth, & Konig, 1979).

Cortical excitatory impulses are contingent on changes in sensory stimulation in the ascending sensory tract and collaterals to the reticular formation, which in turn activate the hypothalamic sites that initiate the autonomic components of the orienting response. When repetitions of sensory stimuli are received, cortical inhibitory impulses travel by way of the collaterals that transmit impulses from the ascending sensory tracts to the reticular formation. These impulses affect the diminution and eventual abandonment of the autonomic responses, thus producing habituation (Lynn, 1966). Orienting responses and habituation are closely associated with attentional processes (Dawson, Nuechterlein & Schell, 1992).

Individual differences and moderated responses. Skin conductance differs among individuals. Responses can be moderated by: (a) having the subject conditioned, affected, potentiated or tasked (e.g., performing the degraded-stimulus version of the Continuous Performance Test, Munro et al, 1987; Rosvold et al., 1956); (b) providing different kinds of stimuli-environments: innocuous/aversive/task-relevant stimuli; simple/complex (e.g., with a preparatory signal) stimuli; with different physical characteristics (e.g., frequency, intensity, duration); in different macro-environments (e.g., time in a day, temperature or even seasons).

SCL-SCOR-SCNSR & Schizophrenia Subtypes

Responders & non-responders. Researchers in the late 1960s began to report differences in the SCL-SCOR-SCNSR between normal and schizophrenic populations (Bernstein, 1987). However, the reports of the early research on schizophrenia appeared to vary from study to study. In the early 1980s, a new consensus about the nature of the electrodermal abnormalities in schizophrenic patients emerged among several reviews published (Spohn & Patterson, 1979; Ohman, 1981; Bernstein et al., 1982; Dawson & Nuechterlein, 1984; Holzman, 1987). The consensus has two aspects, referring respectively to SCOR and SCNSR-SCL: (a) There are large subgroups of schizophrenic patients who are SCOR non-responders. Forty to 50 percent of patients fail to give SCORs to novel innocuous non-task stimuli, compared to only 5 to 10 percent of the normal population; (b) The SCNSR-SCL of the SCOR non-responder is low, while that of the SCOR responder is abnormally high. In short, in the schizophrenia population, non-responders are hyporeactive, whereas responders are hyperactive (Ohman, 1981).

<u>Schizophrenia positive-negative subtypes.</u> It is widely believed that within the schizophrenic patient population, there are two subgroups which manifest a predominance of either positive or negative symptoms. Positive symptoms include features such as affective distress, delusions, and hallucinations. Negative symptoms include signs such as apathy, flat affect, and anhedonia (Andreasen, 1985; Crow, 1985; Pogue-Geile & Harrow, 1984). The groupings are believed to have implications for etiology, diagnosis, treatment and prognosis.

It has been speculated that positive symptoms result primarily from the dysfunction of the hippocampus, while negative symptoms are related to the dysfunction of the amygdala (Venables and Bernstein, 1983) or ventricular enlargement and cell loss (Crow, 1985). It has also been found that patients with positive symptoms respond well to neuroleptics (Andreasen, 1985), whereas patients evidencing negative symptoms tend not to respond to neuroleptics and have a faster frequency of EEG activity over nonspecific sensory cortex than positive symptoms (Gruxelier, Jutai, Connolly & Hirsch, 1984).

SCOR and SCL-SCNSR as indicators. It seems that SCOR responding in schizophrenia is associated with positive symptoms, while non-responding is related to a preponderance of negative symptoms which center on withdrawal (Bartfai, Levander, Edman, Schalling and Sedvall, 1983; Bernstein, 1987; Bernstein, Riedel, Pava, Schnur & Lubowsky, 1985).

There is evidence that distinct autonomic nervous system patterns may also predict further development of schizophrenia (Straube, 1983). Heightened pretreatment skin conductance measures (hyperactiveness) predicts a poorer short-term prognosis among schizophrenic patients (Dawson, Nuechterlein, 1984). A small study using positron emission tomography scans indicated that non-responder patients, compared to the responder patients, evidenced significantly lower absolute and relative metabolic rates in the lateral and medial frontal cortex and in the hippocampus (as cited in Dawson, 1990).

SCL-SCOR-SCNSR & Schizotypy

Medical models and the normal population. Medical models should be applied to the normal population for three main reasons. (a) There are concerns about the confounding effects of medication, institutionalization, labeling and dietary factors on physiological measures for the patient population. So, it is necessary to investigate the responder/non-responder subtypes in the normal population. (b) There are no simple causes for schizophrenia, therefore, many contributing factors may also be present in the normal population. (c) Although it may be useful to understand clinical cases through the so-called "dimensional" studies on the normal population, the scientifically more important job is just on the opposite direction--applying medical models on the normal population. Because the schizophrenia construct has no clear cut clinical boundary, it provides a "natural" path.

Rado's model of schizotypy. Rado (1954, as cited in Meehl, 1962) first proposed a personality construct called schizotypy, with behavioral characteristics of anhedonia, affective impoverishment, impaired capacity for empathy, and social dependency. There are more features including oddness of speech, feeling different from others in a negative sense, impulsivity, extreme anger, derealization, depersonalization, and unusually acute or dulled senses (Fujioka & Chapman, 1984). In Rado's diathesis model of schizophrenic development, the schizotypal person with good coping skills will not develop a severe form of schizophrenia, but those who do not cope well will develop the disorder.

Meehl's model of schizotypy. Meehl (1962) expanded Rado's model, adding cognitive slippage, and slightly disordered patterns of thought. He proposed that a neural integrative defect (schizotaxia) leads to a personality pattern (schizotypy) which is characterized by social withdrawal, inappropriate behavior, and perhaps deviant logic. More specifically (Meehl, 1989, 1990), a single dominant schizogene causes a neuronal integrative deficit, which consisting of a functional aberration of the synaptic control system, which in turn leads to soft neurological signs, cognitive slippage, and aversive drift through mixed positive and negative reinforcement. These in turn lead to anhedonia, ambivalence, and social fear which leads to inappropriate social behavior, and as social interactions become increasingly bizarre, it leads to "accessory symptoms": delusions, hallucinations and catatonia. Only about 10% of true genotypic schizotypes will experience a schizophrenic breakdown while the rest will experience subclinical symptoms. The genetic vulnerability does not lead directly to schizophrenia, it must be combined with "potentiators", which are personality variables that reduce the likelihood of positive social interactions, e.g., submissiveness, hypohedonia, anxiety, introversion, and trauma. According to Meehl, genetic loading combined with these various personality factors increases vulnerability to breakdown, but still the person will not experience a schizophrenic episode in the absence of environmental "bad luck", i.e., adverse life events.

Note that since this study is on the normal population, the above mentioned "deficit" should be read as vulnerability or trait--it is very likely that the person with the vulnerability or trait can function well in a certain special way, and what is more, they can do so just because that very characteristic is combined with successful "coping" dynamics. Indeed, Zubin and Spring (1977), have emphasized that vulnerability is not disorder.

Offspring of schizophrenics. Guided by the model, there are some studies which have attempted to identify marker traits in the offspring of diagnosed schizophrenics. Evidence indicates that children of severely schizophrenic mothers who themselves developed some type of psychiatric illness have a very fast SCOR recovery time, greater amplitude of response, shorter response latency, and poorer habituation to stimuli than the control group (Mednick & Schulsinge 1968; Mednick, Parnas, & Schulsinger, 1987).

Chapman scales. A group headed by L. and J. Chapman has attempted to develop a number of scales that measure different aspects of schizotypy. These include: (a) Physical Anhedonia Scale (Chapman, Chapman, & Raulin, 1976); (b) Social Anhedonia Scale (Eckblad, Chapman, Chapman, & Mishlove, 1982); (c) Perceptual Aberration (Chapman, Chapman, & Raulen, 1976); (d) Magical Ideation (Eckblad, & Chapman, 1982).

Correlational analysis and factor analysis show that (a) and (b) can be used together to measure negative symptoms, while (c) and (d) can be combined for positive symptoms (Chapman, Edell, & Chapman, 1980; Chapman, Chapman, & Miller, 1982; Bentall, Claridge, & Slade, 1989). It has been found that the scores of psychotic patients with different diagnoses (including schizophrenia, major depression, bipolar disorder, or schizophrenoform disorder) did not differ significantly. The combined psychotic group had significant higher scores on the Physical Anhedonia, Social Anhedonia and Perceptual Aberration scales than their relatives, who in turn scored significantly higher than the normal controls on both of the anhedonia scales (Katsanis, Iacono, & Beiser, 1990). Chapman & Chapman (1987) conducted a follow-up study to track individuals with high scores on these scales and determine if they do in fact have higher rates of psychosis. Results indicate that 25 months after the administration of the Perceptual Aberration/Magical Ideation and Physical Anhedonia scales, 22 percent of the high scoring Perceptual Aberration/Magical Ideation group had sought professional psychological or psychiatric help while only 7 percent of the anhedonia and control groups had done so. Three of the 162 former group subjects were diagnosed as psychotic during the follow-up period, while none of the other subjects were hospitalized for psychosis.

Simons (1981) reported that anhedonic subjects, as measured by Chapman's scales, demonstrated a pattern of electrodermal hyporesponsivity similar to that of schizophrenic hyporesponders. Perceptual aberration subjects however did not evidence a pattern of hyper-responsivity and failure to habituate.

SCL-SCOR-SCNSR & Eysenck Personality Measures

Arousal and extroversion-introversion. Eysenck (1967) proposed a theory linking cortical arousal with the Extroversion-Introversion (E) dimension. It is based essentially on the work of Moruzzi and Magoun (1949) regarding the ascending reticular activating system (ARAS). The work indicated that collaterals from the ascending sensory pathways produce activity in the ARAS, which subsequently relays the excitation to numerous sites in the cerebral cortex, which can be observed by the EEG synchronization. Much research has since shown that the reticular formation is implicated in the initiation and maintenance of emotion, conditioning by way of excitatory and inhibitory control of autonomic and postural adjustments, and by way of cortical coordination of activity serving attention, arousal, and orienting behavior. So, it was proposed (Eysenck, 1967) that the Extroversion-Introversion dimension was identified largely with differences in the level of activity in the cortico-reticular loop. In other words, introverts are characterized by higher levels of cortico-reticular activity than extroverts, and thus are chronically more cortically aroused than extroverts.

The prediction that introverts would evidence larger SCORs and slower habituation has been very widely studied and there is a great deal of evidence consistent with it, while there are also negative findings, usually consisting of failures to find differences rather than of contradictory findings (Eysenck & Eysenck, 1985; Graham, 1973; O'Gorman, 1977; Stelmack, 1981). The failures can very likely be attributed to the failures of meeting some methodological requirements (Eysenck, 1990).

<u>Activation & neuroticism.</u> It has also been suggested that the Neuroticism (N) dimension is linked with the limbic system (Eysenck, 1970) and is closely related to the activity of the visceral brain, which consists of the hippocampus-amygdala, cingulum, septum, and hypothalamus. E and N systems are independent, and there is an orthogonal relation between E and N. However, this independence is only partial. One of the ways in which cortical arousal can be

produced is through activity in the visceral brain, which reaches the reticular formation through collaterals. That the activity in the visceral brain produces autonomic arousal is named (by Eysenck, 1970) as "activation" to distinguish the arousal by reticular activity. Thus, in a condition of high activation, there will be high arousal--a person who is strongly affected by anger, fear, or some other emotions will certainly also be in a state of high cortical arousal (Routtenberg, 1966).

The distinction between an arousal system and an activating system has strong empirical support in the work of Thayer (1978a, 1978b, 1986). He constructed an Activation-Reactivation Adjective Check List, which resulted in two major factors. The first of these is "general activation" (energetic, vigorous, lively, full of "pep", active, happy, and activated), which corresponds to the notion of "arousal". The second factor is "high activation" (tense, anxious, jittery, clutched up, fearful, intense, and stirred up), which corresponds to the notion of "activation".

Emotional valence and extroversion. Gray (1991) suggested that, corresponding with the three dimensions of personality, there are three separable sub-systems of the brain, i.e., approach (impulsivity, sensitivity to reward), fight-flight (angry), and behavioral inhibition (anxiety-primary psychopathy). He suggested that extroverts should be relatively more sensitive to and learn more readily about, reward than punishment; while introverts should be relatively more sensitive to, and learn more readily about punishment than reward. Note that habituation is the simplest learning.

Hypothesis

Eysenck and Gray have provided the dimensional study of personality with a neurological model, which is comparable to that of Meehl's schizotypy model. According to Eysenck and Gray, emotion systems are directly related to personality, on the other hand, the schizotypy model must be extended to predict the emotion moderation of SCOR. Integration of the implications of the Meehl and Chapman model of schizotypy and the work of Eysenck and Gray provides a basis for the following predictions:

1. Measures of extroversion and schizotypy-negative, and measures of introversion and schizotypy-positive will be significantly correlated.

2. Schizotypy-negative subjects will evidence significantly faster habituation of SCOR than schizotypy-positive subjects.

3. Schizotypy-negative subjects will evidence faster habituation of SCOR during expressions of the emotion of happiness than during expressions of fear; whereas schizotypy-positive subjects will evidence the opposite pattern.

4. Additionally, hypo-responders will evidence high extroversion or low neuroticism, where hyper-responders will evidence the opposite pattern.

Method

Participants

A. All students who attended mass testing were the participants of the first step of this research by answering the abbreviated Chapman and Eysenck scales. Note that although the Eysenck scale was not used for selecting participants, to verify hypothesis one with sufficient sample size, abbreviated Eysenck scale was also included in mass testing.

B. There were 72 William & Mary students who were selected from the mass testing pool of introductory psychology courses by the standard that 36 of them were among the top 10 percent in Chapman positive scales, and 36 of them were among the top 10 percent in Chapman negative scales, and in each group there were 36 women and 36 men.

Note that an equal number of women and men were selected because because of the fact that in the past studies significant gender difference of electrodermal activities had been found and therefore in the present experimental design gender should be introduced as a basic factor.

Apparatus

Orienting responses were measured by Autogenic System's

Biolab. M160 GSR Module. Manual centering was used during the beginning 3 minutes so that the absolute value of skin conductance could be obtained, after that, automatic centering was used). The M180 Heart Rate Module was used to measure heart rate. In Autogenic System's Biolab, sampling consists of pre-programmed intervals, which in turn consists of pre-programmed sessions. There were 480 samplings in each pre-programmed intervals regardless of the length of the pre-programmed intervals. To make the sampling accurate enough (i.e., sampling duration short enough) while keeping the pre-programmed intervals long enough, a 20-second pre-programmed intervals' duration was set (i.e., sampling duration was about 0.04 second). There were 99 (the largest possible) continuous pro-programmed-intervals in each pre-programmed session, which made up one experimental session. The whole experiment lasted about 30 minutes. Note that since the emotions were self-induced, the experimental duration should not be too long, based on pilot research, it was concluded taht 30 minutes was the optimal duration for the experimental procedure.

As for the questionnaires, there were six measures: (a) Magical Ideation (MID), (b) Physical Anhedonia (PAN), (c) Perceptual Aberration (PAB), (d) Social Anhedonia (SAN), (e) Eysenck's Extroversion-Introversion (EXT), and (f) Eysenck's Neuroticism (NEU). Since these dimensions were used in mass testing, they were abbreviated into 18 questions (three questions for each dimension, see Appendix A). All dimensions were randomly mixed together when administrated.

Procedure

(1) The abbreviated questionnaire was administrated (in a large packet together with other questionnaires) to students in mass testing.

(2) The design was 2 x 2 x 2 x 9 MANOVA (Gender x Schizotypy x Emotion x Trial), with repeated measures for trials. For the between-subject factors, (a) "Gender" is obvious. (b) "Schizotypy": the selection criterion was having the top 10% scores of Chapman scales of positive or negative symptoms in mass testing. (c) "Emotion": there were simulations of emotions of happiness and fear.

All mass testing data were separated into male and female groups, and then for each group, the highest score ranges for two schizotypy subtypes were determined (so that there were only a little more than 18 people in the range, in the top 10 percent). Participants with scores inside the ranges were telephoned and were randomly assigned into emotion cells. Note that on the participant schedule, there were only participants' name, id, and emotion cell, there were no schizotypy subtype information.

(3) The experiment was explained to the participants in everyday language. Note that because the word "schizotypy" almost inevitably would lead to misunderstanding in the context of everyday language, the word was simply eliminated

or replaced by "extreme tendency" in explanation. Written consent form was obtained for each participant.

(4) The lights were made dim just enough to read (this was to make the later light signal more salient).

(5) After putting on the electrodes (on left hand, index and ring finger for electrodermal activities and middle finger for heart rate) and earphones, the participant read the written instructions. While the participant began to read the instructions, skin conductance, heart rate recording began.

(6) The GSR module (GSR/SCL to SCL option) was set to manual centering and adjust the potential meter was adjusted so that the signal on the display was on the zero line. Next, the value on the potential meter was recored, this was the absolute value of the base line SCL (in umho or mSimens). Finally, the equipment was returned to automatic centering status (including returning potential meter to "0").

(7) As instructed by the instruction sheet, the participant said "start" when she or he finished reading and was ready to begin.

(8) About 40 seconds later (right after the beginning of a pre-programmed interval), the experimenter presented "happy" or "fear" card (it depended on which cell the participant was assigned), and the participant began either the experience of happiness of fear.

(9) Two minutes later, the experimenter presented the visual-auditory stimuli (60W light and 1000Hz, 100dB tone, both lasted about 1 second). There were nine trials with inter-trial intervals of 20, 40, 60, 20, 60, 20, 20, 40, 20 seconds, for a total of about 5 minutes. Note that the duration was not too long in order to prevent the effect of the self-induced emotion simulation from fading out.

(10) The "stop" card was presented at the end of the trial.

(11) The second emotion simulation was similar to (8) to (10).

(12) Finally, the experimenter asked the participant to rate if she/he felt that her/his simulation was "real" (very real, ok, not at all).

Results

Correlation Analysis of Mass Testing Data

The questionnaires were administered in two semester's mass testing. In the first semester, there were 666 participants. The correlational pattern was: (a) Among Chapman scales, Physical Aberration was negatively correlated with Magical Ideation (r = -.16, p = .000), and Physical Anhedonia was negatively correlated with Social Anhedonia (r = -.14, p = .000), see Table 1. (b) Opposite to prediction, positive (Magical Ideation + Physical Aberration) was not negatively correlated with negative (Physical Anhedonia + Social Anhedonia), see Table 2. (c)

Positive was strongly correlated with Magical Ideation and Physical Aberration, negative was strongly correlated with Social Anhedonia and Physical Anhedonia, however, because Positive and Negative are the sum of the respective latter two measures, this was just a routine mathematical result, see Table 3. (d) Eysenck's ext and neu were negatively correlated (r = -.33, p = .000), see Table 4. (e) Between the Eysenck and Chapman scales, only neu was negatively correlated with pab (r = -.13, p = .000), see Table 5. (f) As opposite to the hypothesis, there was a small but significant negative correlation between ext and negative (r = -.16, p = .000), and, neu was negatively correlated with positive (r = -.14, p = .001), see Table 6. (g) There were no significant correlations between gender and scales, see Table 7.

Insert Table 1-7 about here

In the second semester, there were 801 participants. Although there were some differences, the correlational pattern was similar to that of the first semester (see Appendix G, Data Table 1-7). That may be because there were almost half of the participants in the second mass testing also attend the first one. After removing this sub-sample from the data pool, the two mass testing data samples were merged together to get larger sample size, the result was still similar to that of the above described (see Appendix G, Data Table 8-14).

MANOVA on the SCOR

In the following tables, sch, emo, and gen stand for schizotypy, emotion and gender, scr and hdu stand for SCOR and their half-duration time. Half-duration time is the duration time measured at the half magnitude of the response.

To test hypotheses 2 and 3, a repeated MANOVA was carried out. Hypothesis 3 predicted an (sch x emo x trial) interaction, hypothesis 2 predicted an (sch x trial) interaction. Results presented in Table 8 indicated that there was no significant (gen x sch x emo x trial) interaction. Results presented in Table 9 indicated that there was no significant (sch x emo x trial) interaction, so, hypothesis 3 was not confirmed. Results presented in

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Insert Table 8-10 about here

Table 10 indicated that there was no significant (sch x trial) interaction, so hypothesis 2 was also not confirmed.

The independent variables in the test were processed in different ways (gen x emo, gen x sch, emo, gen), results (Appendix G, Data Table 15-18) indicated that there were no significant effects.

Scr as an Independent Variable

To further examine the data, scr was treated as an independent variable. Based on its distribution, all participants were categorized into three groups, hypo-responders (no scor in the first three trials), normal ones (no scor in the forth, fifth, sixth and seventh trials), and hyper-responders (scor on all trials or/and except on the eighth or/and ninth). Each group was approximately the same group size (25, 24, 23). In the analysis, a new independent variable (res) was created to represent the grouping, the value 1, 2, and 3 was assigned to hypo-responders, normal ones, and hyper-responders, respectively.

It was hypothesized that the hypo-responders had high negative schizotypy measures, hyper-responders had high positive schizotypy measures. ANOVA was complete, there was no significant result (Table 11, 12).

Insert Table 11-12 about here

Additional ANOVA and MANOVA were completeded to examine if there were effects on each of Chapman and Eysenck scales (hypothesis 4) or on all of them together on responsivity. Then, gender (gen) and emotion (emo) as independent variables were introduced in the analysis. After gen and emo were introduced, the grouping was still well balanced (Appendix G, Data Table 19). There were no significant results (Appendix G, Data Table 20).

ANOVA on SCR Baseline and Simulation Authenticity

To test if there was a SCR baseline difference between gender and schizotypy, ANOVA was carried out. Table 13 (bas stands for baseline) indicated that there was no significant 3-way interaction, 2-way interaction, or main effect.

To test if there was difference in answering the question "How do you feel the simulation (answer: real, ok, not real at all)", ANOVA was carried out. Table 14 shows that there were no significant effects.

Insert Table 13-14 about here

Repeated Emotions and Heart Rate

Because of the habituation effect, most of the scr and hdu in the second session were zero, so, no further data process.

An equipment problem resulted in serious systematic errors in the heart rate module, so, the data were discarded. However it must be indicated that through the measurement, the experimenter observed that there was an interesting pattern about the latency of the orienting response, i.e., some people evidence SCOR first, and some people evidenced heart rate change first.

Rising Time, Falling Time and Latency Time

Hdu can be divided into two parts, one is rising time, another one is falling time. Besides those, there is another one, latency time--the time between the start of the signal and the beginning of the response. Because of the inaccuracy of the equipment, rising and falling were combined into hdu, and latency time was not processed.

Discussion

There were some students who had both high scores on positive and negative Chapman scales (note that this phenomenon also occurs in clinical situations). This indicated that at least for some people, positive and negative were not the two opposite directions of one dimension, they may be two separate dimensions.

The results did not support predictions of group differences based on questionnaire measures. Perhaps group differences were minimal. The item content of Chapman scales are too extreme for use with the normal population. The distributions indicated that most of the scores were skewed in the direction of low scores. So, in the future, new less extreme items may need to be developed.

Task-oriented tests (instead of descriptive questionnaires) with strong impact on emotions should be introduced in the future. However, note that the lack of confirmation of predictions may also have resulted because of the questionnaire abbreviation. Because the mass testing includes a package of questionnaires, abbreviation is practically the only way to administer the Chapman and Eysenck scales.

Experimental results indicated no support to the hypothesis that the positive group would be more responsive to the combined auditory and visual signals. These results are not consistent with the findings reported by Simons (1981). The first cause may be that, as mentioned above, Chapman scales are not applicable on normal population. However, it is also possible that it is because of the use of abbreviated scales. The whole questionnaires should be administered to the subjects in the experimental session to confirm the results of the mass testing and for further detailed data analysis (esp. in "scr as an independent variable"). However, because the experimenter treated the schizotypy as an independent variable, and did not recognize the analytical power of treating scr as an independent, he did not administer the whole questionnaires. This was a flaw in the research design.

The second cause may be that the self-induced emotion simulation was not effective and powerful. In the future study, subjects may be presented with more compelling imagery or reading material, or some sections of movies, to trigger strong emotions.

The third cause may be that the signal presentations were not meaningful and real. In future studies, this may be designed and improved together with the emotion triggering design.

The fourth cause may be that orienting responses were not necessarily confined in skin conductance, several orienting response should be measured simultaneously, e.g. SCOR, heart rate and EEG. Further speaking, Meehl (1990) has suggested that the key to the measurement of the concept of schizotypy as a marker of psychosis proneness lies not in psychometric measures one step removed from markers of vulnerability but with the investigation of soft neurological markers themselves.

Finally, Meehl (1990) indicated that complex interactions of genetic, developmental, trait, and social factors that contribute to psychosis proneness may not be evident in strong correlational relationships between physiological indicators and paper and pencil measures of traits. So, the meta-paradigm of this study may be not the right path--that is the risk of science.

References

Andreasen, N.C. (1985). Positive vs. negative schizophrenia: A critical evaluation. Schizophrenia Bulletin, 11, 380-389.

Bartfai, A., Levander, S., Edman, G., Schalling, D. & Sedvall, G. (1983). Skin conductance responses in unmedicated recently admitted schizophrenic patients. Psychophysiology, 20, 180-187.

Bentall, R. P., Claridge, G. S., & Slade, P. D. (1989). The multidimensional nature of schizotypal traits: A factor analytic study with normal subjects. British Journal of Clinical Psychology. 28, 363-375.

Bernstein, A.S. (1987). Orienting response in schizophrenia: Where we have come and where we might go. Schizophrenia Research, 13, 623-641.

Bernstein, A.S., Frith, C.D., Gruzelier, J.H., Patterson, T., Straube, E., Venables, P.H., & Zahn, T. P. (1982). An analysis of the skin conductance orienting response in samples of American, British, and German schizophrenics. Biological Psychology, 14, 155-211.

Bernstein, A.S., Riedel, J.A., Pava, J., Schnur, D. & Lubowsky, J. (1985). A limiting factor in the "normalization" of schizophrenic orienting response dysfunction. Schizophrenia Bulletin, 11, 230-254.

Chapman, L. J., & Chapman, J. P. (1987). The search for symptoms predictive of schizophrenia. Schizophrenia Bulletin, 13, 497-503.

Chapman, L. J., Chapman, J. P. & Miller, E. N. (1982). Reliabilities and intercorrelations of eight measures of proneness to psychosis. Journal of Counselling and Clinical Psychology, 50, 187-195.

Chapman, L. J., Chapman, J. P. & Raulin, M. L. 1976. Scales for physical and social anhedonia. Abnormal Psychology, 85, 374-382.

Chapman, L. J., Edell, W. S. & Chapman, J. P. (1980). Physical anhedonia, perceptual aberration and psychosis proneness Schizophrenia Bulletin, 6, 639-653.

Crow, J. J. (1985). The two-syndrome concept: Origins and current status. Schizophrenia Bulletin, 11, 471-486.

Dawson, M. E., Nuechterlein, K. H. (1984) Psychophysiological dysfunctions in the developmental course of schizophrenic disorders. Schizophrenia Bulletin, 10, 204-232.

Dawson, M. E., Nuechterlein, K. H. & Schell, (1992). Electrodermal anomalies in recent-onset schizophrenia: relationships to symptoms and prognosis. Schizophrenia bulletin. 18, 295-311.

Eckblad, M. & Chapman, L. J. (1982). Magical ideation as an indicator of schizotypy. Journal of Consulting and

Clinical Psychology, 51, 215-225.

Eckblad, M. L., Chapman, L. J., Chapman, J. P. & Mishlove, M. (1982). Revised social anhedonia scale. Unpublished text. Reported in Mishlove, M. & Chapman, L. J., Journal of Abnormal Psychology,94, 384-396.

Eysenck, H. J. (1967). The biological basis of personality. Springfield, IL: Charles C Thomas.

Eysenck, H.J. (1970). The structure of human personality (3rd ed.). London: Methuen.

Eysenck, H. J., & Eysenck, M. W. (1985). Personality and individual differences: A natural science approach. New York: Plenum.

Eysenck, H. J. (1990). Biological dimensions of personality. in Pervin (Ed.), Handbook of personality. New York/London: Guilford Press.

Fujuoka, T. A., & Chapman, L. J. (1984). Comparison of 2-7-8 MMPI profile and the Perceptual Aberration Scale in identifying hypothetically psychosis-prone college students. Journal of Consulting and Clinical Psychology, 52, 458-467.

Gray J.A. (1991). Neural systems, emotion and personality. In John Madden IV (Ed.), Neurobiology of learning, emotion and affect.(pp. 272-306). New York: Raven Press.

Graham, F.K. (1973). Habituation and dishabituation of responses innervated by the autonomic nervous system. In H. Peeke & M. Herz (Eds.), Habituation (vol. 1), (pp.163-218).

London: Academic Press.

Gruzelier, H. W., Jutai, J. W., Connolly, J. F., Nirsch, S. R. (1984). Cerebral asymmetries in unmedicated schizophrenic patients in EEG spectra and their relation to clinical and autonomic parameters. 5th international symposium on: Clinical neurophysiological aspects of psychopathological conditions (1983, Vienna, Austria). Advances in Biological Psychiatry, 15, 12-19.

Holzman, P. S. (1987). Recent studies of psychophysiology in schizophrenia. Schizophrenia Bulletin, 13, 49-75.

Katsanis, J., Iacono, W. G., & Beiser, M. (1990). Anhedonia and perceptual aberration in first episode psychotic patients and their relatives. Journal of Abnormal psychology, 99, 202-206.

Lacey, J. I., & Lacey, B. C. (1958). Verification and extension of the principle of autonomic response-stereotype. American Journal of Psychology, 71, 50-73.

Lykken, D. T., & Venables, P. H. (1971). Direct measurement of skin conductance: A proposal for standardization. Psychophysiology, 8, 656-672.

Lynn, R. (1966). Attention, arousal and the orienting reaction. New York: Pergamon Press.

Moruzzi, G., & Magoun, H. W. (1949). Brain stem reticular formation and activation of the EEG. Electroencephalography and Clinical Neurophysiology, 1, 455-

473.

Routtenberg, A. (1966). Neural mechanisms of sleep: Changing view of reticular formation function. Psychological Review, 73, 481-499.

Mednick, S. A., Parnas, J., & Schulsinger, F. (1987). The Copenhagen high-risk project, 1962-1986. Schizophrenia, Bulletin, 13, 485-495.

Mednick, S. A. & Schulsinger, F. (1968). Some premorbid characteristics relating to breakdown in children with schizophrenic mothers. In Rosenthal, D. & Kety, S. S. (Eds). The transmission of schizophrenia. New York: Pergamon Press.

Meehl, P.E. (1962). Schizotaxia, schizotypy, schizophrenia. American Psychologist, 17, 827-838.

Meehl, P.E. (1989). Schizotaxia revisited. Archives of General Psychiatry, 46, 935-944.

Meehl, P.E. (1990). Towards an integrated theory of schizotaxia, schizotypy, and schizophrenia. Journal of Personality Disorders, 4, 1-98.

Munro, L. L., Dawson, M.E., Schell, A. M., & Sakai, L. M. (1987). Electrodermal lability and rapid performance decrement in a degraded stimulus continuous performance task. Journal of Psychophysiology, 1, 249-257.

Ohman, A. (1981). Electrodermal activity and vulnerability to schizophrenia: A review. Biological Psychology, 12, 87-145.

Ohman, A., Nordby, H., and d'Elia, G. (1986). Orienting and schizophrenia: Stimulus significance, attention, and distraction in a signaled reaction time task. Journal of Abnormal Psychology, 95, 326-334.

Pogue-geile, M. F. and Harrow, M. (1984). Negative and positive symptoms in schizophrenia and depression: A follow up. Schizophrenia Bulletin, 10, 371-387.

Simons, R. F. (1981). Electrodermal and cardiac orienting in psychometrically defined high-risk subjects. Psychiatry Research, 4, 347-356.

Rosvold, H. E., Mirsky, A. F., Sarason, K., Bransome, E.D.Jr. & Beck, L.H. (1956). A continuous performance test of brain damage. Journal of Consulting Psychology, 20, 343-350.

Sokolov, E. N. (1963). Perception and the conditioned reflex. Oxford: Pergamon Press.

Spohn, H. E., and Patterson, T. (1979). Recent studies of psychophysiology in schizophrenia. Schizophrenia Bulletin, 5, 581-611.

Stelmack, R. M. (1981). The psychophysiology of extroversion and neuroticism. In H.J. Eysenck (Ed.), A model for personality (pp. 38-64). New York: Springer.

Straube, E. R. (1983). High and low arousability in schizophrenia: A clue to cause and development of the illness ascertained by differences in autonomic nervous system reactivity? Advances in Biological Psychiatry, 13, 107-114. (From PsycLit, 1983-1988, abstract No. 72-01481)

Thayer, R.E. (1978a). Factor analytic and reliability studies on the Activation-Deactivation Adjective Check List. Psychological Reports, 42, 747-756.

Thayer, R.E. (1978b). Toward a psychological theory of multidimensional activation (arousal). Motivation and Emotion, 2, 1-34.

Thayer, R.E. (1986). Activation (arousal): The shift from a single to a multidimensional perspective. In J. Strelau, F. Farley, & A. Gale (Eds.), The biological basis of personality and behavior (Vol. 1, pp115-127). London: Hemisphere.

Thayer, R. E., Takatashi, P. J., & Pauli, S. (1988). Multidimensional arousal states, diurnal rhythms, cognitive and social processes, and extroversion. Personality and Individual Differences, 9, 15-24.

Van Olst, E. H. (1971). The Orienting Reflex. The Hague, Netherlands: Mouton.

Venables, P. H. & Bernstein, A. S. (1983). The orienting response and psychopathology: Schizophrenia. In D. Siddle (Ed.) Orienting and habituation: perspectives in human research (pp. 475-504). Chicester: John Wiley & Sons.

Zubin, J. & Spring, B. (1977). Vulnerability--a new view of schizophrenia. Journal of Abnormal Psychology, 86, 103-126.

Table 1.

Correlations among Chapman's scales in Mass Testing 1

	MID	PAB	SAN	PAN
MID	1.0000 (606)	-.1567** (606)	.0044 (606)	-.0141 (606)
PAB	-.1567** (606)	1.0000 (606)	-.0358 (606)	.0611 (606)
SAN	.0044 (606)	-.0358 (606)	1.0000 (606)	-.1425** (606)
PAN	-.0141 (606)	.0611 (606)	-.1425** (606)	1.0000 (606)

(Coefficient / (Cases))

* P < .05
** P < .01

Table 2.

Correlations among Positive / Negative

in Mass Testing 1

	POSITIVE	NEGATIVE
POSITIVE	1.0000 (606)	.0040 (606)
NEGATIVE	.0040 (606)	1.0000 (606)

(Coefficient / (Cases))
* P < .05
** P < .01

Table 3.

Correlations between Positive / Negative and

Chapman's scales in Mass Testing 1

	MID	PAB	SAN	PAN
POSITIVE	.6970**	.5990**	-.0224	.0329
	(606)	(606)	(606)	(606)
NEGATIVE	-.0060	.0122	.7334**	.5684**
	(606)	(606)	(606)	(606)

(Coefficient / (Cases))
* P < .05
** P < .01

Table 4.

Correlations among Ext / Neu in Eysenck's scales in Mass Testing 1

	EXT	NEU
EXT	1.0000 (666)	-.3324** (666)
NEU	-.3324** (666)	1.0000 (666)

(Coefficient / (Cases))
* P < .05
** P < .01

Table 5.

Correlations between Eysenck's and Chapman's scales in Mass Testing 1

	MID	PAB	SAN	PAN
EXT	-.0880*	-.0259	-.1030*	-.0870*
	(606)	(606)	(606)	(606)
NEU	-.0488	-.1315**	.0460	-.0498
	(606)	(606)	(606)	(606)

(Coefficient / (Cases))
* $P < .05$
** $P < .01$

Table 6.

Correlations between Ext / Neu and Positive / Negative in Mass Testing 1

	POSITIVE	NEGATIVE
EXT	-.0902*	-.1453**
	(606)	(606)
NEU	-.1350**	.0040
	(606)	(606)

(Coefficient / (Cases))
* P < .05
** P < .01

Table 7.

Correlations between Gen and All Other Scales in Mass Testing 1

	GEN
POSITIVE	-.0331 (595)
NEGATIVE	.0485 (595)
MID	.0337 (595)
PAB	-.0832* (595)
SAN	.0174 (595)
PAN	.0497 (595)
EXT	-.0544 (595)
NEU	-.0665 (595)

(Coefficient / (Cases))
* P < .05
** P < .01

Table 8.

MANOVA of Scr and Hdu by Gen Sch Emo and Trial

Test Name	Value	Appr.F	HypDF	ErrDF	Sig.F
Pillais	.26625	1.11128	16.00	49.00	NS
Hotellings	.36287	1.11128	16.00	49.00	NS
Wilks	.73375	1.11128	16.00	49.00	NS

* $P < .05$
** $P < .01$
NS: non significant ($P < .05$)

Table 9.

MANOVA of Scr and Hdu by Sch Emo and Trial

Test Name	Value	Appr.F	HypDF	ErrDF	Sig.F
Pillais	.22813	.90512	16.00	49.00	NS
Hotellings	.29555	.90512	16.00	49.00	NS
Wilks	.77187	.90512	16.00	49.00	NS

* P < .05
** P < .01
NS: non significant (P < .05)

Table 10.

MANOVA of Scr and Hdu by Sch and Trial

Test Name	Value	Appr.F	HypDF	ErrDF	Sig.F
Pillais	.16273	.59520	16.00	49.00	NS
Hotellings	.19435	.59520	16.00	49.00	NS
Wilks	.83727	.59520	16.00	49.00	NS

* $P < .05$
** $P < .01$
NS: non significant ($P < .05$)

Table 11

ANOVA of Positive by Res

Variation Source	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	1.229	2	.614	.251	NS
RES	1.229	2	.614	.251	NS
Explained	1.229	2	.614	.251	NS
Residual	169.216	69	2.452		
Total	170.444	71	2.401		

* P < .05
** P < .01
NS: non significant (P < .05)

Table 12

ANOVA of Negative by Res

Variation Source	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	.513	2	.256	.140	NS
RES	.513	2	.256	.140	NS
Explained	.513	2	.256	.140	NS
Residual	126.598	69	1.835		
Total	127.111	71	1.790		

* P < .05
** P < .01
NS: non significant (P < .05)

Table 13

ANOVA of Bas by Gen Sch Emo

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	38.592	3	12.864	1.071	NS
GEN	12.202	1	12.202	1.016	NS
SCH	12.185	1	12.185	1.015	NS
EMO	14.204	1	14.204	1.183	NS
2-way Interactions	39.660	3	13.220	1.101	NS
GEN SCH	11.729	1	11.729	.977	NS
GEN EMO	13.957	1	13.957	1.162	NS
SCH EMO	13.974	1	13.974	1.164	NS
3-way Interactions	11.076	1	11.076	.923	NS
GEN SCH EMO	11.076	1	11.076	.923	NS
Explained	89.328	7	12.761	1.063	NS
Residual	768.377	64	12.006		
Total	857.706	71	12.080		

* P < .05
** P < .01
NS: non significant (P < .05)

Table 14

ANOVA of Real by Gen Sch Emo

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	.597	3	.199	.459	NS
GEN	.347	1	.347	.800	NS
SCH	.125	1	.125	.288	NS
EMO	.125	1	.125	.288	NS
2-way Interactions	.819	3	.273	.629	NS
GEN SCH	.014	1	.014	.032	NS
GEN EMO	.681	1	.681	1.568	NS
SCH EMO	.125	1	.125	.288	NS
3-way Interactions	.681	1	.681	1.568	NS
GEN SCH EMO	.681	1	.681	1.568	NS
Explained	2.097	7	.300	.690	NS
Residual	27.778	64	.434		
Total	29.875	71	.421		

* P < .05
** P < .01
NS: non significant (P < .05)

Appendix A

Questionnaire

The following questions will be mixed up when administrated.

EXT1 I often long for excitement.

EXT13 I often do things on the spur of the moment.

EXT17 I hate being with a crowd who play jokes on one another.

NEU14 I often worry about things I should not have done or said.

NEU31 Ideas often run through my head so that I cannot sleep.

NEU50 I am easily hurt when people find fault with me or my work.

PAB34 At times I have wondered if my body was really my own.

PAB20 Ordinary colors sometimes seem much too bright to me.

PAB33 Parts of my body occasional seem dead or unreal.

MID23 I have sometimes been fearful of stepping on sidewalk cracks.

MID12 I have sometimes felt that strangers were reading my mind. MID25 I have had the momentary feeling that I might not be human.

PAN13 The sound of rustling leaves has never much pleased me.

PAN20 Trying new foods is something I have always enjoyed.

PAN3 I have often enjoyed the feel of silk, velvet, or fur.

SAN5 I like to make long distance calls to friends and relatives.

SAN6 Playing with children is a real chore.

SAN39 My relationships with other people never get very intense.

Appendix B

The Actual Questionnaire

Fill up the blank by Y (yes) or N (no).

___1. I often long for excitement.

___2. I often worry about things I should not have done or said.

___3. At times I have wondered if my body was really my own.

___4. I like to make long distance calls to friends and relatives.

___5. I have sometimes been fearful of stepping on sidewalk cracks.

___6. The sound of rustling leaves has never much pleased me.

___7. I often do things on the spur of the moment.

___8. Ideas often run through my head so that I cannot sleep.

___9. Ordinary colors sometimes seem much too bright to me.

___10. Playing with children is a real chore.

___11. I have sometimes felt that strangers were reading my mind.

___12. Trying new foods is something I have always enjoyed.

___13. I hate being with a crowd who play jokes on one another.

___14. I am easily hurt when people find fault with me or my work.

___15. Parts of my body occasionally seem dead or unreal.

___16. My relationships with other people never get very intense.

___17. I have had the momentary feeling that I might not be human.

___18. I have often enjoyed the feel of silk, velvet, or fur.

Appendix C

Verbatim of Instruction

Hi! My name is Kai Qu, and I am doing some research for my thesis in psychology. I need the help of some people to simulation two basic emotions while some physiological measurements are carried out. It would require about 45 minutes. Would you be willing to participate? I will explain the study more fully afterward and you can obtain the final results if you wish. O.K.? First, please read and fill out this consent form. Note that all responses are anonymous and that you may terminate participation at any time. If you want the results of the study, put your campus address below your signature. Now, please read this Instruction Sheet.

(Study is carried out)

In this study I am looking for the possibility to use electrodermal activities as an indicator of personalities. My hypothesis basically is that the electrodermal activities of extroversion kind of personalities is more sensitive to positive emotions, introversion does the opposite. Do you have any questions?

Thank you very much.

Appendix D

Consent Form

COLLEGE OF WILLIAM AND MARY

PSYCHOLOGY DEPARTMENT CONSENT FORM

The general nature of this study of Electrodermal Activity of Personalities in Emotions conducted by Kai Qu has been explained to me.

I understand that I will be asked to simulate two emotions when tones and visual signals are presented through earphones and light, and my sweat gland activity (electrodermal activity), heart rate and skin temperature are recorded from electrodes attached to my fingers. I further understand that my anonymity will be preserved and that my name will not be associated with my responses or with any of the results of this study. I know that I may refuse to answer any question asked and that I may discontinue participation at any time. I also understand that any grade, payment or credit for participation will not be affected by my responses or by my exercising any of my rights. I am also aware that I may report dissatisfactions with any aspect of this experiment to the Psychology Department Chair. I am aware that I must be at least 18 years of age to participate. My signature below signifies my voluntary participation in this experiment.

--------------------   -----------------------------

Date   Signature

Appendix E

Instruction Sheet

In this experiment, I will be measuring some bodily changes that may occur during you experience emotions such as happiness or fear. In order to help you to experience these emotions, I would like you to imagine (as vividly as possible) a happy or fearful situation when the respective cue word is presented on a card before you.

During the measurement, it is important to keep body and hand movement to a minimum, so, please get as comfortable and relaxed as you can in your chair NOW. Also, please do not speak during the measurement.

Once you finish reading, please say "start". Then I will present the cue word ("happy" or "fear") on a card before you. It will signal you to begin imagining a happy or fear situation and experience that you have experienced or could experience. Please notice there is a light. You will see flashes from the light and hear tones from the earphones simultaneously. There are about 12 flash-tones. Please just try to continue with the imagery, until I present the "stop" card. After a few minutes, I will present another cue word card, you are then to imagine a situation with that emotion and experience you have experienced or could experience until I present the "stop" card again.

Now ready?

(instruction sheet continued)

Please say "start", watch the light, relax and wait for the cue word card.

Please write down the number on the consent form.

How do you feel the simulation?

real	ok	not real at all
1	2	3

Also please write down the professor's name of the introductory psychology course on the consent form.

Appendix F

Data Tables

Data Table 1.

Correlations among Chapman's scales in Mass Testing 2

	MID	PAB	SAN	PAN
MID	1.0000 (726)	.0751 (726)	.1869** (726)	.0631 (726)
PAB	.0751* (726)	1.0000 (726)	.0637 (726)	.0539 (726)
SAN	.1869** (726)	.0637 (726)	1.0000 (726)	-.0851* (726)
PAN	.0631 (726)	.0539 (726)	-.0851* (726)	1.0000 (726)

(Coefficient / (Cases))
* P < .05
** P < .01

Data Table 2.

Correlations among Positive / Negative

in Mass Testing 2

	POSITIVE	NEGATIVE
POSITIVE	1.0000 (726)	.1913** (726)
NEGATIVE	.1913** (726)	1.0000 (726)

(Coefficient / (Cases))
* P < .05
** P < .01

Data Table 3.

Correlations between Positive / Negative and

Chapman's scales in Mass Testing 2

	MID	PAB	SAN	PAN
POSITIVE	.7451**	.7210**	.1725**	.0799*
	(726)	(726)	(726)	(726)
NEGATIVE	.1914**	.0872*	.7373**	.6103**
	(726)	(726)	(726)	(726)

(Coefficient / (Cases))
* P < .05
** P < .01

Data Table 4.

Correlations among Ext / Neu in Eysenck's scales in Mass Testing 2

	EXT	NEU
EXT	1.0000 (801)	-.2343** (801)
NEU	-.2343** (801)	1.0000 (801)

(Coefficient / (Cases))
* P < .05
** P < .01

Data Table 5.

Correlations between Eysenck's and Chapman's scales in Mass Testing 2

	MID	PAB	SAN	PAN
EXT	.1197** (726)	.0958* (726)	-.0197 (726)	-.0123 (726)
NEU	-.0426 (726)	-.0019 (726)	-.0083 (726)	-.0880* (726)

(Coefficient / (Cases))
* P < .05
** P < .01

Data Table 6.

Correlations between Ext / Neu and Positive / Negative in Mass Testing 2

	POSITIVE	NEGATIVE
EXT	.1473 (726)	-.0240 (726)
NEU	-.0308 (726)	-.0663 (726)

(Coefficient / (Cases))
* P < .05
** P < .01

Data Table 7.

Correlations between Gen and All Other Scales in Mass Testing 2

	GEN
POSITIVE	.0018 (714)
NEGATIVE	.0219 (714)
MID	-.0252 (714)
PAB	.0289 (714)
SAN	-.0218 (714)
PAN	.0576 (714)
EXT	-.0271 (714)
NEU	-.0237 (714)

(Coefficient / (Cases))
* P < .05
** P < .01

Data Table 8.

Correlations among Chapman's scales in Merged data

	MID	PAB	SAN	PAN
MID	1.0000 (946)	-.0334 (946)	.1014** (946)	.0225 (946)
PAB	-.0334 (946)	1.0000 (946)	.0320 (946)	.0872** (946)
SAN	.1014** (946)	.0320 (946)	1.0000 (946)	-.1202** (946)
PAN	.0225 (946)	.0872** (946)	-.1202** (946)	1.0000 (946)

(Coefficient / (Cases))
* P < .05
** P < .01

Data Table 9.

Correlations among Positive / Negative

in Merged data

	POSITIVE	NEGATIVE
POSITIVE	1.0000 (946)	.1325** (946)
NEGATIVE	.1325** (946)	1.0000 (946)

(Coefficient / (Cases))

* P < .05

** P < .01

Data Table 10.

Correlations between Positive / Negative and Chapman's scales in Merged data

	MID	PAB	SAN	PAN
POSITIVE	.7222**	.6672**	.0977**	.0771*
	(946)	(946)	(946)	(946)
NEGATIVE	.0983**	.0857**	.7359**	.5837**
	(946)	(946)	(946)	(946)

(Coefficient / (Cases))
* P < .05
** P < .01

Data Table 11.

Correlations among Ext / Neu in Eysenck's scales in Merged data

	EXT	NEU
EXT	1.0000 (1042)	-.2885** (1042)
NEU	-.2885** (1042)	1.0000 (1042)

(Coefficient / (Cases))
* P < .05
** P < .01

Data Table 12.

Correlations between Eysenck's and Chapman's scales in Merged data

	MID	PAB	SAN	PAN
EXT	.0058	.0693*	-.0450	-.0609
	(946)	(946)	(946)	(946)
NEU	-.0356	-.0904**	.0372	-.0870**
	(946)	(946)	(946)	(946)

(Coefficient / (Cases))
* P < .05
** P < .01

Data Table 13.

Correlations between Ext / Neu and Positive / Negative in Merged data

	POSITIVE	NEGATIVE
EXT	.0523 (946)	-.0784* (946)
NEU	-.0891** (946)	-.0290 (946)

(Coefficient / (Cases))
* P < .05
** P < .01

Data Table 14.

Correlations between Gen and All Other Scales

in Merged data

	GEN
POSITIVE	.0075
	(930)
NEGATIVE	.0597
	(930)
MID	.0251
	(930)
PAB	-.0162
	(930)
SAN	.0132
	(930)
PAN	.0718*
	(930)
EXT	-.0258
	(930)
NEU	-.0470
	(930)

(Coefficient / (Cases))
* $P < .05$
** $P < .01$

Data Table 15.

<u>MANOVA of Scr and Hdu by Gen Emo and Trial</u>

Test Name	Value	Appr.F	HypDF	ErrDF	Sig.F
Pillais	.29225	1.26457	16.00	49.00	NS
Hotellings	.41292	1.26457	16.00	49.00	NS
Wilks	.70775	1.26457	16.00	49.00	NS

* P < .05
** P < .01
NS: non significant (P < .05)

Data Table 16.

MANOVA of Scr and Hdu by Gen Sch and Trial

Test Name	Value	Appr.F	HypDF	ErrDF	Sig.F
Pillais	.31514	1.40923	16.00	49.00	NS
Hotellings	.46016	1.40923	16.00	49.00	NS
Wilks	.68486	1.40923	16.00	49.00	NS

* $P < .05$
** $P < .01$
NS: non significant ($P < .05$)

Data Table 17.

MANOVA of Scr and Hdu by Emo and Trial

Test Name	Value	Appr.F	HypDF	ErrDF	Sig.F
Pillais	.22562	.89226	16.00	49.00	NS
Hotellings	.29135	.89226	16.00	49.00	NS
Wilks	.77438	.89226	16.00	49.00	NS

* $P < .05$
** $P < .01$
NS: non significant ($P < .05$)

Data Table 18.

<u>MANOVA of Scr and Hdu by Gen and Trial</u>

Test Name	Value	Appr.F	HypDF	ErrDF	Sig.F
Pillais	.27768	1.1773	16.00	49.00	NS
Hotellings	.38443	1.1773	16.00	49.00	NS
Wilks	.72232	1.1773	16.00	49.00	NS

* $P < .05$
** $P < .01$
NS: non significant ($P < .05$)

Data Table 19.

Cell Means of Positive by Res Emo Gen

TOTAL POPULATION

2.22
(72)

RES

1	2	3
2.28	2.04	2.35
(25)	(24)	(23)

EMO

0	1
2.03	2.42
(36)	(36)

GEN

0	1
2.06	2.39
(36)	(36)

(Data Table 19 continued)

RES \ EMO	0	1
1	2.00 (12)	2.54 (13)
2	2.08 (12)	2.00 (12)
3	2.00 (12)	2.73 (11)

RES \ GEN	0	1
1	1.92 (12)	2.62 (13)
2	2.08 (13)	2.00 (11)
3	2.18 (11)	2.50 (12)

EMO \ GEN	0	1
0	1.67 (18)	2.39 (18)
1	2.44 (18)	2.39 (18)

(Data Table 19 continued)

GEN = 0

RES	EMO 0	EMO 1
1	1.00 (4)	2.38 (8)
2	1.83 (6)	2.29 (7)
3	1.88 (8)	3.00 (3)

GEN = 1

RES	EMO 0	EMO 1
1	2.50 (8)	2.80 (5)
2	2.33 (6)	1.60 (5)
3	2.25 (4)	2.63 (8)

(Means / (cases))

Data Table 20.

ANOVA of Positive by Res Emo Gen

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	5.809	4	1.452	.562	NS
RES	1.087	2	.544	.210	NS
EMO	2.752	1	2.752	1.065	NS
GEN	1.829	1	1.829	.708	NS
2-way Interactions	9.532	5	1.906	.738	NS
RES EMO	3.333	2	1.666	.645	NS
RES GEN	3.878	2	1.939	.751	NS
EMO GEN	4.273	1	4.273	1.654	NS
3-way Interactions	.132	2	.066	.026	NS
RES EMO GEN	.132	2	.066	.026	NS
Explained	15.474	11	1.407	.545	NS
Residual	154.970	60	2.583		
Total	170.444	71	2.401		

* P < .05
** P < .01
NS: non significant (P < .05)

Data Table 21.

ANOVA of Negative by Res Emo Gen

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	2.829	4	.707	.355	NS
RES	.552	2	.276	.139	NS
EMO	1.357	1	1.357	.682	NS
GEN	.959	1	.959	.482	NS
2-way Interactions	3.973	5	.795	.399	NS
RES EMO	2.634	2	1.317	.662	NS
RES GEN	.594	2	.297	.149	NS
EMO GEN	1.015	1	1.015	.510	NS
3-way Interactions	.893	2	.447	.224	NS
RES EMO GEN	.893	2	.447	.224	NS
Explained	7.696	11	.700	.352	NS
Residual	119.415	60	1.990		
Total	127.111	71	1.790		

* P < .05
** P < .01
NS: non significant (P < .05)

VITA

Kai Qu

Born in Nanchang, China, August 31, 1963. Graduated from Attached High School of Jiangxi Teacher's University, Nanchang, China, July 1980. He received his Bachelor of Science degree in Physics, July 1984, from Fudan University, Shanghai, China. He then studied philosophy of science at Shanghai JiaoTong University and received a SBA (equivalent to Master of Arts) degree. This thesis completes his requirements for a Master of Arts degree in Psychology from the College of William & Mary, August 1996.