AN ABSTRACT OF THE THESIS OF

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The Magical Ideation and Perceptual Aberration Scales were used to screen 406 college undergraduates for schizotypy. Twenty-four such schizotypal students were identified and willing to continue participation in the study. These 24 schizotypals were matched by sex, age, and year in school to normal controls. All subjects were then individually tested in a sorting task designed to assess cognitive structuring. In this task, students were presented with 24 amorphous clay shapes which they were asked to sort into groups so that the members of a group were as similar as possible in overall appearance. Participants then rated each stimulus on ten different bipolar physical attributes. The ten 9-point scales included: short vs. tall, small vs. large, narrow vs. wide, rough vs. smooth, angular vs. round, compact vs. dispersed, smooth vs. jagged, simple vs. complex, asymmetrical vs. symmetrical, and orientation (angle of view) unimportant vs. orientation important. Multidimensional scaling (MDS) was used to analyze the data. A separate MDS solution was obtained from each condition. A solution allows an interpretation of the rules that underlie the decisions about which the stimuli shapes were sorted. These sets of rules were compared between the two conditions and significant differences were found. Interpretation of the differences indicated that schizotypals were heterogeneous in the set of rules they used, such that each individual utilized a unique set of rules, while the normals were homogeneous in their rules. It was concluded that a difference in the cognitive structuring of the environment is involved in the experience of schizotypy.

COGNITIVE STRUCTURING IN SCHIZOTYPAL COLLEGE STUDENTS

A Thesis

Presented to

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and Special Education

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of the Requirements for the Degree

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by

John D. Caporale

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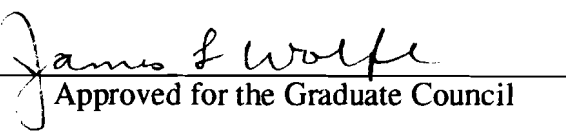
Approved for the Major Division



Approved for the Graduate Council

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CHAPTER I

Introduction

When Rado (1953) introduced the term "schizotype," his hope was to classify psychological disorders by etiology. He felt that etiology was a result of an interaction between genetics and the environment in the form of psychodynamic factors. Schizotype was Rado's abbreviation for "schizophrenic phenotype," this being the outward expression of the presumed genetic base of schizophrenia. Rado described schizotypy as defining a person from birth to death, regardless of whether the person ever developed a full psychosis. Characteristics of the schizotype discussed by Rado include insufficient experience of pleasure resulting in poor performance and reduced zest for life, pervasive fear described as "fear of existence," rage, overdependency on external support, blurred awareness, magical ideation and distorted bodily perception.

Meehl (1962) elaborated on this concept. He named the genetic predisposition schizotaxia, which he stated was a necessary condition for schizotypy. Environmental influences determined if this then would decompensate to schizophrenia. Meehl described four main schizotypic traits. The first is *thought disorder* which he referred to as "cognitive slippage" which includes very mild forms of thought disorder. The second is *interpersonal aversiveness* in which the schizotype suffers a degree of social fear, distrust, expectation of rejection, and conviction of his or her own unlovability. The third trait is *anhedonia* which is a marked deficit in the ability to experience pleasure, especially in interpersonal situations. Meehl called this one of the most consistent and dramatic behavioral signs of schizotypy. The fourth and last trait described by Meehl is *ambivalence* which is simply the existence of conflicting thoughts and beliefs.

As seen by Rado's (1953) introductory article, the concept of schizotypy is clearly based on a genetic model. There is little doubt that schizophrenia has genetic components, and many believed, and still believe, that schizotypy is genetically related to schizophrenia. Torgerson (1985) provided an excellent review of adoption and twin studies. In adoption

and family studies, for example, Kendler, Gruenberg and Straus (1981) found that eleven percent of the biological relatives of adopted schizophrenics were schizotypic. However, a study by Stone (1979) did not find evidence supporting a relationship between schizotypy and schizophrenia. Twin studies result in more inconclusive evidence. It appears that schizotypes are found more often in the relatives of schizophrenics, but there is no greater probability of schizophrenics being found among the relatives of schizotypes than in the general population. Torgerson (1985) explains these results with a "polygenic multiple-threshold model" which, in short, states that because schizotypy is uncommon itself, finding the even rarer schizophrenia among relatives of schizotypics is going to be difficult even if there is a relationship.

Kendler (1985) offered another explanation, which first requires some background. The current DSM-III-R description of schizotypy is a combination of two histories, one being genetic/familial and the other, clinical. The genetic/familial tradition examined biological relatives of schizophrenics and found many of them to be characterized by odd-eccentric behavior and demeanor, social isolation, and irritability, aloof-cold affect, and suspiciousness and to a lesser degree, superstitiousness, poor psychosocial functioning, nervousness, odd speech, and social anxiety-hypersensitivity (Kendler, 1985). The clinical tradition was more interested in individuals who presented schizophrenic-like symptoms. These included disordered thinking, magical ideation, a lack of deep interpersonal relationships, deviant sexuality, profound anger, interpersonal dependency, sensitivity to rejection, anhedonia, and superficial social intactness (Kendler, 1985). While there is some overlap, the traditions do emphasize different traits. The genetic/familial tradition maintains the relationship of schizotypy to schizophrenia but, as Frances (1985) argued, the clinical tradition is more relevant to clinicians. The fact that the evidence of a genetic relationship is weak, Kendler explained, is the result of the DSM-III-R description being an amalgam of familially and clinically defined schizotypic characteristics.

Regardless, the next step becomes an attempt to identify the schizotype. Although

the Rorschach, the Thematic Apperception Test and the Goldstein-Scheerer Object Sorting Test have been used in the past, the most widely used measures today are the MMPI and the Chapman scales. In a review of these methods, Grove (1982) concluded that the Chapman scales were the most promising.

The Chapman scales are a number of true/false questions independently developed by Loren and Jean Chapman and their colleagues. Each scale seeks to identify schizotypes based on a single symptom. There are several scales, among them are Physical Anhedonia (Chapman, Chapman & Raulin, 1976), Social Anhedonia (Chapman et al., 1976), Perceptual Aberration (Chapman, Chapman & Raulin, 1978), Magical Ideation (Eckblad & Chapman, 1983), Social Fear (Raulin & Wee, 1984), Impulsive Nonconformity (Chapman et al., 1984), Intense Ambivalence (Raulin, 1984), and Cognitive Slippage (Miers & Raulin, unpublished manuscript). The typical procedure involved in developing these scales consisted of generating a large number of questions believed to be related to the particular symptoms and then revising them on a college population before determining that the scales reliably discriminate between a normal population and a schizophrenic population. To validate the scales on schizotypes, Chapman and Chapman (1980) developed a manual for rating psychotic and psychotic-like experiences on a continuum. For example, there is a category of "Transmission of one's own thoughts" in which there is a range of experiences from the most psychotic, "S has actively experienced thoughts leaving his head so that anyone in the area could hear the thoughts through his ears," to the mildly psychotic-like, "S has concluded or suspected that he has successful ESP experiences as a result of a conscious attempt to achieve them." After administering a scale to a college population, those students who scored two standard deviations above the mean were compared to those scoring half a standard deviation above the mean or less and were found to report experiencing a significantly greater number of psychotic and psychotic-like experiences (e.g., Chapman, Edell, & Chapman, 1980).

Although Chapman and Chapman (1980) described the schizotypic symptoms as

"attenuated versions of psychotic experiences," it must be noted that there is no conclusive evidence that schizotypy and schizophrenia are different degrees of the same disorder nor that schizotypes will eventually decompensate to a full-blown schizophrenia. However, Chapman and Chapman (1984) are currently involved in a long-term follow-up of subjects who scored high on their scales and have analyzed data from a short-term, 25-month follow-up of subjects scoring high on Physical Anhedonia, Impulsive Nonconformity and a combined Perceptual Aberration-Magical Ideation scale (Per-Mag), and a group of control subjects. There were 67, 60, 161, and 144 subjects, respectively, in each group, at the original interview and the Chapmans were able to reinterview 94% of these subjects. During the follow-up months, 22% of the Per-Mag subjects and 7% of the control subjects sought professional help for emotional problems, most of which involved "mild psychopathology and...maladjustment" (p. 166). Also in this time period, ten percent of the Per-Mag subjects reported having had psychotic or psychotic-like experiences while none of the control subjects reported such experiences. Of all the follow-up subjects, three had received their first clinical attention for psychosis in the preceding twenty-five months. All three were Per-Mag subjects. One was a "clear-cut bipolar disorder," who had been hospitalized once for a manic episode and once for a depressive episode. The second became shizophrenic and had been hospitalized twice. The third subject manifested a paranoid delusion, recognized this, and sought therapy. In addition, one other Per-Mag subject had been hospitalized for a nonpsychotic depression. There were no differences found among the Physical Anhedonics, Impulsive Nonconformists and control subjects.

These data suggest that Per-Mag schizotypes are prone to a variety of psychopathological disorders. For this reason the Chapman scales are considered to be indicators of psychosis proneness rather than schizophrenia proneness.

Once schizotypes are identified, whether by the Chapman scales or the MMPI, they are subjected to various assessment procedures to examine how they compare to normals and schizophrenics. A vast majority of the studies on schizotypes involve cognitive,

perceptual memory deficits.

A recent study (Spaulding, Garbin & Dras, unpublished manuscript) assessed schizotypes on a battery of ten tests. This battery of cognitive laboratory tests, known as COGLAB, is run entirely on a computer and includes the following tests: size estimation, backward masking, Mueller-Lyer effect, vigilance in high- and low-demand conditions, reaction time crossover, false alarms in vigilance, concept processing, reaction time, distraction recovering in reaction time and anticipatory reaction time errors. These tests are designed to obtain a variety of measures, encompassing preattentional, attentional, psychomotor, and conceptual levels of cognition (Spaulding et al.). The schizophrenics in the study differed from the normal controls on all but two tests: reaction time anticipatory errors and vigilance false alarms. The schizotypes were in the normal range on all but three of the tests: reaction time anticipatory errors, concept processing and backward masking, only the latter two of which were consistent with schizophrenics. So it appears that, while schizotypes differ somewhat from normals in cognitive processing, they do not show simply a less severe pattern of deficits as compared to schizophrenics.

Nevertheless, schizotypes display some deficits that are uniquely schizophrenic, the aforementioned deficit in backward masking being one such example (Merritt & Balogh, 1984). In backward masking, a number or letter (target stimulus) is flashed on a screen for, say, 150 milliseconds, and then replaced by the flash of another symbol (the mask) after a varying period of hundreds of milliseconds. Schizophrenics consistently require longer intervals than normals to accurately identify the target stimulus (Saccuzzo, Hirt & Spencer: cited in Cromwell & Spaulding, 1978), and several studies (e.g., Merritt & Balogh, 1984; Steronko & Woods, 1978) have shown this deficit to occur also in schizotypes.

Similar to this is the span of apprehension task in which a matrix of letters is flashed on the screen for a varying range of milliseconds. The subject is told to watch for one of two letters and must report which of those two was included in the matrix. A span

of apprehension deficit has been shown to exist in schizophrenics (Asarnow & MacCrimmon, 1981). A later study (Asarnow, Nuechterlein & Marder, 1983) demonstrated a relationship between shizotypy and a span of apprehension deficit by showing that persons selected from a normal population who displayed this deficit scored more deviantly on tests of schizotypy than did those not showing the deficit.

The deficits in backward masking and span of apprehension were originally thought to be due to a deficiency in iconic storage. However, a study by Knight, Sherer, Putchat and Carter (1978) developed a purer measure of iconic memory (Chapman, 1979) and obtained different results. Instead of number matrices, they used pairs of slides which, when seen superimposed, formed a line drawing of a common object while, when seen separately, the object pictured is unidentifiable. The slides were flashed with varying intervals between them, and schizophrenics and normals did not differ. Knight et al. thus concluded that an iconic memory deficit was not responsible for previously demonstrated span of apprehension deficits but instead that there was a deficiency in information transfer from the iconic memory to subsequent stages.

Koh and his colleagues have done copious work on short- and long-term memory in schizophrenics. Koh, Kayton and Berry (1973) demonstrated that schizophrenic recognition memory was as good as that of normals but schizophrenics did demonstrate a deficit in recall memory which they attributed to a retrieval deficiency due to poor mnemonic organization. Koh, Kayton and Streiker (1976) concluded that short-term memory for nonverbal stimuli in schizophrenics is intact. They stated that schizophrenics' "stimulus encoding, storage capacity, invulnerability to extraneous stimulation, and decision-making processes were all quite comparable to those of the normal controls" (p. 98). Moreover, a review by Broga and Neufeld (1981) presents evidence that long-term memory is intact in schizophrenics.

In his review of the literature, Chapman (1979) stated that Koh and his colleagues concluded from their numerous studies that schizophrenics do not have a short- or long-

term memory impairment but that deficits occurred due to less efficient mnemonic strategies. Chapman related this to the studies of backward masking and span of apprehension, concluding that each individual stage of information processing in schizophrenics was equal to that of normals but that schizophrenics have a deficit in integrating the various stages. In a later review, Neufeld and Broga (1981) concluded that schizophrenics utilize the same processing strategies as normals, but less efficiently. For example, George and Neufeld (1985) explained:

> Schizophrenic encoding may proceed more slowly than in normals, and this initial retardation is presumed to have an adverse effect on all of the subsequent processing stages - by the time initially presented information is encoded, other relevant information may no longer be available, resulting in insufficient information on which to base adequate performance (p. 269).

In his review of cognitive deficits in schizophrenia, Knight (1983) concluded that "process schizophrenics do not automatically organize their perceptual world in the same way...controls do" (p. 109). In short, then, it seems that schizophrenics, and presumably schizotypes, utilize the same cognitive processes as do normals, yet due to the aforementioned deficits, structurally organize their cognitive impressions of the world differently than do normals.

The current study sought to determine whether schizotypes do in fact cognitively structure their perceptions of their environment differently than do normals. In order to do this, a schizotypic individual must display a physical manifestation of his or her cognitive structuring. To best measure cognitive structuring, it is necessary to eliminate societal influences on how it "should be" done. Therefore, a procedure borrowed from the visual and tactual perception literature (Garbin & Berstein, 1984) will be used. Garbin and Bernstein's procedure involved subjects either visually or tactually examining amorphous shapes and then sorting them into groups in whatever way they wished, thus entailing no social demand.

In the current study, subjects were allowed to visually examine the shapes for as long as they wished. It is presumed that this more extensive examination served to override any cognitive or perceptual deficits, enabling the schizotypic subjects to accurately encode the stimulus information which is vital for a pure measure of cognitive structuring. The manner in which subjects sorted the amorphous shapes was considered a physical reflection of cognitive structuring. It was hypothesized that schizotypes would demonstrate a qualitatively different method of sorting than would normals.

CHAPTER II

Method

Participants

Participants were undergraduates in introductory psychology classes at the University of Nebraska-Lincoln (UNL) who participated to fulfill a class requirement. A few participants' data were removed for scoring above the cut-off criteria on the validity scale and several more were removed for failing to complete all the items.

The participants for the cognitive structuring part of the experiment were determined by deviant scores on the Perceptual Aberration-Magical Ideation Scale. A mean score was determined for both male and female participants on each constituent scale and on the combined scale. A participant who scored two standard deviations or greater above the mean on either single scale or three standard deviations above the mean on the combined scales was considered schizotypic (Chapman & Chapman, 1984) for the purposes of this study only. Normal participants were randomly selected from among those who scored one half of a standard deviation above the mean or less on both scales. Twenty-eight schizotypes were identified. This was just over 7% of our valid screening sample, which is slightly higher than the estimated schizotypal rate of 5% for the UNL campus (W. Spaulding, personal communication, April, 1988). Twenty-four schizotypals agreed to come back for the second portion of the study. Twenty-four normals were then matched on sex, age and year in school. There were 16 females and 8 males. The age range was 18 to 21. Participants included freshmen, sophomores, and juniors.

Because the Chapman scales were standardized on caucasians only, this study required caucasions only. Noncaucasians were allowed to participate; however, their data were not used.

Stimuli

The stimuli were twenty-four "complex irregular three-dimensional solid shapes" (Garbin & Bernstein, 1984) made of pottery clay. These amorphous shapes were painted

black and were devoid of fine texture features. All shapes weighed from 85-99 grams and could fit within a 9.0 cm sphere.

Questionnaire

Because high scorers on both the Perceptual Aberration Scale and the Magical Ideation Scale report similar psychotic-like, schizotypal and affective symptoms, Chapman and Chapman (1984) have combined these scales into a single scale which they call the Perceptual Aberration-Magical Ideation Scale (Per-Mag Scale). An example of a Perceptual Aberration item is, "Sometimes I have had feelings that I am united with an object near me," and an example of a Magical Ideation item is, "I think I could learn to read others' minds if I wanted to."

The Jackson Infrequency Scale is a set of true/false items which are very rarely endorsed in a particular direction; for example, "I have never bought anything in a store," would hardly ever be marked as true. It is typically mixed in with other scales, and three or more of these items being endorsed in the rare direction invalidates the entire questionnaire. Such was the case in this study.

The participants in this study completed a 170 item questionnaire containing Per-Mag items, Jackson items and filler items, all intermixed. The filler items were less direct or threatening and were to make the questionnaire seem less probing.

Procedure

After signing an informed consent form, each of the initial 406 participants completed a subject information sheet with his/her name, address, and phone number. Each participant was assigned a four digit identification number which was printed on the subject information sheet and the questionnaire answer sheet. The subject information sheet and the questionnaire were kept separately. Before completing the questionnaire, each participant was assured that only the experimenters would have his/her name and that his/her name would not be associated with the data. The participant was then asked to complete the questionnaire honestly, with the knowledge that the questionnaire included a

built-in "lie detector." D. Reed (personal communication, April, 1988) found this to be an effective method of keeping the Jackson items below three. Participants recorded their answers on a general purpose computer scorable answer sheet.

After all participants were screened, means and standard deviations were calculated and schizotypes identified. At this time, answer sheets were matched with subject information sheets by a second experimenter who then telephoned students and invited them back for the second part of the experiment. The second experimenter was necessary to insure that the principle investigator was blind to subject condition in the cognitive structuring procedure. Returning participants received five dollars for participating.

Students participating in the cognitive structuring portion of the study were given a separate piece of paper imprinted with their identification number and the question, "Have you ever been hospitalized for mental or emotional problems?" Participants were presented this question after signing the informed consent form. The experimenter assured participants that they were not obligated to answer this question and may choose not to. The experimenter then left the room while the student completed this form, placed it in an envelope and sealed it. After all participants had been run, the envelopes were opened and the data from those responding affirmatively were not intended to be used in data analysis. No one failed to respond to this question. All participants responded in the negative except for one normal. It was decided that the inclusion of this data would not adversely affect data analysis.

Procedures for the cognitive structuring task were as follows. Participants were seated at a table upon which the 24 stimuli shapes were placed randomly in four rows of six. Participants were asked to sort the objects into groups based on similarity of shape. They were told to use any criteria or rules they wished as long as each group contained a minimum of three to a maximum of eight items. They were encouraged to carefully examine each shape by sight with minimal touch and were told to consider the shape by several rotational orientations with the one restriction of keeping the base on the table.

Following this sorting task, participants rated each form on each of ten 9-point bipolar attributes: (1) small vs. large, (2) short vs. tall, (3) narrow vs. wide, (4) dispersed vs. compact, (5) angular vs. round, (6) smooth vs. jagged features, (7) smooth vs. rough features, (8) simple vs. complex, (9) asymmetrical vs. symmetrical, and (10) orientation not important vs. orientation important to shape (Garbin & Bernstein, 1984). Only two of these bipolar attributes were specifically defined. Regarding "symmetry," subjects were asked to give an overall rating rather than selecting a single axis upon which to base the rating. The "importance-of-orientation" attribute was "explained as the extent to which the form would change its overall shape if it were rotated on its base," (Garbin & Bernstein, 1984). Each student rated the shapes on the attributes in a different random order. Stimuli were presented by the experimenter one at a time with the other stimuli hidden from view. Participants' verbal ratings were recorded by the experimenter.

There were no time constraints on either the sorting or the rating tasks. Experimental sessions averaged 30 to 45 minutes in duration.

Debriefing

Because of the controversial nature of schizotypy and the dangers of identifying *potential* psychosis, special precautions were taken into consideration when deciding what the participant learned about the experiment and his/her part in it. The consensus opinion appeared to be that "schizotypes" should not be informed of their "condition" because it could only cause them undue (and most likely unnecessary) alarm, grief, and worry. However, participants in an experiment do have the right to know their part in that experiment. Therefore, the following procedures were employed as a compromise to safeguard the participants' feelings without abridging their rights.

The initial 406 participants were informed that the experiment was examining the relationship between personality styles and beliefs and a particular cognitive task. Participants who were called back for the second part of the experiment were told by the experimenter that there is a possible relationship between the psychometric scales used and

mental health issues, and that if the students wanted more information about the nature of the study, they had to explicitly request it of the experimenter at the end of the session. This same information was also in print on a second informed consent form.

If this further debriefing was requested, the participant would be told that the study examined two groups. One group showed a pattern of responses on the questionnaire which may in some manner be associated with mental health concerns, and the other showed no such pattern of responses. If the participant then wished to know which group he/she was in, the experimenter (who tested blindly) would locate the participant's questionnaire and inform him/her. The experimenter would then offer to answer any questions or discuss any concerns. To date, only one student has called to inquire about his/her experimental condition.

CHAPTER III

Results

Multidimensional scaling (MDS) was used to analyze the data. A separate MDS solution was obtained from each condition. A solution allows an intepretation of the rules that underlie the decisions about which the stimuli shapes were categorized. The MDS analyses were computed with the ALSCAL program.

Pearson *r* correlations were calculated to determine the degree of similarity between the normal and schizotypal solutions. Separate correlations were calculated for each of the two sets of dimensional values of the solutions. The dimension one correlation was $r = -.09$ and the dimension two was $r = -.06$. The fact that both correlations are near zero indicate that the respective dimensional values (location on the MDS map) are unalike. Therefore, the normal and schizotypal subjects provided different solutions to the cognitive sorting task. The normal solution from this study correlated $r > .95$ with previous MDS solutions obtained from normal samples (C. Garbin, personal communication, April, 1988). Two dimensions -- height/size and complexity -- accounted for 90% of the variance in the normal solution whereas the same dimensions accounted for only 70% of the variance in the schizotypal solution.

The normals grouped four stimuli together that could be characterized as having "ears" (large, wide protrusions). Schizotypals had three of these four shapes grouped together in a cluster but had replaced the fourth "normal" stimulus with a different one. The replaced stimulus sat alone, about equidistant between its normal cluster and a second cluster.

The normals' second cluster consisted of six shapes -- three in a very tight core and three in "orbit" a short distance from this core. The schizotypals had a similar second cluster. However, their cluster consisted of four of the same stimuli in a dense core, but the two remaining stimuli from the normals' cluster were in two completely separate clusters for the schizotypals.

The normals' third cluster consisted of five stimuli that might loosely be described as "convoluted." The schizotypals' third cluster consisted of six stimuli, four of them in common with the normals' third cluster. Of the remaining two stimuli, one was from the normals' second cluster and the other was one that normals had set off in relative isolation.

The schizotypals had a fourth cluster where the normals did not. It consisted of three stimuli, one of which was in approximately the same map location as where the normals had it in relative isolation, one of which was shifted a relatively short distance but out of a normal cluster, and the third of which was pulled a great distance from where the normals had it in isolation.

The last cluster for both the normals and the schizotypals consisted of the same five stimuli which could be characterized as the shortest and flattest of the lot. In both conditions, this cluster is vertically "narrow" with two pairs of very closely proximal stimuli in the same map positions relative to each other. However, the fifth stimulus, the single one, lies between the pairs in the normal cluster and below both pairs in the schizotypal cluster.

Both conditions placed the same stimulus in relative isolation from the rest albeit at somewhat different positions along the complexity dimension. And lastly, normals left four stimuli not placed in clusters and which did not easily cluster among themselves while schizotypals left only the one stimulus relatively isolated.

Multiple regression was used to analyze the rating task and provide visual representation of the 10 attributes on the MDS solution "maps." Each of the attributes was regressed over the two dimensional coordinates of the MDS solution using the Statistical Package for the Social Sciences - PC+ (SPSS/PC+) (Norusis, 1986). All the regressions were significant, $p < .02$, except the rough-smooth dimension. This was true of both the normal and schizotypal solutions.

Table 1

Multiple Correlations Between Attribute Ratings and MDS Solution Coordinates

Bipolar Attributes	Normal	Schizotypal
Tall vs. Short	.86**	.87**
Large vs. Small	.86**	.81**
Narrow vs. Wide	.80**	.57†
Rough vs. Smooth	.41	.27
Angular vs. Round	.87**	.86**
Dispersed vs. Compact	.61*	.93**
Jagged vs. Smooth	.69*	.78**
Simple vs. Complex	.80**	.81**
Symmetrical vs. Asymmetrical	.71*	.84**
Orientation Important vs. Unimportant	.79**	.90**

* $p < .01$ ** $p < .001$ † $p = .0157$

The resulting standard regression weights were used to obtain the angles of the regression lines (Kruskal & Wish, 1978). In the formula

$$C_r = \frac{b_r}{\sqrt{b_1^2 + b_2^2}}$$

b_1 and b_2 are the standard beta weights for dimension one and dimension two, respectively; b_r is the beta value for dimension one or dimension two ; and C_r is the cosine of the angle

between the regression line and the coordinate axis. Angles derived from the dimension one regression weights are measured counterclockwise from the horizontal axis. Angles derived from the dimension two regression weights are measured clockwise from the vertical axis. Dimension one and dimension two angles result in the same regression line.

Figure 1 shows the MDS solutions for the normals, and Figure 2 shows that for the schizotypals. The regression lines depict the attribute continuums and the numbers represent each of the 24 stimulus shapes. The closer a stimulus number is to an attribute line or lines, the greater the impact that attribute had on the decision to categorize the stimulus. Similarly, the farther from the center a stimulus is, the greater it was seen to be characteristic of that end of the attribute continuum. For example, stimulus 22 among schizotypals seems to have been categorized based mainly on width and was seen as very narrow. Stimulus 18, on the other hand, appears to have been categorized based on its orientation, size, jaggedness and complexity but was not seen as very small, jagged, etc.

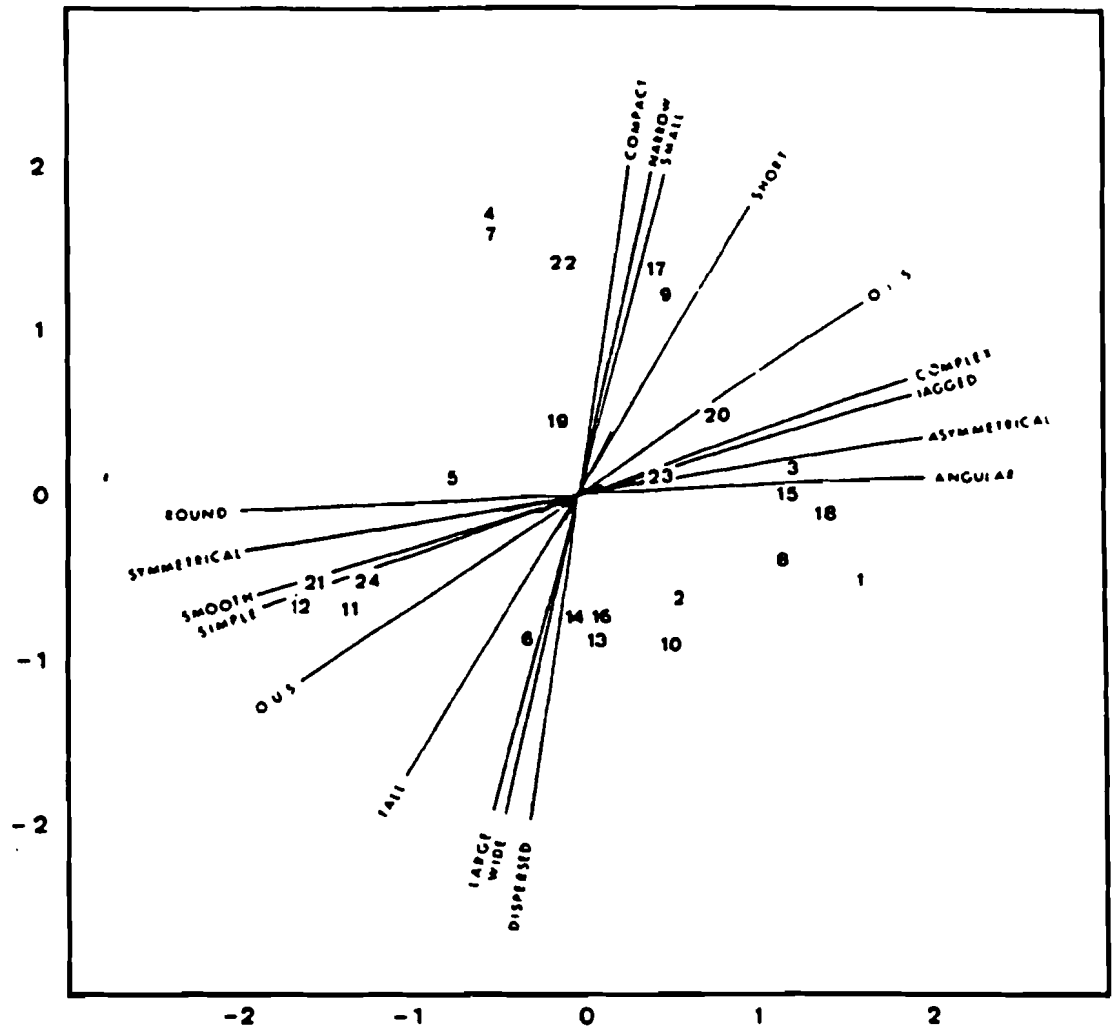

Figure 1. Normal MDS solution.

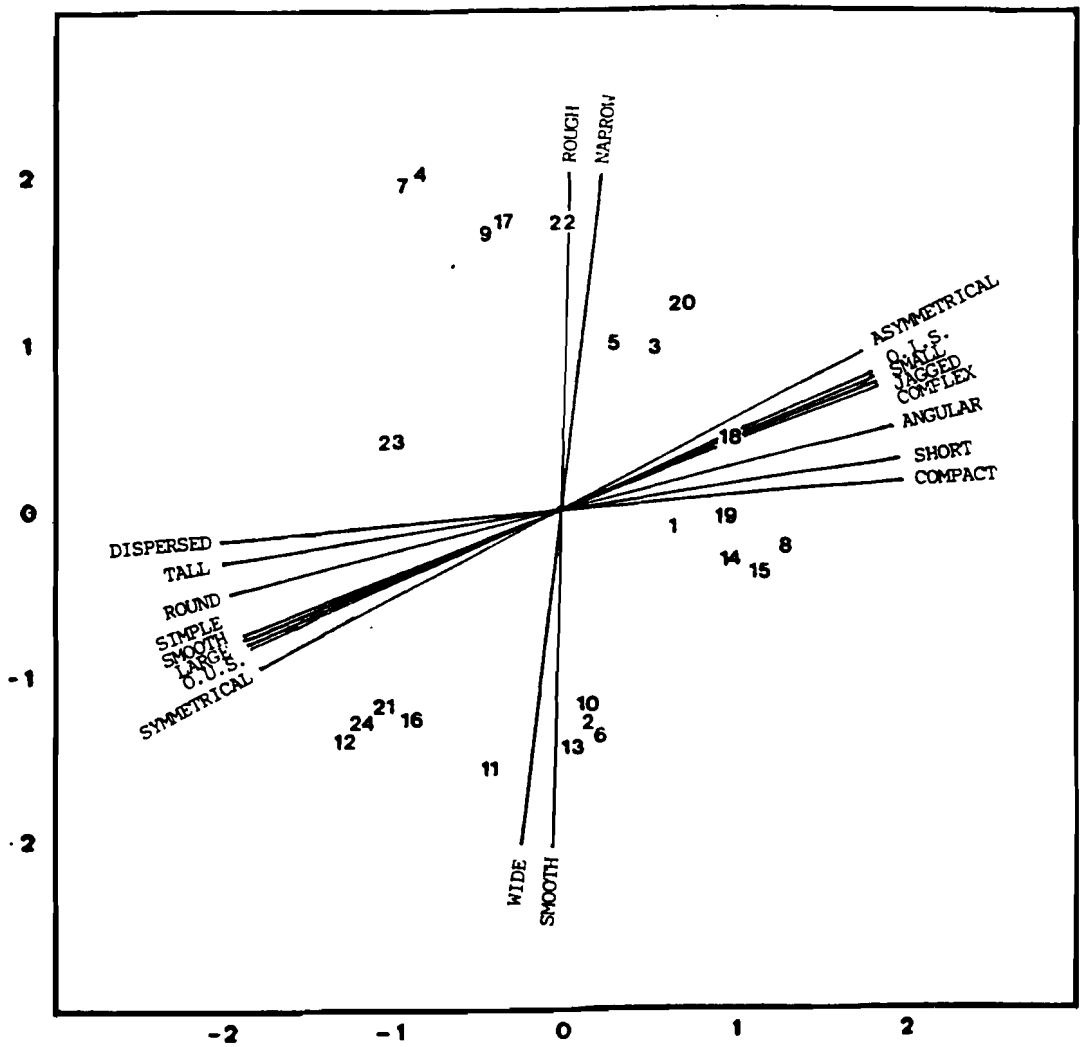

Figure 2. Schizotypal MDS solution.

CHAPTER IV

Discussion

It is clear from the data obtained that schizotypal college students provided a distinctly different solution than did the normal college students to the sorting task designed to assess the process of cognitive structuring. The solution for the schizotypals had many similarities to that of the normals, but there were also a number of differences. Both groups tended to focus on the same attributional dimensions as indicated by the dimensions of height/size and complexity accounting for 90% of the variance among the normals and 70% among the schizotypals. Although the schizotypals' attention was more scattered among the other attributes, both groups attended to the same attributional dimensions even to the extent of both disregarding the rough-smooth dimension, as indicated by its nonsignificance in both sets of multiple regressions.

As previously described, there are both similarities and differences in the solution positioning of the stimuli clusters. Other cognitive diffferences are clearly reflected on the solution maps. The regression lines of the schizotypal map are more closely spaced than those of the normal map. This would seem to indicate that schizotypals differentiate less among height, size, angularity and the other attributes. The difference in variance mentioned above can be partially attributed to this apparent difference in differentiation. The less the schizotypals differentiate among attributes, the less likely they are to focus on any particular attribute or attributes.

In practical terms, this would suggest that schizotypals may place less significance on any one particular salient aspect of the environment that normals would label as significant or important, thus leaving the schizotypals diffident or confused in a situation. For example, there are copious anecdotal examples of schizotypal students becoming lost on the way to psychology experiments. It is possible that their cognitive structuring of their surroundings places as much importance on "not route" markers (attributes of the environment) as on "route" markers such that they become confused on their way to a

particular location. Similarly, the lesser degree of discrimination that schizotypals appear to make among attributes could explain why a "magical" belief has as much appeal as a rational belief. With schizotypals, when there are equally appealing "magical" and rational beliefs, due to equally appealing attributes, there is equal chance that the "magical" belief is accepted. This is an oversimplification, but serves to illustrate the point.

Further interpretation of the 90% vs. 70% variance difference plus the positioning of the regression lines suggest differences in the rules each group used to reach its solution. It appears that the normals had consistent rules among themselves for sorting the shapes, whereas each schizotypal student had his or her own idiosyncratic set of rules for sorting, with each schizotypal individual's rules deviating to some degree from the normals' rules. Logic would dictate that idiosyncratic rules are more likely to result in deviant beliefs. It is difficult if not impossible to determine an origin of the idiosyncratic rules. They may be learned, genetic, or a combination thereof. Regardless, it is apparent that these rules can produce a vicious cycle in which the idiosyncratic rules generate deviant cognitive structuring which engenders deviant beliefs which contribute to the development of idiosyncratic rules.

Schizotypals have been shown to have a slight but consistent time lag in perception as revealed in backward masking paradigms (Merritt & Balogh, 1984). In the present study, it is assumed that this perceptual lag had no effect on the sorting task in which unlimited time was allotted for sorting. There is no evidence that schizotypals receive different perceptions. Therefore, the data obtained in this study indicated that normals and schizotypals perceived the same things but, once perceived, these items were cognitively interpreted or structured differently.

To summarize, it was shown in this study that normals and schizotypals do in fact sort amorphous clay shapes differently. The multiple dimensional scaling analysis indicates that these two groups applied a different set of rules to the sorting task such that the normals' rules were consistent while those of the schizotypals' were heterogeneous.

The sorting task used here is assumed to be a valid reflection of the cognitive structuring process. Therefore, it is concluded that schizotypals interpret, categorize, cognitively sort and structure their environment differently than normals and in so doing arrive at their deviant magical and perceptual beliefs.

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