INDIVIDUAL DIFFERENCES IN COGNITIVE STYLE: PREFERENCE FOR COMPLEXITY-SIMPLICITY

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ABSTRACT

Research on preference for complexity-simplicity, creativity and field-independence was reviewed. In Study I 50 psychology, 25 engineering and 12 art students expressed preference for series of random polygons and verbal sequences varying in complexity. Tests of intelligence, field-independence, creativity and personality were given to the psychology and engineering Ss. An examination was made of 1) individual differences in preference for complexity-simplicity, 2) group differences in preference for complexity-simplicity, 3) preference for complexity as a function of distance from the most preferred complexity level. The results showed that 1) preference for polygon complexity was most significantly related to negative response bias, anxiety level, femininity, aestheticism and complexity tolerance; verbal complexity was most significantly related to complexity tolerance, negative response bias, lack of practical outlook, thinking introversion, autonomy, and impulse expression. 2) On polygon preference the psychology Ss preferred significantly more complexity than engineering Ss; all other differences were insignificant. On verbal preference the art Ss preferred significantly more complexity than psychology and engineering Ss, and psychology Ss preferred significantly more than engineering Ss. 3) Preference for complexity tended to decrease with increased distance from the most preferred complexity level.

In Study II 48 of the psychology Ss selected their three most and three least preferred of ten polygons, rated them on semantic differential scales, and stated their preference for asymmetry-symmetry. From a principal component analysis of the semantic differential scales three interpretable factors were obtained: I Unpredictability-Complexity, II Aesthetic-

Evaluation, III Potency. The mean scale values of the polygons on the semantic differential were compared by inspection of the data. The ratings appeared to be affected by the level of complexity of the polygons and whether they were most or least preferred. A comparison of four groups differing on creativity and intelligence showed the high creativity - low intelligence group preferred most complexity. A further comparison of the high creativity - low intelligence and low creativity - high intelligence groups indicated some differences on the semantic differential ratings of the polygons. For all Ss preference for asymmetry was significantly correlated with preference for complexity.

"Nothing is objectively simple or complex except that man makes it so. This is the reason that philosophers and scientists who seek an objective denotation for 'simplicity' are bound to fail. There isn't any."

Nehemiah Jordan

Themes in Speculative Psychology

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CHAPTER I

PREAMBLE

It is generally recognized that all organisms need a minimum level of environmental stimulation in order to function effectively. There is also a maximum level above which stimulation may produce confusion. In the field of human behaviour it has been observed that in between these extreme levels there are individual differences in the amount of environmental variation which is preferred. Some people prefer life to be simple, predictable and straightforward; they are intolerant of uncertainties and ambiguities; they avoid situations which threaten to change the existing order. Others thrive on complexity, uncertainty and disorder; they easily become bored with known and unchanging situations and actively seek out new experiences.

These modes of functioning may be manifested in many spheres of life, in work, in leisure, in intellectual and in emotional activities. They appear to represent differences in cognitive style, that is differences in orientation towards various aspects of experience. Although these styles have been recognized it is only recently that they have been investigated scientifically. The study of preference for environmental variation and complexity entails research in seemingly unrelated areas of psychology. Some recent theories of motivation have considered the importance of needs for novelty, variety and information in the environment. Research in personality and creativity has related preference for complexity to other cognitive styles. And in experimental aesthetics the significance of the various kinds of reaction which aesthetic stimuli may produce has been examined.

This investigation is concerned with preference for complexity-simplicity as a cognitive style. The first study focuses on individual differences and related group differences in preference for complexity-simplicity, and also examines preference for complexity as a function of the most preferred complexity level. The second study is intended as a supplementary study to the first, and is concerned primarily with semantic descriptions of polygons. It is now more generally realized that investigations of the connotative meanings of such stimulu may aid the understanding of both general preferential behaviour and individual differences in aesthetic preference.

S T U D Y I

C H A P T E R I I

I N T R O D U C T I O N

II.1 CREATIVITY

In reading the literature on creativity one is struck by the divers ways in which creativity has been investigated and the lack of a unitary concept. At present there is no universally accepted definition of creativity: it has been defined as an aptitude trait, an aspect of thinking, and a style of life; it has been measured in terms of processes, products and questionnaire responses; it has been considered to be a cognitive ability and a motivational or personality characteristic; it has been associated with neurosis and anxiety on the one hand and with good adjustment and self-actualisation on the other. The nature of creativity appears to depend mainly on the theoretical inclination of the investigator.

The aim here is to present some theories to introduce the main concepts of creativity, and since theory dictates measurement, the ways of assessing creativity will then be examined. This will be followed by a discussion of the relation of creativity to intelligence and personality; and lastly environmental influences and occupational choice will be considered.

II.1.1 Theories of Creativity

The theories of creativity to be discussed here are:-

1. Psychoanalytic and neopsychoanalytic theories.
2. Interpersonal theories.
3. Perceptual theory.
4. Association theory.
5. Gestalt theory.
6. Guilford's trait theory.

After a description of each of these theories some of the tests proposed to measure creativity will be mentioned.

Psychoanalytic and neopsychoanalytic theories

In the field of creativity Freud is perhaps best known for his assertion that cultural and artistic achievements are the result of displaced libido: this process he called sublimation. He has in addition made a number of other contributions to the theory of creativity. In a discussion of Freud's proposals Getzels and Jackson (1962) have summarized his major points as follows:

(i) "Creativity has its genesis in conflict, and the unconscious forces motivating the creative 'solution' are parallel to the unconscious forces motivating the neurotic 'solution';

(ii) the psychic function and effect of creative behaviour is the discharge of pent-up emotion resulting from conflict until a tolerable level is reached;

(iii) creative thought derives from the elaboration of the 'freely rising' fantasies and ideas related to day-dreaming and childhood play;

(iv) the creative person accepts these 'freely rising' ideas, the non-creative person suppresses them;

(v) it is when the unconscious processes become, so to speak, ego-syntonic that we have the occasion for 'achievement of special perfection';

(vi) the role of childhood experience in creative production is emphasized, creative behaviour being seen as 'a continuation and substitute for the play of childhood'." (1962, Page 91 - 92)

It can readily be seen that Freud places great importance on unconscious processes and associates creative and neurotic behaviour, however, in the reformulations of neopsychoanalytic theorists, notably Kubie, there is a change of emphasis away from the unconscious and conflict.

Kris (1950; see Getzels and Jackson, 1962) was perhaps the first to emphasize the role of preconscious processes in creativity, and the major implications of his theory derive from his concept of "regression in the service of the ego". Kris states that:

"...ego regression (primitivization of ego functions) occurs not only when the ego is weak - in sleep, in falling asleep, in fantasy, in intoxication, and in the psychoses - but also during many types of creative processes."

Relating regression to creativity is an important step because regression is commonly associated with autistic or uncontrolled, not productive thinking.

Kubie (1958; see Getzels and Jackson, 1962) dissents even further from traditional psychoanalytic theory in claiming that if the unconscious does operate in creativity it probably has a harmful effect. He suggests that the preconscious (which may operate in states of abstraction, dreaming or free association) is the only process which permits flexibility of symbolic imagery, so essential for creativity. Conscious processes lead to cognitive restriction and unconscious processes lead to symbolic confusion.

Although Kubie claims that his theory is within the psychoanalytic framework, it is mainly through his use of concepts. In denying the role of the unconscious and also the relation between creativity and neurosis, his postulations have little in common with Freud. One common belief which these theorists share is the value of fantasy for creativity; this has also been mentioned by Barron (1963a) and by Schmeidler (1965), who reported a relation between visual imagery and creativity. Another point of agreement is the association of creativity with childhood playfulness, also frequently observed in empirical studies of creativity.

Measurement of psychoanalytic concepts necessitates the use of projective techniques, and the Rorschach has been employed to assess creativity, particularly "regression in the service of the ego". Mackler and Schontz (1965) quote the following three investigations of the use of the Rorschach as a measure of creativity: Pine and Holt (1961) obtained results which indicated that the Rorschach was a valid measure of creativity, and performance on the Rorschach was related to quality of imaginative production on tests including Guildord's Brick Uses and Consequences Test, a Humour Test and the TAT. Cohen (1961) found that subjects rated as creative showed higher adaptive regression on the Rorschach than less creative subjects. Goldberg and Holt (1961) compared Rorschach performance with behavioural changes during sensory isolation. They observed that subjects who were able to "regress in the service of the ego" measured on the Rorschach also utilised their primary processes adaptively under isolation, whereas subjects who were unable to "regress in the service of the ego" on the Rorschach showed signs of anxiety and disturbed functioning under isolation.

Interpersonal and perceptual theories

Like psychoanalytic theories, interpersonal theories are concerned with motivation for creativity, but the approach adopted may be regarded as antithetical to the reductionism of the former theories. Creativity is believed to be an emergent property of the individual which he needs to express and which develops to its full with maturity when the individual is able to achieve self-realization.

Rogers and Maslow (1959, 1959; see Mackler and Schontz, 1965) both regard the need for self-actualization, or the realization of one's full potential, as the main motivation for creativity. Rogers defined creativity as an

"...emergence in action of a novel relational product, growing out of the uniqueness of the individual on the one hand, and the materials, events, people or circumstances of his life on the other."

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The individual qualities which he believes to be important for creativity are openness to experience, internal locus of evaluation, and an ability to toy with elements; and the necessary environmental conditions include unconditional acceptance of the individual, lack of critical evaluation, and psychological freedom. The presence of these conditions permits psychological safety and fosters creativity. Maslow believes that creativity is an innate property which is lost by most persons during the process of socialization. Self-actualizing individuals are among those who have been able to retain it and their behaviour is characterized by spontaneity, openness to experience and a "self-actualizing creativeness".

Tumin (1954; see Mackler and Schontz, 1965) has outlined the social forces which impose difficulties for creativity. Tumin regards man as a social being who is dependent on others for his self-evaluation. Rather than ignore the evaluation of others and become marginal and deviant, he tends to conform in order to gain social acceptance. As conformity usually involves discarding what is novel, unique or different, social acceptance and creativity are made incompatible in many societies.

Torrance, like Tumin, has stressed the environmental obstacles which creative persons must overcome. From a review of the literature on creativity he has suggested five necessary conditions for creativity which are closely related to the conditions proposed by interpersonal theorists:

(i) "The absence of threats to the self and the willingness to take risks.
(ii) Self-awareness, appreciating one's own feelings.
(iii) Self-differentiation, or an awareness of distinctiveness.
(iv) Openness to the ideas of others together with confidence in one's own ideas and perceptions of reality.
(v) Mutuality in interpersonal relations, or a balance between sociability and pathological asociability." (1962; see Nash, 1970, Page 385)

Torrance disagrees with Guilford's attempt to establish discrete factors of creativity, he believes that it is more fruitful to study the creative person, not just his abilities. Torrance (1965) defined creativity in terms of sensitivity to problems, formulating and testing hypotheses and communicating results, and as an attempt to measure this kind of creativity he has devised a number of complex tests which require several types of divergent thinking, such as originality, flexibility and fluency. The non-verbal tests include Circles, Figure Completion Test, and Picture Construction; and verbal tests include Just Suppose, Product Improvement and Ask and Guess. Torrance placed special emphasis on making the tests interesting and involving, and they have been used extensively in investigations of creativity among children.

Perceptual theory

Schachtel proposed that creative behaviour is a function of openness to the world, and that the need to relate to the environment is a basic motive in creativity (1959; see Getzels and Jackson, 1962). He suggests that there are two basic perceptual modes of communication between subject and object - the autocentric, i.e. subject centred, and the allocentric, i.e. object centred. The creative person is able to maintain allocentric perception, or in other words he is able to remain perceptually open to the world rather than seeking security in the embeddedness of a closed world. This feature is expressed in Schachtel's definition of creativity; he states it is the

"...art of seeing the familiar fully in its inexhaustible being, without using it autocentrically for purposes of remaining embedded in it and reassured by it."

Association theory

An association theory of creativity has been proposed by Mednick (1962). He defines the creative thinking processes as:

"...the forming of associative elements into new combinations which either meet specified requirements or are in some way useful. The more mutually remote the elements of the new combination, the more creative the process or solution." (1962, Page 221)

To account for his proposition of an associative basis of creativity, Mednick suggests that there is a hierarchy of possible responses to a stimulus word. More common associates are higher in the hierarchy and more unique associates are lower in the hierarchy - but the gradient between the stereotyped and the original associates may be steep or shallow. Mednick argues that high creativity corresponds to the shallow gradient and low creativity to the steep gradient. Thus, initially the low creative person can offer many stereotyped associations rapidly but his response repertoire is soon exhausted. The highly creative person also offers stereotyped responses at first, although not so rapidly, and gradually he includes more unique associates as they become more readily available.

Mednick has developed a "Remote Associations Test" (RAT) to measure associative creativity. In this test the subject is given three words and is required to supply a fourth word which relates all three; e.g. given the words "rat", "blue" and "cottage", the response which links these three words meaningfully is "cheese". Although this test requires remote thinking it is not typical of tests of creativity; as there is only one correct answer some original thinking might be penalized. RAT scores have been found to correlate significantly with rated creativity among design students but not among physicists or engineers (see Datta, 1964). It has also been demonstrated that creative persons prefer remote over more stereotyped associates (Houston and Mednick, 1963).

Wallach and Kogan (1965) have also proposed an associative conception of creativity. They suggest two crucial aspects in the creative process: the generation of abundant and unique associates, and a playful, permissive attitude toward the task. These aspects influenced their decision to employ measures of creativity which involved the generation of associates; these measures were - Instances, Alternate Uses, Similarities, Line Meanings and Pattern Meanings. Wallach and Kogan recommend that to permit playfulness and original associations on these tests subjects should feel free from evaluation and not be under temporal pressure.

Gestalt theory

Wertheimer was critical of attempts to understand creativity or productive thinking through association theory or traditional logic because he regarded these approaches as limited and "piecemeal". He proposed instead a Gestalt theory of productive thinking. Wertheimer's description of the process of productive thinking has been outlined by Mackler and Schontz (1965).

"First a critical region of the field becomes focal but not isolated. This is followed by a deeper structured view of the field, involving changes in the functional meaning, grouping and re-organisation of the items in the field until the gaps and difficulties in the problem are resolved. The field is restructured to restore harmony; an equilibrium is attained." (1965, Page 221)

Wertheimer emphasised that the steps in this thinking process are not made independently, they are made only in consideration of the whole situation. According to Gestalt theory creativity refers to an action which suddenly produces insight or a novel idea, and novelty arises not from logical reasoning but from the imagination.

Guilford's trait theory

It was Guilford who gave the impetus to many investigations of creativity when he highlighted the need for research in this area in an address to the A.P.A. (1950). His own work on creativity is subsumed within a general theory of intellect, which he has devised in accordance with the American multi-factorial conception of intelligence.

Guilford has proposed a cubical model to account for intellectual abilities (see Figure II.1). There are five kinds of operation, four types of content, and their interaction may give six kinds of products. One hundred and twenty cells are contained in this model, each representing a factor which Guilford and his colleagues have established or hope to demonstrate. Considerable progress has been made with this aim: when the model was proposed (1959) between forty and fifty cells were accounted for and by 1965 seventy-five of the cells had been filled (Guilford, 1966).

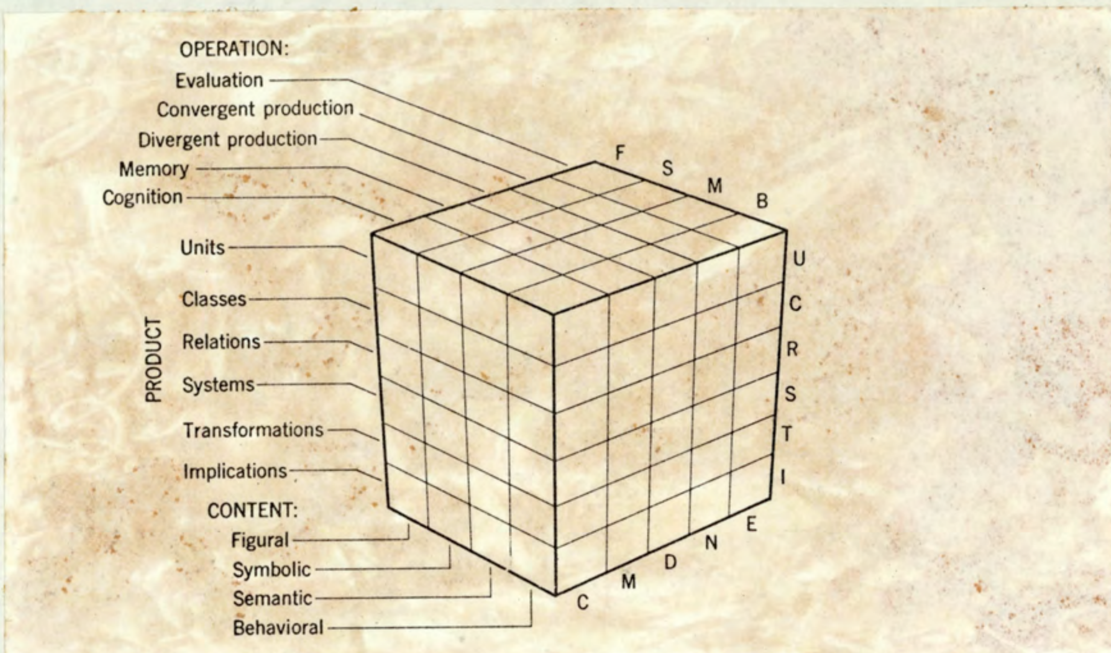

Figure II.1

Guilford's structure of intellect model. (From Guilford, 1967, Page 63).

The process which is of most relevance here is divergent production. Guilford has stated that:

"It is in divergent thinking that we find the most obvious indications of creativity." (1957, Page 112)

Divergent production refers to the kind of processes involved in most tests of creativity where questions are typically open-ended and there is no one correct answer. This may be contrasted with convergent production which is similar to some processes involved in tests of intelligence where there is one correct answer on which to "converge".

There are twenty-four cells for the divergent production abilities, so far sixteen of them have been accounted for (Guilford, 1967). The main factors to emerge have been four kinds of fluency, two kinds of flexibility, originality, and elaboration. These are depicted in Table II.1 to show the content and product categories to which they correspond, and are discussed later. Some of the tests used to measure the factors will be described since they not only illustrate Guilford's tests of divergent production but also many of them have been employed (sometimes in modified form) by other researchers of creativity (e.g. Getzels and Jackson, 1962).

TABLE II.1

The divergent production factors.

PRODUCT \ CONTENT	FIGURAL	SYMBOLIC	SEMANTIC	BEHAVIOURAL
UNITS		Word fluency	Ideational fluency	
CLASSES			Spontaneous flexibility	
RELATIONS			Associational fluency	
SYSTEMS			Expressional fluency	
TRANSFORMATIONS	Adaptive flexibility		Originality	
IMPLICATIONS			Semantic elaboration	

<u>Word fluency</u> - divergent production of symbolic units.

The tests employed to measure this factor consist mainly of generating words, e.g. listing words with the suffix - TION.

<u>Ideational fluency</u> - divergent production of semantic units.

Tests used to measure this factor may involve naming objects which satisfy two specifications, e.g. listing objects which are both round and edible, or, listing as many uses as possible for a common object such as a brick or a pencil.

Spontaneous flexibility - divergent production of semantic classes. The most frequently used test for this factor has been Brick Uses - the subject suggests as many different uses as possible for a common object such as a brick or a pencil. Flexibility here is spontaneous since it is not predetermined by the instructions. A new test has also been devised to measure this factor - the Multiple Groupings Test, where a subject is given a list of objects and asked to classify them into as many different sub-groups as possible.

Associational fluency - divergent production of semantic relations. Tests loading on this factor may involve relations such as similarity or opposition, e.g. Controlled Associations - list as many words as possible of similar meaning to each of eight words given.

Expressional fluency - divergent production of semantic systems. This factor is measured mainly by sentence construction tests, e.g. Four word combinations - construct four word sentences using the following initials, W____ C____ E____ N____.

Adaptive flexibility - divergent production of figural transformations. The distinguishing characteristic of tests loading on this factor is that they involve trial and error behaviour, e.g. Match Problems - given six adjacent squares constructed with match sticks, remove three matches to leave four squares.

Originality - divergent production of semantic transformations. Tests employed to measure this factor usually involve one of the following three abilities:

1. Ability to produce responses which are statistically rare in the population.
2. Ability to produce remotely related responses.
3. Ability to produce clever responses.

A test of the second ability is the Remote-associations test (cf. Mednick's RAT) e.g. give a single word which is related to both the given words: Jewellery - Bell

Semantic elaboration - divergent production of semantic implications. These tests involve planning, detail or elaboration, e.g. Possible Jobs - given a symbol such as an electric light bulb, name groups of people or occupations for which the object could stand as a symbol.

Although Guilford links divergent production most closely with creativity this association is not exclusive. Transformations and evaluation may sometimes be a part of creative activity, and convergent production may often be an aid in creative problem solving.

II.1.2 Creativity and Intelligence

Attempts to discover the relationship between creativity and intelligence have developed from Guilford's work on convergent and divergent thinking and especially from an investigation by Getzels and Jackson (1962). The latter authors claimed that they had found creativity to be largely independent of intelligence, but they have been challenged on this issue as on further inspection their results appeared to be inconclusive. Even today, after numerous attempts at replication, no definite conclusion may be drawn.

Wallach and Kogan (1965) are highly critical of Getzels and Jackson's procedure and made a replication with a more rigorous methodology. They also reviewed previous findings of correlations between creativity and intelligence. As most data are in the form of correlation coefficients and these are fairly representative they will be summarized overleaf with the results obtained by Wallach and Kogan.

TABLE II.2

Correlation coefficients quoted by Wallach and Kogan,

a) between creativity and intelligence, and

b) among creativity tests.

		AVERAGE CORRELATIONS	
Authors	Sample	Creativity and I.Q.	Creativity Tests
Getzels and Jackson	Boys Girls	.26 .27	.28 .32
Cline et al. (1963)	Boys Girls	.35 .33	.21 .24
Cline et al. (1962)	Males Females	.35 .32	.21 .22
Flescher	Total	.04	.11
Guilford and Christensen		.24	.27
Wilson et al.		.12	.14
Wallach and Kogan	Boys Girls Total	.05 .13 .09	.34 .50 .41

Two main conclusions may be drawn from these results:

(i) Correlations among creativity tests are generally low - unlike correlations among intelligence tests which are generally high.

(ii) Correlations between intelligence and creativity, although low on average, are almost as significant as correlations among the creativity tests.

There have been few factor analytic studies of creativity and intelligence but there are two which lead to similar conclusions. Wallach and Kogan (1965) report a study by Thorndike of the Getzels and Jackson data, where both creativity and intelligence tests loaded on the same factors and the loadings of the intelligence tests were intermediate among the creativity tests. Cropley (1966; see Freeman et al., 1968) factor analysed a battery of intelligence and creativity tests and found that although the two main factors were convergent and divergent thinking they were significantly correlated.

From the evidence presented here, two main points emerge:

(i) The low correlations among the creativity tests do not support the notion of a unitary trait of creativity, and

(ii) Both the correlational and factor analytic studies suggest that although creativity differs from intelligence it cannot be claimed to be independent of it.

Several authors have noted the lack of persons who are highly creative yet not highly intelligent. Figure II.2 (overleaf) shows a typical scatter found by Guilford.

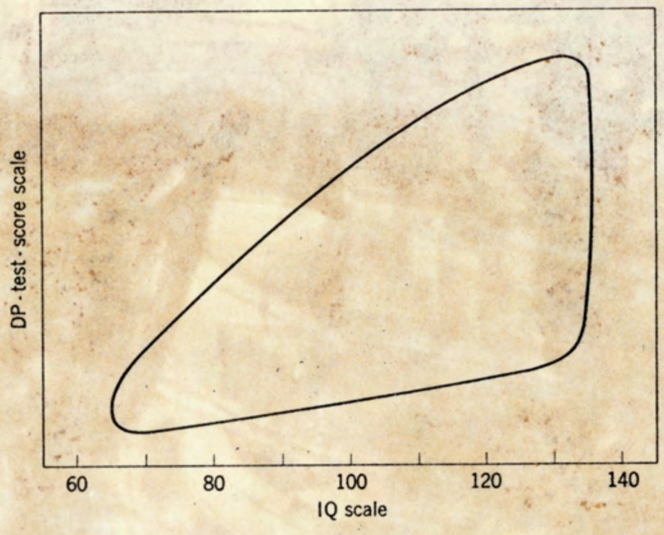

Fig. 6.12 Illustration of a somewhat typical scatter of individuals when scores for divergent-production tests are considered in relation to IQ. One striking feature is the scarcity of cases combining low IQ with high status on divergent production; the other is the incidence of conjunction of low divergent-production ability and high IQ.

Figure II.2

Relation of divergent production scores to IQ. (From Guilford, 1967, Page 168).

This seems to suggest that intelligence may be a necessary but not a sufficient condition for creativity. Several authors have suggested that up to an IQ of 120, intelligence is important for creative ability (e.g. Barron, 1963a; MacKinnon, 1962). Once this level is reached it appears that motivational and temperamental variables are of greater importance.

II.1.3 Creativity and Personality

Most of the investigations to be presented here compare the personality characteristics of persons high on ratings or tests of creativity with the characteristics of less creative individuals. The study by Getzels and Jackson (1962) will be discussed, first as it has influenced the design of later investigations of creativity in children and adolescents.

Getzels and Jackson administered a battery of five creativity tests (Word Associations, Uses for Things, Hidden Shapes, Fables and Make-up Problems) to a sample of adolescents, and on the basis of creativity test scores and I.Q. they formed two contrasting groups - the high creativity group was in the top 20% on tests of creativity, but not on intelligence (mean I.Q. 127): the high intelligence group was in the top 20% on intelligence, but not on creativity (mean I.Q. 150). The two groups were then compared on their performance on some personal-social variables, and the main results are summarised below:

(i) Despite differences in I.Q. the two groups had the same school achievement.

(ii) Despite this equal achievement the teachers preferred the high I.Q. children.

(iii) In fantasy production high creativity children expressed more imaginative, humerous, playful and stimulus-free themes.

(iv) The groups differed in their sense of values, in particular the creative group valued a sense of humour more highly. Also, unlike the high I.Q. group, the high creativity group's ideal personal values did not correlate with values for future success nor with values they believed teachers would like.

Partial support for Getzels and Jackson was provided by Torrance (1962; see Butcher, 1968) who found that creative children tended to have higher school achievement than less creative children matched for I.Q. But Hasan and Butcher (1966), who made a partial replication of the Getzels and Jackson study with an unselected sample of children, reported that their high creativity group had lower attainment than the high I.Q. group. They also found that teachers preferred the high I.Q. group to the high creativity group, but they suggested that this was due to the lower intelligence of the latter group rather than their high creativity as such. It is interesting to note that in this unselected sample the correlations between measures of creativity and intelligence were very high, (.743 for combined creativity scores and I.Q.), unlike the low correlations obtained by Getzels and Jackson.

Wallach and Kogan (1965) made an investigation similar to Getzels and Jackson, but in addition they included subjects who were high or low on both intelligence and creativity. Their summary of the distinctive characteristics of the four groups is given below:

"1. High creativity - high intelligence: These children can exercise within themselves both control and freedom, both adultlike and childlike kinds of behaviour.

2. High creativity - low intelligence: These children are in angry conflict with themselves and with their School environment and are beset by feelings of unworthiness and inadequacy. In a stress-free context, however, they can blossom forth cognitively.

3. Low creativity - high intelligence: These children can be described as "addicted" to school achievement. Academic failure would be perceived by them as catastrophic, so that they must continually strive for academic excellence in order to avoid the possibility of pain.

4. Low creativity - low intelligence: Basically bewildered, these children engage in various defensive manoevres ranging from useful adaptations, such as intensive social activity, to regressions such as passivity or psychosomatic symptoms." (1965, Page 303)

Torrance (1965) reported three personality characteristics which differentiated highly creative children from less creative children of equal intelligence.

(i) Both teachers and peers rated the creative children (especially the boys) as having wild and silly ideas.

(ii) The creative children produced ideas which were unusual (without being silly).

(iii) In their work creative children showed humour, playfulness, relative lack of rigidity and relaxation.

Hudson (1966) observed personality differences between his groups of convergers and divergers. Compared with the convergers, the divergers were more humerous, less authoritarian and conventional, more concerned with literature and politics than technical or practical matters and willingly expressed their feelings. But Hudson claims that the diverger is not necessarily "open" and the converger "closed", rather they differ in their use of defence mechanisms.

We turn now to studies on adults. Guilford (1957) examined the relationship between personality and some aptitude factors. Subjects relatively high on ideational fluency were more appreciative of originality and somewhat less neurotic; subjects relatively high on originality were more tolerant of ambiguity, felt less need for orderliness and were more interested in aesthetic expression and divergent thinking.

Barron has investigated three major dimensions in his research on creativity:- independence of judgement, originality and preference for complexity (see II.3 for greater detail). In a comparison of the personality characteristics of subjects who showed independence of judgement and those who conformed to the group in an Asch-type situation, he found no difference in emotional stability, but there were striking personality differences (1953a). Independents described themselves as original, emotional and artistic; yielders described themselves as obliging, optimistic, efficient, determined, patient and kind. Independents valued creativity, close interpersonal relations and the individual as opposed to the group; yielders were group oriented and practical minded. Independents preferred complexity; yielders preferred simplicity.

Barron also examined the personality characteristics of subjects who had high scores on a battery of originality tests (1957). He summarised their distinguishing attributes under the following headings:

"a) disposition towards integration of diverse stimuli,
b) energy, fluent output and involvement,
c) personal dominance and self-assertion,
d) responsiveness to impulse and emotion,
e) expressed femininity of interests,
f) general effectiveness of performance."

As well as replicating some of these findings he has also found originality to be related to preference for complexity, a rating of complexity as a person and independence of judgement (1955).

MacKinnon (1962) has studied eminent men in creative writing, mathematics, industrial research, physical sciences and engineering. (As the most extensive research is on architects it will be discussed in more detail here.) The creative architects described themselves as inventive, determined, independent, individualistic, enthusiastic and industrious - and they had a high self-acceptance; the less creative rated themselves as responsible, sincere, reliable, dependable, clear-thinking, tolerant and understanding. The CPI profile of the creative architects confirmed some of these findings, their characteristics included dominance, self-confidence, lack of sociability, freedom from conventional restraints and inhibitions, independence, flexibility and more femininity of interests. Taking the creative persons from all samples, MacKinnon obtained the following results. On the Myers-Briggs Type Indicator the creatives were perceptive rather than judging types, they used intuitive rather than sensory perception and about two-thirds of them scored as introverts. On the Allport-Vernon-Lindsey Study of Values their highest values were theoretical and aesthetic.

In a comparison of arts and science students rated as more or less creative

Drevdahl (1956) concluded that the creatives appeared to have superior verbal facility, fluency, flexibility and originality, as measured by Guilford's tests; and on the 16PF they were more radical, self-sufficient, schizothymic and desurgent. The latter four tendencies were also found by Cattell and Drevdahl (1955; see Freeman et al., 1968) to be characteristic of research scientists. In addition, researchers were lower on ego strength and extraversion but higher on bohemianism than teachers and administrators. Drevdahl and Cattell (1958; see Freeman et al., 1968) also found creative artists and writers to be more radical, self-sufficient, schizothymic and desurgent, as well as being above average on dominance, emotional sensitivity, bohemianism and ergic tension.

Two characteristics - femininity and emotional stability - which have been referred to repeatedly, need more elaboration. Femininity is frequently reported to be a correlate of creativity, especially in males. Torrance (1962; see Nash, 1970) has suggested that emphasis on sex roles handicaps creativity in both sexes, since creativity requires both masculine and feminine traits. MacKinnon (1962) suggests that it is not that creative persons are effeminate but rather they are open to their feelings and emotions, and have a breadth of interests which includes those regarded as feminine as well as masculine.

There has, for a long time, been a general belief that neurosis and creativity are associated, but in recent years this has been disputed. MacKinnon's creative architects were higher than average on the MMPI but he believes that this does not necessarily suggest psychopathology, but rather

"a good intellect, complexity and richness of personality, general lack of defensiveness and candor in self-description - in otherwords, an openness to experience and especially to experience of one's inner life." (1962)

Cattell (1963) helps to clarify the issue by distinguishing between neurosis and anxiety. He argues that although there are indications of emotional instability in literary geniuses, effective research scientists have above average ego strength and emotional stability, but there is evidence of high anxiety.

Golann (1963) suggested that personality and stylistic modes might be used as criterion variables for creativity: modes such as tolerance for or seeking of ambiguity, openness to experience, childlike traits, self-actualization and independence of judgement. It is possible that the use of these descriptive concepts which are theoretically based might assist in the understanding of creativity.

II.1.4 Creativity and Environmental Influences

The studies discussed here centre mainly on the family; the data have been obtained either from parents of creative children or from creative adults' descriptions of their childhood, but first a developmental study of creativity will be mentioned.

Torrance (1962, see Nash 1970) has described creativity in terms of a developmental process in childhood. Creativity was found to increase steadily from the first to the third grade, followed by a sharp drop in the fourth grade. Then there was an increase during the fifth and sixth grades, but another decline at the seventh grade, followed yet again by an increase for the remaining grades. As an explanation for the slumps Torrance states that round about the fourth grade there is more intense socialization and dependence on the group, and the seventh grade slump coincides with the beginning of adolescence when there are social pressures toward conformity combined with feelings of insecurity and physiological changes.

Getzels and Jackson (1961) found that parents of their highly creative children were closer in age, the fathers were more likely to be in business rather than academic or educational occupations, the mothers referred less to earlier financial hardship and stressed internal rather than external qualities in their choice of children's friends. The parents were less vigilant and critical of the child, yet less satisfied with their child-rearing practices.

Reports that creative individuals felt their parents were inconsistent towards them, and that in childhood they preferred solitary activities have been made by Stein and Cattell (1956 and 1959; see Nash, 1970). Weisberg and Springer's results (1961, see Nash, 1970) indicated that in the creative child's family the parents did not stress conformity, the family unit was not very close, there was little dependence, the marriage was not particularly satisfactory and there was much overt expression of feeling. The interaction with the father was strong but with the mother it was ambivalent, and the child was often an older sibling but not usually a favourite. Also, the father was frequently in an occupation which permitted independence and autonomy.

MacKinnon (1962) has described the life histories of creative architects. The following list illustrates the salient characteristics of the family pattern: the parents gave the child independence and respected his ability to make decisions; there was often a lack of closeness with one or both parents, and ambiguities over identification; discipline was consistent but not harsh; there was an emphasis on the development of personal ethical codes rather than reliance on formal religion; and the families tended to move relatively frequently.

The descriptions of the family environments given here help to account for some of the personality characteristics of creative individuals. In particular the families seem to foster the child's self-reliance, nonconformity and autonomy.

II.1.5 Occupational Choice, Creativity and Related Personality Variables

The most famous study of choice of discipline and creativity was made by Hudson (1966) on sixth form boys in England. (He prefers to refer to convergence and divergence, but the concept is basically similar to creativity as discussed here.) Hudson found, unexpectedly, that arts specialists were on average divergers, physical scientists were on the whole convergers and specialists in biology, geography, economics and general arts courses were equally divided into convergers and divergers. With regard to the findings about physical scientists Hudson suggested the possibilities that:

"a) our sixth forms may be attracting boys who are too rigid and inflexible for research, and
b) that scientific education instead of counteracting boys' natural inflexibility tends to reinforce and aggravate it."

A study on the occupational choice of adolescents revealed that creative individuals mentioned more occupations in which they were interested and also more unusual occupations (Getzels and Jackson, 1960). Parloff and Datta (1968) found that when choosing a career in science a higher percentage of the more creative adolescents chose mathematics and a higher percentage of the less creative chose engineering and chemistry. On the Strong VIB creative architects showed interests similar to those of psychologists, authors - journalists, lawyers, artists and musicians, and interests unlike those of bankers, officemen, farmers, carpenters, veterinary surgeons, policemen or morticians.

Other studies have taken subjects belonging to various occupational categories and compared them in relation to creativity and other personality variables. Some studies by Cattell and Drevdahl have already been mentioned. Another by Cross, Cattell and Butcher (1967) compared the personality scores on the 16 PF of artists, craft students and a control group. The distinguishing characteristics of the artists were schizothymia, dominance, self-sufficiency, low emotional stability, low self-integration, bohemianism and low super-ego strength; they were also more suspicious, guilt prone, tense and anxious. An interesting finding was that on most factors the craft students scored intermediate between the artists and controls.

A comparison of dream reports of arts, science and engineering students revealed that arts students reported the most, and engineering students the least number of dreams, and that arts students showed significantly more dream imaginativeness than either science or engineering students. But the groups did not differ in independence of judgement, although this was related to dream imaginativeness. (Schechter et al., 1965).

There have also been suggestions that different kinds of creativity may be required in different fields. MacKinnon distinguishes artistic creativity, "where the creator externalizes something of himself into the public field," and scientific creativity,

"where the creator is a person, who in his creative work acts largely as a mediator between externally defined needs and goals." (1962)

Hudson (1966) suggested that psychologists are "hybrids", showing a mixture of convergence and divergence and he drew an analogy with Roe's findings that, unlike physical scientists who were independent and not guilt prone,

"social scientists are much less free of parental ties in the sense that a number of them still harbour resentment and rebellion even though they have achieved an outward independence." (1966, Page 157)

Differences between creativity in science and engineering have been discussed by Snyder (1967), who suggested that the two disciplines may require different cognitive styles. More specifically, creativity in engineering may involve a "need for closure" and "intolerance of ambiguity".

Snyder's study is one of the few to be found in the literature using the Omnibus Personality Inventory (OPI). He defined creativity in terms of high scores on Thinking Introversion, Complexity and Impulse Expression on the OPI using MIT students for his sample. The mean standard scores of 721 Freshmen were: Thinking Introversion 54.6

Complexity 56.2

Impulse Expression 52.5

The former two were comparable to means of students at other colleges but Impulse Expression was lower. A comparison was also made between engineering and science students' performance on the OPI. Engineering majors were consistently lower on Thinking Introversion and Complexity, but slightly higher on Impulse Expression, and Snyder reports that the pattern for humanities and social science students was more similar to the science than the engineering majors'.

II.1.6 Conclusions

It is evident that a comprehensive yet precise theory of creativity is sadly lacking; none of the theories discussed gives an adequate explanation, they tend to be either too narrow and mechanistic or too vague and unscientific. The relationship between creativity and intelligence is still undecided; it appears that creativity might be related to intelligence up to a certain level after which temperamental variables assume more importance. The study of creativity through personality may be a promising approach. From a wide range of investigations certain common features of creative persons have emerged; in particular, the creative individual is independent, he is open in his encounter with the world, and he enjoys re-organizing and integrating complex and contradictory elements of experience. The growth of creativity appears to be fostered by the environment when the individual is granted freedom and is valued for his own sake.

II.2 FIELD-DEPENDENCE-INDEPENDENCE

The term field-dependence-independence refers to a cognitive style which is characterised by the relative degree of differentiation in perceptual and intellectual functioning. Research on this dimension developed from experiments on space orientation where remarkably consistent individual differences were observed in the use of visual and kinaesthetic cues in determining the position of the upright. Other perceptual tests which also differentiated persons who were able to structure their environment from persons who submitted to the environment were devised and personality correlates of these distinct perceptual modes were investigated.

This research culminated in the publication of "Personality Through Perception", (Witkin et al., 1954), where Witkin introduced the concept of field-dependence-independence. Field-independent persons were those who, on the perceptual tests were able to keep an item distinct from its embedding context; they had an "active-coping" approach, whereas field-dependent persons were unable to distinguish items from embedding backgrounds so easily; their approach was one of "passive-submission" to the environment. Witkin et al., also claimed to have obtained personality correlates of field-dependence-independence which gave support to the construct. The field-independent was described as: attempting mastery and re-organisation of his environment; striving for independence, competence and leadership; being concerned with his inner life; and having control over impulses such as aggression. The field-dependent person, on the other hand, showed little initiative in challenging the structure of the "status quo"; he was conventional and submissive to authority; blandly unaware of his inner feelings; and he feared and denied as well as having poor control over impulses such as sex and aggression.

However, Witkin's conclusions have been strongly criticised on the grounds that his methodology was very weak and the personality tests were of dubious reliability and validity (Gruen, 1957; Postman, 1955). During the next few years there were numerous investigations of field-dependence-independence by Witkin and other researchers, presenting some confirmation for his hypotheses. This work is described in a second book, "Psychological Differentiation" (Witkin et al., 1962), where the theoretical construct of psychological differentiation is used to account for field-dependence-independence. In fact, Witkin et al., now chose to refer to global v. analytical field approaches since they found that the differences in perceptual orientation were also manifested in intellectual activities. Analytical field approach referred to ability to structure and overcome embedding contexts in perceptual and intellectual functioning; global field approach referred to a style which involved submission to the dominant organisation and an inability to overcome embedded contexts.

II.2.1 Measures of Field-Independence

During the process of their research Witkin and his colleagues devised a battery of perceptual tests to measure field-independence. These tests have a common requirement for the subject to separate an item from the field or context of which it is a part and which, therefore, exerts a strong influence upon it. The field-independent person who tends to experience his surroundings analytically, with objects experienced as discrete from their backgrounds, is able to meet these requirements; whereas the field-dependent individual, who tends to experience his surroundings in a relatively global fashion, passively conforms to the influence of the prevailing field or context and is unable to meet the requirements.

The three tests which make up the Witkin perceptual battery are the Tilting-Room-Tilting-Chair Test (TRTC), the Rod-and-Frame Test (RFT) and the Embedded-Figures Test (EFT). The first two tests involve "frame-dependence" and the third "design dependence". They will be described briefly here to illustrate the kind of task a subject is required to perform.

The TRTC tests evaluate the subject's perception of the position of his body and of the whole surrounding field in relation to the upright. The apparatus consists of a box-like room suspended on ball-bearing pivots so that it can be tilted by any amount to left or right; the chair upon which the subject sits inside the room can also be tilted to left or right independently of the room. The TRTC test consists of two parts, the Body-Adjustment-Test (BAT) and the Room-Adjustment-Test (RAT). In the BAT the subject is seated in the tilted chair with the room also tilted, and with the room remaining tilted the subject is required to direct the movement of the chair to a position in which he perceives it to be upright. In the RAT the subject is seated in the chair, and while his chair remains tilted, the subject instructs the experimenter to move the room to a position in which he perceives it as upright. Successful performance on these tests requires the subject to rely on bodily cues and to resist the influence of the field; the field-independent person is able to do this but the field-dependent is not.

The Rod-and-Frame Test evaluates the individual's perception of the upright in a limited visual field. The apparatus consists of a luminous square frame, which is pivoted at its centre so that it may be tilted left or right, and a luminous rod, which is pivoted at the same centre but can move independently of the frame. The test is conducted in the dark so that all the subject can see are the rod and frame which are presented in tilted positions. On some trials the subject is sitting upright to facilitate the use of body cues, and on other trials the subject is tilted so that it is more difficult to utilise body cues. Successful performance on this test requires the subject to "extract" the rod from the tilted frame through reference to body position.

Because of the consistent individual differences in perception of the upright on the TRTC Test and the RFT, and the high correlation between these measures, Witkin formulated the hypothesis that they might be accounted for by the ability to overcome an embedding context. The embedded figures test was developed to test this hypothesis.

On the EFT, like the TRTC and RFT, the subject is required to separate an item from the field, but, unlike the TRTC and RFT, he does not have to determine the position of the upright or the body. The task set for the subject is to locate a particular simple figure which is "embedded" in a larger and more complex coloured design, and the score is the mean time taken to locate twenty-four such figures. On this test, field-independence is reflected by a low score and field-dependence by a high score.

It can be seen that testing subjects with the RFT, TRTC and EFT is both expensive and time consuming, so other embedded-figures-tests have been devised to overcome these problems. Jackson (1956) constructed a shortened version which correlates in the mid-nineties with the full-scale EFT yet can take about a quarter of the time. Jackson et al. (1964) developed a series of group EFTs as measures of field-independence. Two tests used twelve of the Witkin figures in their original form, and one used them without colour; in these tests subjects cannot see the simple and complex figures at the same time so memory is required to locate the simple figures. In two other tests (one chromatic, one achromatic) the figures are presented on the same page so that little memory is involved. The correlations of these tests, with the EFT range from .56 to .84 - substantial but not as high as would be desired.

Witkin et al., (1962), report very significant correlations among the tests in the perceptual battery, which they claim provide evidence of substantial consistency of functioning in these situations. In other independent investigations, however, such a clear picture has not emerged. When Gruen (1955) intercorrelated the TRTC, RFT and EFT, he obtained only four significant correlations out of 14, and one in the opposite direction to what was predicted. Other experiments have produced a number of significant correlations, but these are also much lower than those reported by Witkin (Elliott, 1961; Young, 1959). These are taken to suggest that the field-independence dimension is not as factorially pure as was at first indicated.

II.2.2 Field-Independence and Sex Differences

One of the early findings was consistent sex differences in performance on the tests of the perceptual battery: males tended to be more field-independent and females more field-dependent (Witkin, 1950). This has been observed in many other studies and sex differences have been examined in relation to differences in intellectual functioning, personality and parental attitudes.

Witkin et al. (1962) report nineteen studies using the EFT and RFT where sex differences have been obtained (performance on the BAT has not revealed sex differences, but this test has not been used very frequently). Sex differences appear to begin about the age of eight and are most pronounced in adulthood. However, there are a few investigations where differences were not obtained on these tests (Gruen, 1955; Bieri, 1960), and Jackson et al. (1964) report no sex differences in performance on the group embedded figures tests.

In addition there are different patterns of correlations for males and females. The perceptual tests are more highly intercorrelated for males than females; correlations with other measures of ability are generally higher for males; correlations with personality measures are often higher for females.

Bieri et al. (1958) suggested that sex differences in field-independence might be related to sex differences obtained on tests of spatial ability where males also perform better than females. In their sample they found that males performed significantly better on the EFT and on mathematical aptitude, and mathematical aptitude and EFT scores were significantly correlated for both males and females. From these results Bieri et al. suggest that two factors may account for sex differences in EFT performance among their subjects: i) the superior mathematical aptitude of the male subjects, and ii) the males are more able to combine this aptitude effectively with a conceptual approach to social and objective stimuli, which facilitates EFT performance.

Witkin et al. (1954) suggested that differences in biological roles might lead to differences in the development of articulation of experience, but there is no real evidence for this. A more promising line of investigation appears to be an examination of the different sex roles in our culture. Females are encouraged into a passive, dependent role and males are expected to adopt a more assertive and independent role. This hypothesis was taken further by Bieri (1960) to analyse within sex differences in parental identification, acceptance of authority and EFT performance. If the male role is more independent one would expect father identifiers to be more field-independent than mother identifiers; and as acceptance of authority reflects a more passive and conforming attitude one would expect it to be related to field-dependence. Their results indicated that these relations do hold, and that parental identification is more closely related to field-independence for females, while attitude to acceptance of authority is a more important dimension in relation to field-independence for males.

One would also expect that within each sex field-independence would be associated with masculinity and field-dependence with femininity. Fiebert (1967) reports that there have been few investigations testing this hypothesis and the most they have generally yielded are relatively weak relationships. Using a heterogeneous masculinity-femininity battery, compiled of five sub-tests, and correlating results separately for each sex Fiebert also found an overall weak relationship, but certain sub-tests did correlate significantly with field-dependence, and the correlations were especially high for females. An analysis of these scales revealed that they contained a large number of items relating to feelings of pity and disgust. As an explanation of this result Fiebert suggests that ....

".....women (and perhaps men) who respond adversely to certain stimuli are also field-dependent in their cognitive style behaviour. Thus, it is not high femininity per se which is related to field-dependent behaviour, rather a particular dimension of M-f." (1967, Page 1278)

II.2.3 Field-Independence and Intellectual Functioning

A number of investigations have indicated a relationship between field-independence and intelligence, and the magnitude of the relationship seems to depend both on the measure of field-indepencence and the nature of the intelligence test. The following correlations are illustrative of those between field-independence and general intelligence:- EFT time and ACE intelligence test scores, r = -.53 (p<.001) (Jackson, 1957); perceptual battery scores and Stanford Binet I.Q., r = .59 (boys), r = .76 (girls) (Witkin et al., 1962); EFT and Otis I.Q. r = .34 (p<.05); group Hidden Figures Test and Otis I.Q. r = .42 (p<.01), but insignificant correlations of EFT and group HFT with SCAT Total (Spotts and Mackler, 1967).

Other studies using less general measures of intelligence indicate that field-independence is related to non-verbal but not verbal intelligence, and the correlations with total I.Q. may be "carried" through correlations with non-verbal subtests, e.g. EFT and SAT mathematical aptitude r = .50 (p<.001) for females, r = .40 (p<.01) for males, but insignificant correlations between EFT and SAT verbal aptitude (Bieri et al., 1958); EFT and SCAT Quantitative r = .29 (p<.01), EFT and SCAT Linguistic r = .21 (p<.05), but insignificant correlations of the RFT and Thurstone's EFT with SCAT scores (Elliott, 1961). In another experiment the SCAT Quantitative was found to correlate .39 (p<.01) with the EFT, and .31 (p<.05) with a group HFT, but the correlations of these two measures of field-independence with SCAT Verbal and Total scores were insignificant (Spotts and Mackler, 1967).

The association of field-independence with non-verbal measures of intelligence has been investigated further by a factor analytic study of the TRTC, RFT EFT and the WISC subtests (Goodenough and Karp, 1961). Three major factors were obtained, one of "Verbal Comprehension", one of "Attention-Concentration", and a third factor defined by the BAT, RFT, EFT and three of the WISC subtests, Picture Completion, Block Design and Object Assembly. The common requirement of the tests loading on this factor seems to be the capacity to overcome embeddedness.

Factor analysis has also helped to clarify the relation of field-independence to other cognitive processes. Field-independence has been identified with Adaptive Flexibility (see Witkin et al., 1962) and Flexibility of Closure (Pemberton, 1952a). These results, and those of Podell and Philips (1959, see Witkin et al., 1962), where the EFT and a similar test with a random distracting context were found to load on the same cluster, indicate a common requirement of overcoming distracting rather than embedding contexts, but Karp (1963) reported that the field-independence and other embeddedness tests loaded and defined different factors from the distraction tests, although the two factors tended to be moderately correlated.

II.2.4 Field-Independence and Personality

Witkin et al. (1954) attempted to test the validity of the field-dependence-independence dimension by investigating its personality correlates. They administered a battery of personality tests based on clinical techniques including the Rorschach, TAT, DAP and an assessment interview, and interpreted the results as indicating considerable validity to the dimension. The characteristics of the field-dependent and field-independent individuals were summarised as follows:

"Field-dependent persons tend to be characterised by passivity in dealing with the environment; by unfamiliarity with and fear of their own impulses, together with poor control over them; by lack of self-esteem; and by possession of a relatively primitive, undifferentiated body image. Independent or analytical perceptual performers, in contrast, tend to be characterised by activity and independence in relation to the environment; by closer communication with, and better control of their own impulses; and by relatively high self-esteem and a more differentiated, mature body image".

However, this research has been severely criticised for its methodological weaknesses (Postman, 1955) and it now appears that the dimension may not be as factorially pure as Witkin and his colleagues believed (Gruen, 1957. Young, 1959). There have been many attempts to replicate the above personality correlates of field-independence, using a variety of personality measures, but in most cases their results are much less significant than those of the Witkin group.

Young (1959) found partial confirmation for the activity/passivity dimension (originally considered to be one of the main correlates of field-independence), but League and Jackson (1961) concluded from their results that activity reflected in perceptual tasks was not observable in other measures of personality. Orientation toward inner life (originally the other major dimension) has also received only partial confirmation. Young obtained significant correlations between introspectiveness and performance on the RFT but not on the EFT; Evans (1967) found extraversion (on the MPI) to be significantly related to field-dependence on the DAP and EFT; and Marlowe (1958) reported a significant correlation between Intraception and EFT performance. However, Elliott (1961) obtained no significant correlations between EFT and RFT measures of field-independence and either psychological mindedness or self-concept differentiation; and Bieri and Messerly (1957), contrary to expectation, found extratensive subjects to be significantly more field-independent than introversive subjects.

Other investigations have attempted to relate field-independence to personality measures of independence. Several confirmatory findings are reported by Witkin et al. (1962) but again other experiments tend to yield less significant results. Linton (1955) found field-dependent performance on the TRTC and EFT to be associated with high conformity on autokinetic tests and measures of attitude change. Elliott (1961) reported a significant correlation between independence of judgement and Thurstone's EFT, but not Witkin's EFT or the RFT. Partial support was provided by Marlowe (1958) who found the EFT correlated significantly with Succorance but not with Autonomy or Dominance on the EPPS; but Dana and Goocher (1959) failed to obtain any significant correlations between the EFT and the EPPS. Ohnmacht (1968) attempted to relate field-independence to independence measured on the 16PF, but the correlation between the HFT and this measure was insignificant. However, it has been significantly correlated with the RFT for females, .30 ($p<.01$), but not for males (Johnson et al., 1969). Ohnmacht queried the construct validity of the measure of independence on the 16PF but it was suggested in reply that the lack of relationship was possibly due to reliance on a single test as a measure of field-independence and that this construct would be more fruitfully investigated through a factor analytic approach (Cattell and Hundleby, 1968; Cattell, 1969).

A relation between field-independence and achievement motivation has been hypothesised since both field-dependence and low need for achievement have been attributed to restrictive parental pressures and fewer demands for independent behaviour. Wertheim and Mednick (1958) obtained a significant correlation between the EFT and n-Ach, .40 ($p<.01$), but Honigfeld and Spigel (1960) suggest that this was due to the large number of females in the sample, since they found a significant positive correlation (.42) for females and an insignificant negative correlation (-.12) for males. However, Marlowe (1958) also used a sample consisting mainly of females, yet the correlation between the EFT and Achievement on the EPPS was insignificant; a possible explanation for this result concerns the nature of the material for testing achievement motivation, since Marlow used a paper and pencil test and the former authors used a projective test.

It has been suggested that although neither field-independence or field-dependence is predictive of good or bad adjustment they are predictive of the kind of pathology persons may develop (Witkin et al., 1962). Field-dependents tend to suffer from illnesses characterised by severe identity problems, poorly developed controls, inadequacy, passivity and helplessness - e.g. hysteria, alcoholism, asthma. Field-independents, on the other hand, tend towards illnesses characterised by self-aggrandisement, expansive delusions, isolation and a struggle to maintain identity - e.g. obsessive - compulsive behaviour and paranoia. If these tendencies are latent in the general population they might be expected to show up on clinical measures. Female nurses who are field-dependent were found to have higher deviations on the MMPI scales (Goldbloom and Silverman, see Adevai et al., 1968) but a réplication with male students revealed no significant differences (Adevai et al., 1968). Similarly the female field-dependent subjects were significantly more anxious than field-independent subjects, but the male subjects did not differ significantly. However, a significant correlation between field-dependence and anxiety among male subjects was reported by Messick and Fritzky (1963). It therefore seems that among normal subjects attempts to relate field-independence-dependence to type of pathology or anxiety are generally inconclusive.

Messick and Fritzky also found field-independence to be related to severity v. sentimentalism, but this and anxiety are the only two personality variables which correlate out of a total of thirty-one, including independence-yielding, complexity-simplicity, and authoritarianism. In Pemberton's study (1952b) flexibility of closure, on which the HFT was highly loaded, was related negatively to the following traits: socially outgoing, systematic and dependent on good opinion of others, and was positively related to the following characteristics: ambitious and persevering, logical and theoretical.

An interesting experiment which may help explain the lack of hypothesised relationships in some of the above studies was conducted by Gordon et al. (1961). In a factor analytic investigation of the Gottschaldt EFT and part of Saunder's Personality Research Inventory they obtained three interpretable factors. Factor A consisted of EFT items which were easily solved, and their correct solution was related to impulsivity and intolerance of ambiguity. The items loading on Factor B were more difficult to solve and were related to tolerance of both ambiguity and frustration. The items on Factor C required the subject to shift his attention to different parts of the figure for correct solution, and they were related to tolerance of frustration and a reduced need for self-gratification. These three different types of items and their unique personality correlates would not be evident in other studies using one total measure of field-independence and correlating it with personality variables, and this may be one reason why so many investigations of personality correlates of field-independence have been inconclusive.

II.2.5 Field-Independence and Creativity

There have been few investigations of the relationship between field-independence and creativity, which is surprising when one considers that tests very similar to the EFT have been used as part of creativity test batteries (e.g. Getzels and Jackson's Hidden Shapes) and the reported personality correlates of field-independence and creativity are also remarkably similar.

Spotts and Mackler (1967) have made the most extensive investigation, using the EFT, a group HFT and four creativity tests from the Torrance and Guilford batteries. They found that field-independents performed consistently better than field-dependents on the creativity tests, both when the groups were matched for intelligence and when they were unmatched. Bieri et al. (1958) obtained a significant correlation between the EFT and Brick Uses for males but not for females. McWhinnie (1967) reported that the EFT correlated significantly with originality and elaboration but not with flexibility or fluency, however, he failed to mention the tests from which the measures of creativity were obtained.

There is some support for the similarity of the field-independence dimension and creativity in a summary of traits shared by field-independent and creative persons (Bloomberg, 1967). (See Table II.3)

However, there may be situations where field-independence possibly hinders creativity. As Crutchfield points out:

"Analytic perception is sometimes the enemy of creative insight. What may be needed is a free spontaneous look at the phenomenon, a childlike apprehension of what is there, an attitude of what may be called disciplined naivete."

(See Bloomberg, 1967). It appears that creativity involves both analytical and global functioning and the ability to shift readily from one mode to the other.

The most promising approach to finding a link between field-independence and

TABLE II.3

Review of Studies Finding Similar Traits in Field Independent and Creative Persons

Trait	Field-Independent	Creative
Low conformity	Linton	Barron
High level of incidental learning	Witkin et al.	Mendelsohn and Griswold
Relative lack of repression	Witkin	Myden
Risk taking	Kogan and Wallach	Mackworth Taylor and Holland
Permissive parents	Dyk and Witkin	Getzels and Jackson
Low identification with mother (among males)	Vaught	Garwood

(from Bloomberg, 1967, page 132)

creativity seems to lie in examining the concepts of "differentiation" (Witkin et al., 1962) and "fixity-mobility" (Witkin, 1965) and relating them to constructs employed by other theorists. (See Bloomberg.)

The concept of differentiation has been popular amongst developmental theorists, e.g. Lewin, Piaget and also Werner, on whose theory Witkin's is modelled. Werner proposed that development involves an increase in differentiation and hierarchic integration. Developmentally earlier perception is said to be global, where whole qualities are dominant, this is followed by analytic perception where attention is directed towards parts, and the final stage is synthetic, where parts become integrated with respect to the whole. It can readily be seen how closely this compares with Witkin's analytic and global functioning of field-independents and field-dependents.

The other important proposition of Werner's concerns the person's flexibility to operate at different levels depending on the requirements of the situation; i.e. the ability of the highly differentiated individual to regress to earlier levels when necessary. Werner believes that ability to shift vertically between levels is essential to creativity. Here also an analogy may be drawn with Witkin's (1965) observation that some field-independents function consistently at a highly differentiated level, whereas others are able to vary their behaviour. Witkin suggests that the former show "fixity of functioning" and the latter show "mobility of functioning". Field-dependents would not be able to show mobility since they are fixed at a lower level. This difference in ability to shift levels appears very similar to the requirements for creativity and it led Bloomberg to the hypothesis that field-independence is a necessary but not sufficient cause for creativity; hence all creative persons are field-independent, but only some field-independents are creative.

Haronian and Sugarman (1967) suggest that fixity and mobility of functioning would fit in with Kris' psycho-analytic concept of "regression in the service of the ego", a process where intellectual activity and passive receptiveness are combined in creativity (see II.1.1). They also relate it to the developmental theory of cognitive complexity proposed by Harvey, Hunt and Schroeder, who postulate that behaviour develops from being global and simple into being differentiated and complex, through a series of four stages. These stages occur in the following order:

Stage I (concrete) - persons functioning at this level depend on rules and external authority.

Stage II (concrete) - these persons are negativistic, they question controls, manifest distrust and externalize blame.

Stage III (abstract) - people at this level adopt dependent roles, they are self-critical and fear rejection.

Stage IV (abstract) - people functioning at this level are autonomous, flexible, secure, democratic and well integrated.

Haronian and Sugarman suggest that Stage IV persons would correspond to mobile field-independents, Stage II persons would be like fixed field-independents, and presumably Stage I would correspond with field-dependence. At present there is nothing corresponding to stage III, nevertheless, the attempt to relate the two theories in this way is an important step.

Spotts and Mackler (1967) mention two distinguishing features of the creative individual, he is highly sensitive to his environment, and he shows a need and ability to "toy" with, restructure and integrate experience. They suggest that the field-dependent person is also extremely sensitive to the environment but he shows little awareness of experience and is unable to structure or integrate environmental events; in contrast the field-independent person, although lacking in sensitivity to the environment, is more able to articulate his experience and environmental events, and he shows the freedom from constraints which may enable creativity. Spotts and Mackler then relate these styles of functioning to Schachtel's theory of creativity, and suggest that the field-dependent person, needing the security of secondary embeddedness, uses autocentric perception, while the field-independent individual, who is able to remain perceptually open to the environment may manifest allocentric perception, (see II.1.1).

II.3 COMPLEXITY - SIMPLICITY

The research described in this section covers a wide area of psychology, and for the purpose of discussion the topics have been divided according to the theoretical standpoint of the investigators or the nature of the research. Inevitably there is some overlap, and the parts are intended to be considered as related, not independent.

The first two parts are complementary, both are concerned with general preferential behaviour, but their orientations differ. The first part focuses on the specification of stimulus properties such as complexity and information content and on organismic variables involved in reaction to these stimuli. In the second part preferential behaviour is examined through experimental aesthetics. After this the emergence of the complexity - simplicity dimension as a variable in aesthetic preference is traced; then individual, group and sex differences in preference for complexity - simplicity are discussed. Following this the relation of complexity - simplicity preference to intelligence, field-independence and creativity is examined; and finally the generality of preference for complexity - simplicity is considered.

II.3.1 Expressed Preference as a Function of Stimulus Variability

The introduction of information theory in the late 1940's had wide implications for psychology and was the impetus to research in many areas. It stimulated the study of human reaction to environmental variability in two ways; by employing the concepts of information theory it became possible to specify and quantify stimulus properties more accurately than previously, and by drawing analogy with information transmission some cognitive theorists began to study human beings as information processing systems.

In most of the investigations presented here, stimulus attributes such as complexity or novelty are manipulated to determine their motivational significance for an organism. First some explanatory models of how an organism reacts to and deals with stimulus variability will be reviewed and then experimental support for the models will be discussed.

Berlyne (1969) suggests that "collative variables", such as information, novelty, complexity, incongruity or surprisingness are the important stimulus attributes for determining curiosity and exploratory responses. They are said to take effect by causing conflict in the organism and so increasing its level of arousal. As increased information about the stimulus leads to a reduction in conflict, and the corresponding decrease in arousal is held to be reinforcing, the organism is attracted to these collative variables. Berlyne has experimental support that organisms are attracted to these variables, but there is still some doubt as to the adequacy of conflict as an explanatory concept since it implies a positive approach to a punishing situation (Maddi, 1961).

Berlyne distinguishes two kinds of exploratory behaviour: specific exploration which,

"... is aimed at receipt of information from particular sources and occurs when the subject is in the kind of motivational condition that we call 'perceptual curiosity'."

and diversive exploration which is,

"... aimed at stimulation from any source that possesses collative properties to the right degree." (1969, Page 133)

Berlyne further suggested that the motivating factors in diversive exploration may be associated with interest in "formal beauty" and decoration in art, and that specific curiosity may be associated with attempts to understand the meaning of and relations within a picture.

Fiske and Maddi (1961) believe that variation in stimulation is the major determinant of exploratory behaviour. Variation consists of novelty and surprisingness and includes complexity because the complex stimulus provides greater opportunity for temporal change; variation together with physical intensity and meaningfulness constitutes the impact of a stimulus. The organismic variable employed here is similar to Berlyne's but, whereas he considers the optimal level of arousal to be important, Fiske and Maddi suggest it is the normal level of activation. The organism seeks to maintain this level in order to avoid the negative affect induced by large discrepancies, and an equilibrium may be achieved by seeking variation when the level drops too low and avoiding variation when it rises too high.

Dember and Earl (1957) regard complexity as the stimulus property which determines responses such as attention and curiosity. They suggest that every organism has a complexity value, built up from past experience, which sets the limits for the amount of stimulus complexity it can deal with most effectively. There is also an amount of complexity which it prefers to attend to, called the "pacer" stimulus, which is just above the level which can be dealt with most effectively. They argue that exploration does not reduce the complexity of the stimulus, rather it increases the organism's complexity value, i.e. its ability to assimilate complexity is improved. This theory can account well for cognitive growth and for most preference functions, but it has been criticised for not allowing for stimuli which are simple but attract much attention, e.g. "A rose is a rose is a rose". Fiske and Maddi can account for this better than Dember and Earl since, although this sentence is highly redundant it is also highly surprising (Maddi, 1961). However, the most important of Dember and Earl's propositions, with regard to the research it has stimulated, is that every organism has an optimal level of complexity which it prefers to attend to, and as distance from this optimal level increases preference will decrease.

The assumptions made by Munsinger and Kessen (1964) in studying the effect of stimulus variability on preference are also of relevance here as a theoretical construct. (See also II.4.) They have stated their fundamental assumptions as follows:-

"a) There is an apparent limitation of the ability of human beings to process environmental variation.

b) It is possible to escape the restriction of this limitation by means of coding rules derived from past experience with environmental variability. It is held that the inter-relation of environmental variation (stimulus variability) and effective coding rules (cognitive structure) can be described as cognitive uncertainty.

c) Human beings prefer an amount of cognitive uncertainty which matches their processing ability. Cognitive uncertainty and, correspondingly, preference can change either through changes in stimulus variability or through the development of cognitive structure." (1964, Page 2)

It can be seen that Munsinger and Kessen, like Dember and Earl, postulate an optimal level of environmental variability; stimuli far below this level lead to boredom and stimuli far above produce confusion. Thus, it would be predicted that preference will be a curvilinear function of variability, with stimuli of intermediate values being most preferred.

The above theories provide the framework within which most of the following experiments were conducted. These experiments provide some support for the propositions mentioned above; some evidence is provided by the theorists and some by other research workers investigating the relation between different kinds of stimulus complexity and preference.

From Berlyne's theory it would be predicted that subjects would choose more complex stimuli over less complex ones, and Berlyne (1969) discusses ways of measuring this choice. He mentions that verbally expressed preference is the response used in most research emphasizing the aesthetic aspects of stimuli, but in addition to this he suggests the use of psychophysiological indices and measures of overt exploratory behaviour. He has, in fact, employed these responses in a series of experiments on reaction to patterns containing collative variables. The stimuli used consisted of pairs of patterns, one containing a greater amount and one a lesser amount of a given variable such as asymmetry, regularity or incongruity.

It was found that when the stimuli were presented tachistoscopically the more complex patterns produced more prolonged E.E.G. desynchronization, which is an index of heightened arousal. When the length of time that subjects chose to expose themselves to stimuli was measured it was found that with relatively simple stimuli subjects chose the one which was more complex, but when the stimuli were relatively complex it was the less complex stimulus which was chosen more frequently. These results indicate that exploration is an inverted U shaped function of complexity, although, as Berlyne points out, there are considerable individual differences in the location of the peak of the curve.

Results suggesting the operation of specific and diversive exploration have also been obtained. Berlyne (1963) showed that after exposure to patterns for three or four seconds subjects tended significantly to choose the less complex pattern to view for a further period, but when the initial exposure was only half to one second the more complex patterns were chosen to be viewed. An explanation of these results is that brief exposures induce specific curiosity about the stimuli and with longer exposure times specific curiosity is dissipated so it is diversive exploration which is operating. It may seem rather surprising that stimuli containing lesser amounts of the collative variables are chosen when diversive exploration occurs but a further experiment helps clarify the position. Berlyne (1963) asked subjects to rate the patterns on a 7-point scale, some subjects rated the patterns for "pleasingness" and others rated them for "interestinness". There was a significant tendency for the more complex patterns to be rated as less pleasing but more interesting. Berlyne interpreted his results as indicating that:

"...the patterns that subjects look at for a longer time are not those that they judge more pleasing but, on the contrary, those that they find less pleasing and more interesting. These are also the patterns that, according to our electroencephalographic findings, are more arousing or disturbing. On the other hand, patterns judged more pleasing tend to be the ones to which subjects prefer to expose themselves when given a choice after adequate acquaintance with the alternatives and dissipation of perceptual curiosity." (1969, Page 135)

An extensive series of experiments on preference for verbal sequences and random shapes was conducted by Munsinger and Kessen (1964). The verbal sequences consisted of different sequential approximations to English (Miller and Selfridge, 1950), varying from redundant letters through prose to random letters. As hypothesized the most preferred sequences were of intermediate variability. When the experiment was repeated using third and sixth grade children as well as adults (Munsinger et al., 1964) it was found that for all groups preference was an inverted U function of variability, but for younger children the point of inflection was nearer the redundant end of the continuum. This result, together with the finding that there is a direct relation between recall of and preference for variability (Munsinger and Kessen, 1966a) is interpreted as indicating that preference is related to processing ability.

Munsinger and Kessen argued that when verbal sequences were used as stimuli cognitive uncertainty was largely a function of cognitive structure i.e. the processing and coding ability of the person. So for further experiments they decided to use random polygons as they claimed that persons would not have many rules for coding such stimuli and therefore cognitive uncertainty would be largely a function of stimulus variation. (See also II.4.)

Using asymmetrical random polygons varying from three to forty independent turns preference was found to be a W shaped function of complexity (Munsinger and Kessen, 1964). It was argued that the unexpected high preference for figures of very few and very many turns was due to their meaningfulness, so two further experiments were conducted, one using random shapes from five to twenty-five turns, and one using random shapes from five to forty turns which were corrected for meaningfulness. In both these studies preference was found to be an inverted U shaped function of complexity. However, when art students judged the original random shapes preference was found to be an increasing monotonic function of complexity. This result was interpreted as an indication that the art students' experience with shapes enabled them to deal more effectively with the polygons. It is interesting that a remarkably similar preference function was obtained when non-art students expressed their preference for symmetrical shapes varying from five to twenty-five independent turns. As all the symmetrical shapes were ranked higher in meaningfulness than the corresponding asymmetrical shapes the results are read as confirming the expectation that symmetry reduces stimulus variability and hence increases the ease with which it is processed.

Munsinger and Kessen claimed that the results showing preference to be an inverted U shaped function of complexity, and the monotonic functions obtained a) for less complex stimuli, and b) by experienced art students, supported the proposition that there is an intermediate amount of cognitive uncertainty, corresponding to subjects' limit for processing information, which is most preferred.

Dorfman and McKenna (1966) tested a similar hypothesis - that preference is a function of pattern uncertainty. However, unlike Munsinger and Kessen who held matrix grain constant and manipulated coordinality, Dorfman and McKenna applied the concepts of information theory and manipulated the matrix grain. Their stimuli consisted of combinations of green and white cells varying in uncertainty from four to one hundred and forty-four bits of information. Preference was found to be a curvilinear function of pattern uncertainty for psychology students and art students. The last result was rather surprising in view of Munsinger and Kessen's (1964) finding that art students' preference was a monotonic function of complexity. Dorfman and McKenna also tested the Dember and Earl hypothesis that each subject has a preferred level of complexity and that as distance from this preferred level increases preference correspondingly decreases. Subjects were separated according to their most preferred level of uncertainty, and for each group the mean ranks were plotted against uncertainty. The results supported the Dember and Earl hypothesis ($p < .001$) for all groups among psychology students and art students.

When Vitz (1964) varied the information content of auditory stimuli, (sequences of tones which sounded like simple music) he found that preference was an increasing monotonic function of the amount of information presented. Since there was no evidence of a decline in pleasantness at high information values the experiment was repeated with greater information variation and, as hypothesized, preference was a curvilinear function of uncertainty. A secondary hypothesis that subjects with training and interest in music would prefer more complex sequences was also supported (Vitz, 1966a). Vitz (1966b) then investigated the mean pleasantness ratings of random line compositions, referred to as random walks and random patterns, and found that for these stimuli too, preference was a curvilinear function of complexity. It was also shown that exposure to random walks led to a significant increase in preference for the more complex walks, and subjects with interest or experience in art preferred the more complex walks; however, for random patterns no significant differences were obtained. There was confirmatory evidence for the Dember and Earl hypothesis from both experiments. In discussing these results Vitz made the important point that the perceptual complexity or simplicity of a stimulus may be a poor index of its total psychological complexity.

Rump (1968) conducted a series of interesting experiments employing a wide range of visual stimuli. When Mondrian paintings and combinations of quadrilaterals or triangles were used as stimuli both group and individual preference were curvilinear functions of complexity, but no definite trend appeared in preference for random polygons and symmetrical figures from the Welsh Figure Preference Test. Rump also examined individual differences in age, emotionality and interest in art, but he found no relation between these variables and preference for complexity.

The above experiments, using an impressive array of stimuli, undoubtedly give a firm indication that preference is a curvilinear function of objective complexity. But in their attempt to specify complexity in absolute terms many investigators have ignored a key variable - subjective complexity. As Heckhausen (1964) pointed out, complexity should be considered not only in "elementaristic informational theoretic" terms but also phenomenally, since objective and phenomenal complexity might not always correspond. This is similar to the view of Gestalt psychologists who proposed that the total configuration contains emergent properties which cannot be predicted from a knowledge of the parts. A second distinction which they made concerns the figure/ground relation. Koffka (1922) stated that "...no visual figure can occur without a ground upon which it appears", but the figures here have not been discussed in relation to their ground. A further concept developed in Gestalt theory was "figural goodness", which refers to the symmetry, balance, closure, continuity, simplicity and unity contained in figures. These "good forms" are said to be preferred and when visual stimuli are perceived there is a tendency to impose these dimensions in order to achieve "figural goodness" (see Easterby, 1970). These points raised by the Gestalt psychologists suggest that in addition to stimulus attributes, perceptual attributes may also be important determinants of preference.

II.3.2 Objective Determinants of Aesthetic Preference

The studies discussed here represent attempts to account for general aesthetic preference in terms of objective qualities of the stimulus objects. The studies either present experimental evidence regarding the attributes of stimuli which are considered aesthetically pleasing or they are attempts to devise measures which will predict the aesthetic value of stimuli.

Fechner suggested that "unity in variety" was a fundamental law of aesthetic preferences, and he defined aesthetic pleasure as a function of order and complexity elements (see Eysenck, 1968). However, these propositions were not tested until the 1930's when experimental aesthetics was a popular area of investigation for psychologists. Birkhoff, a Harvard mathematician, stimulated much interest with the publication of a book on aesthetic measure (1932; see Davis, 1936). Based on the concept of unity in variety he devised a formula for the aesthetic measure of polygons, vases, poetry and music. Birkhoff states in his formula that $M = O/C$; i.e. aesthetic measure is a function of order divided by complexity. According to this the most preferred polygon would be the simple square. Birkhoff's formula has been criticized by Davis (1936) who argued that it was not supported by either "a priori" or experimental evidence. An analysis of correlations of the Birkhoff formula with group preference for polygons, poetry, vases and music revealed that although the correlations were all positive they were generally low (Eysenck, 1941b). On the basis of experimental results Eysenck (1942) instead proposed that aesthetic measure is a direct function of order and complexity: $M = O \times C$. In a later study aimed at investigating the bases of preference judgements for polygons Eysenck (1968) obtained eleven meaningful primary factors (e.g. rotational symmetry, simplicity, familiarity and steeple factors), but concluded that a higher order factor of complexity-simplicity was the most important in determining general preference. These results led to the retention of the above formula with only minor modifications of the scoring of order and complexity.

Harsh et al. (1939), noting individual differences in preference judgements, hypothesized that different observers use different criteria. This hypothesis was confirmed when they obtained four independent common factors of judgement, which represented liking for a) smoothness of contour, b) simplicity, c) symmetry, mainly rotational and diagonal, and d) odd points. Harsh et al. therefore, suggested alterations to Birkhoff's formula to account for the operation of liking for smoothness of contour and odd points.

Independent empirical evidence of general aesthetic preference for polygonal and line figures may be interpreted in relation to these proposed formulae. Investigations of polygonal preference have indicated that simplicity is preferred to complexity, and symmetry is preferred to asymmetry (Eisenman, 1967a; Eisenman and Rappaport, 1967); and when these dimensions are combined polygons combining complexity and symmetry are overwhelmingly preferred (Eisenman and Gellens, 1968). This confirms results from an item analysis of the BWAS where the modal preference of male and female non-artists was for complex/symmetrical designs (Moyles et al., 1965). These results, indicating that complex/symmetrical figures are most aesthetic, lend support to Eysenck's formula ($M = O \times C$) since they contain a high amount of order and complexity.

Some of the above studies have implied that the mean preference ratings of a stimulus is a measure of the aesthetic value of that stimulus, and also that the degree to which a person agrees with the mean preference ratings is a measure of his aesthetic sensitivity (e.g. Eysenck, 1940). These proposals have been reviewed critically by Child (1962; 1964) who demonstrated that mean preference for paintings was negatively rather than positively related to the aesthetic value of the paintings as judged by experts. This finding, considered in conjunction with the striking individual differences in preference for complexity - simplicity (see next section), makes it seem somewhat doubtful that the aim of devising a universal objective formula of aesthetic value will be realized.

II.3.3 The Historical Development of Investigations of Aesthetic Preference for Complexity-Simplicity

The importance of complexity-simplicity as a variable influencing aesthetic preference was discovered independently by Eysenck (1940) and Welsh (Barron and Welsh, 1952). Although the nature of their research was very different, Eysenck was concerned with aesthetics, and Welsh with clinical testing, the manner in which they came upon the complexity-simplicity dimension was remarkably similar. In each case a factor analysis revealed a general factor of aesthetic preference and a secondary bipolar factor contrasting preference for complexity with preference for simplicity.

Eysenck numbered among the many researchers of experimental aesthetics in England in the 1930's. In his investigation of visual aesthetic preference for eighteen kinds of pictures, including portraits, statues, bookbindings, clocks etc. a factor analysis revealed a general factor of aesthetic appreciation and a secondary bipolar factor opposing formal and representative art (Eysenck, 1940). The general factor was also found to correlate with appreciation of odours, polygons and colours, indicating that there are some stimuli which are liked by almost everyone. Eysenck believed that this factor reflected "good taste" and hence he called it "T". The nature of the bipolar factor was examined further using pictures of works of visual art, poetry, polygons and odours, and in each case the same bipolar factor emerged. It contrasted persons liking simple, highly unified and brightly coloured pictures, poetry with an obvious rhyme and rhythm, simple polygons, and strong obvious odours, with persons liking more complex and less vivid pictures, more complex polygons, poems with less obvious rhyme and rhythm and more subtle odours (Eysenck, 1941a, 1942). Eysenck's interpretation of this factor is one which opposes simplicity and order with complexity. On the basis of this factor Eysenck later developed a K test in an attempt to relate preference to personality, and it features as an important variable in his formula of aesthetic appreciation.

Welsh was originally not researching into aesthetics but was concerned with constructing a psychiatric diagnostic test which would be a non-verbal equivalent of the MMPI. The test consisted of two hundred 3 x 5 inch white cards containing black and white line drawings to which the subject responded "Like or dislike". When it was given to a sample of psychiatric patients and a control group a factor analysis of the preference scores revealed two factors which accounted for most of the variance. The first was an acceptance - rejection factor (a general tendency to like or dislike the figures) and the second was a bipolar factor, orthogonal to the first, which on inspection of the figures represented complexity - asymmetry and simplicity - symmetry. This dimension did not differentiate patients and controls, but it was noted that persons at extremes of the scale differed in personality. Those preferring complexity - asymmetry, including all the artists in both samples, were judged to be dissident, cynical, eccentric and deviant, and those preferring simplicity - symmetry were quite conservative, organized and conventional (Barron and Welsh, 1952).

Barron and Welsh were interested in these individual differences and wished to see whether the observed differences were due to a) simple differences in aesthetic judgement; b) simple differences in personality of artists and non-artists; or c) related differences in both aesthetic judgement and personality. They therefore constructed a new series of four hundred figures, and chose twenty figures which artists liked significantly more than people in general and forty five which artists disliked significantly more than people in general, to make up the Barron-Welsh Art Scale (BWAS). This scale was cross-validated on other groups where it also differentiated artists from non-artists. The artists liked figures which were complex, asymmetrical, free-hand rather than ruled, restless and moving - or as they described them "organic"; nonartists liked figures which were relatively simple, symmetrical, regularly predictable - these were described by the artists as "static", "dull" and "uninteresting".

The BWAS and the RA (Revised Art scale, consisting of forty items balanced for response bias) have been used in numerous individual difference studies, and complexity-simplicity preference has differentiated people in their interpersonal relations, politics, religion, sensuality, conformity and creativity.

II.3.4 Personality Correlates of Preference for Complexity - Simplicity

This section will concentrate on personality correlates of preference for complexity - simplicity on scales of the Welsh Figure Preference Test (WFPT) and polygons. To introduce this section, however, three experiments using paintings will be mentioned since their results and especially their interpretation are of relevance to this discussion.

Child (1965) measured students' aesthetic judgement of works of art (i.e. their degree of agreement with an external standard of value) and examined the correlates of aesthetic judgement. It was significantly correlated with measures of visual preference including complexity v simplicity on the BWAS ($p<.05$), Barroque v. Classical art and Shades v. brighter colours - a preference for stimuli which appear to share relative lack of obvious unity, structure or meaning. Aesthetic judgement was also significantly correlated with the following cognitive styles as measured by a questionnaire: tolerance of complexity, scanning, independence of judgement, regression in the service of the ego, intuition v. sensation, and perception v. judgement. Child makes an interesting interpretation of the general pattern of these correlates which lead him to suggest that:

"...good aesthetic judgement is in large measure an outcome of a general cognitive approach to the world, an approach involving search for complex and novel experience which is then understood and evaluated through relatively autonomous interaction of the individual with objects providing such experience." (1965, Page 510)

Child points out the similarity between this personality pattern and that of creative individuals described by Barron and MacKinnon.

Pyron (1966) hypothesized that persons have a need for complex and simple order, and that this need would be related to acceptance and rejection of avant-garde art. He argued that avant-garde art contains more ambiguity, novelty, and unexpected arrangements than classical or popular art which contain more order, regularity and predictability; subjects with a need for predominantly simple order would therefore be expected to reject avant-garde art because of its ambiguity and uncertainty. In support of this hypothesis Pyron found that rejection of avant-garde art was significantly related to simplicity of social ordering and some measures of attitudinal rigidity.

Eysenck's K factor has already been described as one which opposes preference for complexity to preference for simplicity. In order to explore its psychological ramifications Eysenck (1941a) developed the K test which consisted of pairs of pictures dealing with the same subject matter but in different ways, one being modern and colourful and one being classical. Preference for modern art was found to correlate significantly with extraversion, radicalism and youth; a further study confirmed the relation with extraversion and radicalism, and added general interest in art to the list of correlates (1941c).

The most extensive studies on personality correlates of complexity - simplicity preferences have used the BWAS or the RA scale. However, in interpreting the results it should be borne in mind that although Barron may refer to the scale as a measure of complexity - simplicity it is heavily confounded with asymmetry - symmetry.

Barron (1952) conducted an investigation on personal effectiveness in male graduate students. It was hypothesized that the BWAS, as a measure of aesthetic taste, would differentiate subjects rated high or low in personal effectiveness. Although this hypothesis was not confirmed Barron did obtain a bimodal distribution of scores on the BWAS, representing preference for complexity - asymmetry and preference for simplicity - symmetry. The two groups, one preferring complexity and one preferring simplicity, were then compared on their preference for paintings and their self-description on the Gough Adjective Check-List. The striking differences have been summarized by

Barron as follows:

"I

In Figure Preferences:

Preferring what is simple, regularly predictable, following some cardinal principle which can be educed at a glance.

In Art Preferences:

Preferring themes involving religion, authority, aristocracy, and tradition.

In Adjective Self-Checks:

Contented, gentle, conservative, patient, peaceable, serious, individualistic, stable, worrying, timid, thrifty, dreamy, deliberate, moderate, modest, responsible, foresighted, conscientious.

II

In Figure Preferences:

Preferring what is complex, irregular, whimsical.

In Art Preferences:

Preferring what is radically experimental, sensational, sensual, esoteric, primitive and naive.

In Adjective Self-Checks:

Gloomy, pessimistic, bitter, dissatisfied, emotional, pleasure-seeking, unstable, cool, irritable, aloof, sarcastic, spendthrift, distractible, demanding, indifferent, anxious, opinionated, temperamental, quick."

(1953b, Pages 164-165)

In addition Barron (1953b) compared the performance of these groups on personality tests, objective tests and interviews. The results which have also been confirmed in two other samples of male college students are given below:

a) complexity is related positively to personal tempo, verbal fluency, impulsiveness and expansiveness.

b) it is related positively to originality, good taste, and artistic expression.

c) it is related positively to sensuality, sentience, aesthetic interest, effeminacy and femininity in men.

d) it is related negatively to rigidity and constriction.

e) it is related negatively to control of impulse by repression and positively to expression of impulse and to breakdown of repression.

f) it is related negatively to political and economic conservatism, to subservience to authority, to ethnocentrism and to social conformity.

g) It is related positively to independence of judgement.

As an explanation of these results, Barron suggests that persons who prefer complexity are oral characters. In their personality attributes he finds indication of early oral deprivation and pessimism concerning the maternal source of supply - a lack of Erikson's infantile "trust". Supporting this supposition is the relationship obtained between complexity and femininity which may also be a characteristic of oral fixation.

Barron (1952) claimed that preference for complexity or simplicity represents a "perceptual decision" - a choice of what to attend to in a world that is both simple and complex, stable and unstable, predictable and unpredictable, ordered and chaotic. A person may attend primarily to the simple, stable, and predictable aspects, or he may attend to the complex, unpredictable and arbitrary aspects of the world. Both of these perceptual decisions may be associated with personal effectiveness or ineffectiveness. According to Barron, preference for simplicity at its best makes for stability, optimism and trust, and at its worst leads to rigidity, fear of aggressive and erotic impulses and categorical rejection of all that might disturb order and equilibrium: preference for complexity at its best makes for creativeness, originality and richness of experience, and at its worst it produces disorganized behaviour, surrender to chaos, nihilism, despair and disintegration.

Some of Barron's hypotheses and results have received confirmation from other investigators. Sechrest and Jackson (1961; see Bieri, 1961) suggested that complexity of family background may be a determinant of preference for complexity. They found that preference for complexity on the BWAS was related to social intelligence - this would not be expected from Barron's finding of non-conformity, but his sample consisted of males and this one of females. Bieri suggests that the obtained differences may be due to sex differences, and that for women personality characteristics related to complexity preference are more typical of the feminine role. Littlejohn (1967), using a sample of male and female adolescents, compared high and low scorers on the RA on tests of masculinity - femininity, and obtained only partial support for Barron. Males preferring complexity scored significantly more feminine on the MF scale of the WFPT than did males preferring low complexity, but they did not differ on the four other questionnaire measures. High complexity girls also scored significantly higher on femininity on the MF scale of the WFPT, but on three of the questionnaire measures they were significantly more masculine than low complexity girls.

Cashden and Welsh's (1966) sample, consisting of talented male and female adolescents in art and natural science, expressed preference for complexity - simplicity on the RA and rated themselves on the Gough Adjective Check-List. There was no significant difference in self-description of high complexity subjects in art and science, nor between male and female, indicating that high complexity subjects show similar personality characteristics. But there were significant differences in personality between subjects showing high and subjects showing low complexity preference: the adolescent who likes complexity was characterised as an autonomous, non-conforming individual who is spontaneous, energetic and enjoys expressing his will; he prefers variety and changes, delights in what is new and is open and active in interpersonal relations; on the other hand, the adolescent liking low complexity, particularly the male, is somewhat compulsive, eager to please, overly concerned with maintaining order, and he shies away from change. These personality patterns are so similar to those of high and low creative subjects that Cashden and Welsh suggest that preference for complexity on the scales of the WFPT may be regarded as a measure of creativity.

Day (1966) reported some experiments where preference for complexity - simplicity was not so strongly associated with personality variables. In one investigation extraversion was significantly correlated with preference for complexity on the BWAS, but not with measures of exploration; and neither preference for complexity nor exploratory behaviour was significantly correlated with tolerance of ambiguity (Day, 1964; see 1966). In a further experiment the BWAS was correlated with extraversion but not with neuroticism, dogmatism or intolerance of ambiguity, and none of these personality variables was related to looking time (Day, 1966).

There have been relatively few experiments on the personality correlates of polygonal preference, and those that have been conducted are mainly the work of Eisenman and his colleagues. Using as stimuli random asymmetrical polygons from Vanderplas and Garvin and symmetrical polygons from Birkhoff (see Taylor and Eisenman, 1964), he has attempted to extend some of Barron's findings of the correlates of preference for complexity-simplicity.

Eisenman hypothesized a relationship between birth order and complexity preference. Since first borns are regarded as more conservative and conventional they would be expected to like less complexity than would later borns, and Eisenman demonstrated that among females, first borns were more anxious and preferred less complexity (1965a). Although these results have been confirmed on other females there must be a sex/birth order interaction because it was shown that among males, first borns preferred greater complexity than later borns (Eisenman, 1967b, 1967c). Eisenman found a significant curvilinear relation between anxiety and complexity preference (subjects of moderate anxiety preferred the most complexity), but complexity preference was not significantly related to flexibility, a questionnaire measure of independence of judgement, insolence or socialization (1968a, 1968b). However polygon preference has been associated with attitude change. Subjects preferring simplicity showed the least change when they were involved in their attitudes and the greatest change when they were uninvolved, subjects preferring complexity showed identical intermediate changes in attitude under both conditions. These results are interpreted as indicating that preference for simplicity is associated with a lack of independence and a susceptibility to external influence on objective issues, and with rigidity and dogmatism in beliefs (Eisenman, 1968c).

II.3.5 Group Differences in Preference

Some group differences in preference for complexity - simplicity on the BWAS would be expected from the nature of the scale construction, since it was designed to differentiate artists from people in general. A comprehensive list of group preferences on the BWAS and RA, presented by Golann, illustrates the way in which these tests are able to discriminate inter- and intra-group differences. In this list high scores indicate preference for complexity and low scores preference for simplicity.

Scores above 35:-

a) Students in creative writing classes

b) Several groups of artists

c) MacKinnon's group of highly creative architects.

Scores 26 - 33:-

a) Writers

b) Highly creative research scientists

c) Less creative architects

d) Mathematicians

*e) Team members of the first American expedition to attempt Mount Everest (*Barron, 1965).

Scores 19 - 24:-

a) Children aged 6 - 8

b) Ph.D. candidates

c) Undergraduates

d) Less creative research scientists

e) Medical school seniors.

Scores 12 - 16:-

a) Unselected adults

b) Military personnel

c) Neuropsychiatric inpatients

(Golann, 1962. P. 589)

The salient features of this list appear to be that subjects in more artistic or creative occupations prefer more complexity, and also within a given occupation more creative subjects prefer more complexity.

Some group differences in polygonal preference have been obtained by Eisenman. A finding that asymmetry was preferred by art students and symmetry by mathematic students led Eisenman to the interesting suggestion that Birkhoff, being a mathematician, might have been biased toward simple - symmetrical stimuli! (Eisenman and Coffee, 1964). Compared with a control group, schizophrenics preferred less complex polygons and less novel poems, and showed less consistency in their preference for complexity and novelty. To account for these differences it was proposed that schizophrenics may have difficulty in assimilating percepts (Eisenman, 1965b). Eisenman also observed that nurses tended to prefer more simplicity than other students and suggested that the former might be more conventional and conservative and less creative than students in general (Eisenman, 1965a; Eisenman et al., 1966).

II.3.6 Sex Differences in Preference

Many investigations using the WFPT scales have had all male samples so there are not many sex differences to report. Welsh (see Schaefer, 1968) noted that in the original control sample of the RA, females preferred more complexity than males, and Schaefer (1968) reported that adolescent girls preferred significantly more complexity than adolescent boys ($p<.001$). This tendency for females to prefer greater complexity has also been observed in polygon preference (see Eisenman, 1967c). Eisenman expressed surprise at these results since females generally seem more conforming and less creative, and he suggested that perhaps females are more responsive to social influences than males but do not necessarily lack aesthetic appreciation. However, Munsinger and Kessen (1964) reported that male and female psychology students did not differ significantly in their preference for random polygons.

II.3.7 Preference for Complexity - Simplicity and Intelligence

Correlational results indicate that preference for complexity - simplicity and intelligence are not related. Littlejohn (1967) reported that RA scores typically show no correlation with IQ, and similarly insignificant correlations have been obtained between polygon preference and IQ. Eisenman and Robinson (1967) found that Stanford Binet IQ correlated +.11 with complexity of most preferred polygon and -.18 with complexity of least preferred polygon, and Eisenman (see 1968c) reported that polygon preference and SAT scores were unrelated. Insignificant correlations between polygon preference and intelligence were also reported by Munsinger and Kessen (1964). Although these results are consistent with the view that complexity - simplicity preferences are not merely reflections of intellectual differences it should be noted that subjects in the latter investigations were students, presumably of above average intelligence, so the findings are of a limited generality.

II.3.8 Preference for Complexity - Simplicity and Field-Independence

There have been surprisingly few attempts to link field-independence and preference for complexity and those that have been made yield generally inconclusive results. Bieri et al. (1958) found that preference for complexity on the BWAS was significantly related to EFT performance among males but not females. They hypothesized that these results:

"...reflect the fact that persons tend to prefer those stimuli to which they can respond most effectively. Those men who are most proficient in coping with the complex figures of the EFT prefer more complexity in art productions." (1958, Page 8)

But Bieri et al. have not received support from other investigations. McWhinnie (1967) administered a battery of perceptual tests and found that preference for complexity - asymmetry on the WFPT and in works of art, and differentiation of form on a figure drawing were all unrelated to field-independence and non-verbal creativity. In addition perceptual training to increase preference for complexity - asymmetry failed to do so in three out of four groups, only sixth grade boys preferring significantly more complexity after training (McWhinnie, 1966). These results bear similarity to those of Child (1965) who found that measures of skill in perception of visual form, including field-independence were unrelated to aesthetic judgement.

II.3.9 Preference for Complexity - Simplicity and Creativity

The results of a number of investigations discussed so far have indicated that creativity and preference for complexity may be closely associated. It is proposed here to extend these findings and to clarify the relation between the two concepts.

Rosen (1955) obtained a significant difference on the BWAS between artists and non-artists, although preference was not related to level of training in art; also among art students preference for complexity was significantly correlated with rated originality and course grades. Partial support was provided by Schaefer (1968) who reported that subjects who both scored highly on creativity tests and were rated as creative tended consistently to prefer more complexity on the RA than controls, but the only difference which reached significance was among boys in artistic fields. Golann (1963) quotes the following results - creativity was related to preference for complexity (Crutchfield, 1961); research workers' creativity was correlated more highly with the BWAS (.41) than with any other variable (Gough, 1961); and the RA was significantly correlated with rated originality (.40) and with creativity (.35) of creative writing students (Welsh, 1959).

In an attempt to account for relations between creativity and complexity preference Golann (1962) hypothesized that artists are high in creativity motivation. He showed that the items on the RA which artists liked were significantly more ambiguous or evocative than the items which they disliked, but there was no difference among the items liked and disliked by unselected adults. A further study employing a questionnaire of preference for activities revealed that high RA boys indicated preference for situations and activities which allowed for self-expression, independence and utilisation of creative capacity, in comparison to low RA boys who preferred structured, familiar or routine activities. Golann claims that these results support the self-actualizing, as opposed to the reductionist theories of creativity.

MacKinnon (1962) reports consistent findings that creatives prefer complexity - asymmetry on the BWAS and that in general the more creative a person is the stronger is his preference. Creativity was also significantly correlated with an Institute scale which measures preference for perceptual complexity (.48 for the sample of architects) and with production of complex mosaics by artists. MacKinnon suggests that these results taken together indicate that:

"... creative persons are especially disposed to admit complexity and even disorder into their perceptions without being made anxious by the resulting chaos. It is not so much that they like disorder per se, but that they prefer the richness of the disordered to the stark barrenness of the simple. They appear to be challenged by disordered multiplicity which arouses in them a strong need which in them is serviced by a superior capacity to achieve the most difficult and far-reaching ordering of the richness they are willing to experience." (1962)

Barron relates creativity to complexity preference in a manner very similar to MacKinnon. He hypothesized that originality would be related to complexity preference because both these attributes represent a generalised experiential disposition, permitting disorder to gain richness of experience (1955); he also hypothesized that independents would prefer complexity, since only persons who can tolerate complexity and contradiction, with confidence that order lies behind apparent confusion, would be able to bear the phenomenal discord involved in independence of judgement (1953a). Both these hypotheses were confirmed. Elsewhere Barron (1963b) has suggested that the creative person likes phenomena which cannot be readily assimilated to principles of geometric order but rather require the development or creation of new perceptual schemata; these schemata render the phenomena intelligible and ordered and thus capable of arousing aesthetic sentiment.

Eisenman stresses the importance of complexity as a variable in creativity, art and personality research, and he has made several attempts to relate polygon preference to various measures of creativity. It was shown that among art students creative subjects tended to choose more complex figures as preferred and meaningful than did less creative subjects, and as the former also produced more complex designs it was suggested that the creative subjects are able to perceive more order in complexity (Taylor and Eisenman, 1964). Complexity was also preferred by subjects scoring highly on a questionnaire measure of creativity (consisting of measures of tolerance of complexity, tolerance of ambiguity, scanning, independence of judgement and regression in the service of the ego; Eisenman and Robinson, 1967). Eisenman et al. (1966) demonstrated that a creativity set may significantly influence the amount of complexity preferred. As part of an experiment half the subjects were told that complex polygons were preferred by creative people and half were told that simple polygons were preferred by creative people. When subjects expressed their own preference it was found that they chose complex or simple polygons in accordance with what they were told creative subjects would choose. Also subjects who perceived themselves as creative showed an insignificant tendency to choose complex polygons. A correlational study revealed that the BWAS and polygon preference are significantly related (.55, $p < .001$). The two measures of complexity preference had extremely similar correlational patterns with other variables and both were significantly correlated with originality and fluency on an Unusual Uses Test. On the basis of these results and those given above, Eisenman claims there is justification in using preference for complexity - simplicity of polygons as a measure of creativity (Eisenman, 1969).

The research presented here generally lends support to the view that creativity and preference for complexity are related. The preference tests consistently differentiate creatives from non-creatives, and the personality patterns of subjects preferring complexity and creative subjects are so remarkably similar that it has been claimed that preference for complexity - simplicity may itself be a measure of creativity. From the accounts given by both Barron and MacKinnon it appears that the creative individual likes complexity not just for its own sake but also because he is challenged to find in it some new order, and through this process he increases the richness of his experience.

II.3.10 The Generality of Preference for Complexity - Simplicity

There is evidence that different measures of preference for complexity - simplicity are related. Eysenck (1942) demonstrated the generality of preference for complexity or simplicity in poems, polygons, works of art, and odours; and Eisenman (1965b) found that subjects who chose complex polygons tended to choose more novel poems. Eisenman (1969) also obtained a significant correlation between preference for complexity - asymmetry on the BWAS and preference for complex polygons. Similarly Day (1964; see 1966) reported that subjects who scored highly on the BWAS preferred the more complex figures among Berlyne's stimuli and looked at them a longer time. Preference for complexity, both on the BWAS and in polygons, has been related to production of complex designs. In conclusion, it appears that expressed preference for complexity or simplicity is a general characteristic which may reflect a stylistic preference for dealing with complexity or simplicity in the environment.

II.4 REASONS FOR PRESENT INVESTIGATION

The present research was originally inspired by the work of Munsinger and Kessen relating preference for uncertainty to ability to code or process environmental variability. (See II.3.1). As the writer was interested mainly in individual differences, and was acquainted with some of the literature on field-independence and creativity, it seemed a promising line of investigation to examine these concepts in relation to preference for environmental uncertainty. In this attempt the writer was inevitably introduced to Barron's work on complexity - simplicity as a personality dimension so it was decided to examine preference in relation to some additional personality variables.

A consideration of the individual differences obtained in these preference studies led the writer to question some of the assumptions and conclusions of Munsinger and Kessen (1964); these authors acknowledge individual differences but do not take them into account in their model. Their assumptions were described more fully in II.3.1, but briefly they assume that:-

a) human beings are sensitive to environmental variability
b) they have a limited capacity for processing environmental variation
c) they may overcome this limitation through developing rules to code the material, and
d) they prefer an amount of cognitive uncertainty which matches their processing ability.

The key concept here is cognitive uncertainty, which is a joint function of stimulus variability and cognitive structure.

Munsinger and Kessen argued that, when the stimuli consist of sequences of letters and words, cognitive uncertainty is determined mainly by cognitive structure because subjects have learned rules to impose meaning on such stimuli. When random shapes are used as stimuli they claim that:

"...cognitive structure ordinarily makes little contribution to the determination of cognitive uncertainty; in contrast, stimulus variability, defined as coordinality or number of independent turns, contributes a great deal to cognitive uncertainty." (1964, Page 3)

This claim is based on an assumption that unsophisticated subjects will not have developed rules for coding such stimuli; although it is later acknowledged that coding may occur through familiarity with triangles and quadrilaterals, and through meaning imposed on complex shapes because of the "highly projective character of these shapes". Art students, as opposed to unsophisticated subjects, have had experience of inventing and evaluating shapes, and it is assumed that they have developed coding rules for dealing with them.

It seems unlikely that unsophisticated subjects have no experiences from which they could develop "rules" for coding shapes, simply because they have not received specialized training. Many non-art students may have interest or experience in photography, design, some kinds of engineering, or similar activities which include dealing with spatial material. One would not expect that subjects could impose meaning only on highly variable shapes and, in fact, shapes of intermediate variability were rated as less meaningful, not as devoid of meaning. Subjects might interpret stimuli in terms of past experience to make them more meaningful. One might also expect that field-independent subjects, who are able to structure relatively ambiguous and unorganized fields, may also be able to structure other spatial stimuli. It is proposed here that when stimuli consist of random shapes, in addition to the contribution of stimulus variability, the subject may also contribute a large amount to cognitive uncertainty through his cognitive structure.

The second assumption to be examined is that:

"Human beings prefer an amount of cognitive uncertainty which matches their processing ability." (1964, Page 2)

This assumption may often be quite valid, and Munsinger and Kessen pointed out that it has often been observed that an intermediate amount of stimulation is preferable, stimulation below capacity is boring, and above capacity it is confusing. However, some personality research would suggest that, although preference may be related to processing ability, over and above this relation there may be individual differences in the preferred amount of cognitive uncertainty. Barron referred to preference for complexity - simplicity as a perceptual decision:

"...we can conceive this as a matter not simply of capacity, but of preference. Such a choice does of course involve perceptual capacity, but beyond capacity it is a matter of orientation towards experience, in a sense a perceptual attitude." (1952, Page 400)

From the personality descriptions given in the previous sections it appeared that some persons were tolerant of uncertainty and ambiguity; some preferred the disordered, the imperfect, or the unfinished; and some were open to experience and challenged by the complex and chaotic: on the other hand, some individuals were intolerant of uncertainty or ambiguity; some preferred the ordered, the polished or the balanced; and some shied away from new or complex elements of experience, preferring the known and predictable. These different modes of functioning may be interpreted as lending support to the proposal of individual differences in preference for cognitive uncertainty.

If this proposal were accepted it would provide an alternative interpretation of results obtained in an experiment relating preference to estimation accuracy (coding), (Munsinger, 1966). Although preference and estimation accuracy were very highly correlated, over one quarter of the subjects were low on estimation accuracy but high on preference, and a few subjects were high on estimation accuracy but low on preference. It was suggested that the former group only sampled parts of the highly variable shapes, and the preference of the latter group could not be explained. However, these results could be accounted for in terms of individual differences in the amount of cognitive uncertainty which is preferred (or possibly even in terms of other forms of cognitive structure described on the previous page). It is proposed here that there may be individual differences in preference for cognitive uncertainty. Some subjects may prefer an amount which matches their processing ability, but some subjects may prefer more uncertainty and some subjects may prefer less uncertainty than they can process.

The next issue to be discussed concerns Munsinger and Kessen's interpretation of results, and the conclusions drawn from them. In a series of experiments, where unsophisticated subjects expressed their preference for random shapes, preference was found to be an inverted U shaped function of stimulus uncertainty, with a point of inflection at ten independent turns. It was claimed that:

"...the regularity and replicability of the preference for random shapes of about 10 independent turns support the postulation of a fixed limit on the capacity of adult human beings to process stimulation. The link between preference and processing is an assumption that subjects prefer a level of uncertainty of stimulation which matches their ability to process." (Munsinger et al., 1964, Pages 1-2)

Even if this assumption is accepted it is hard to justify the conclusion because the trends are inferred from grouped data which may not be representative of the individuals in the group, especially since significant individual differences in preference were reported. As Dorfman and McKenna (1966) pointed out, averaging data from subgroups with linear or curvilinear functions tends to give curvilinear results. It is therefore proposed that grouped data showing a point of inflection at ten independent turns may be an artefact and need not be determined by a limitation on processing capacity.

Some evidence has been presented in support of the hypothesis that preference is determined by processing ability. Preference for random shapes has been related to estimation accuracy and categorization (Munsinger, 1966; Munsinger and Kessen, 1966b) and preference for sequences of letters and words has been related to recall (Munsinger and Kessen, 1966a); however, in the last experiment subjects knew before expressing their preference that they were required to recall the stimuli, and this may have influenced preference. Also, as expected, art students preferred stimuli of higher variability than unsophisticated subjects. Munsinger and Kessen's interpretation of this result was that "this difference can be taken as evidence that experience increases one's ability to group independent characteristics of stimuli and thereby reduce cognitive uncertainty." (1964, Page 16). Although they offered an alternative explanation that the difference in preference might be due to personality factors or other variables in the selection of art students, this was not investigated further. This latter interpretation is similar to the conclusions which Barron has drawn from his results.

Munsinger and Kessen (1964) were mainly concerned with the experimental manipulation of stimuli so they did not investigate extensively the differences in preference for variability which they observed. When a sample of children and adults expressed preference for sequences of letters and words significant differences were obtained between adult subjects and child subjects, and among the total sample, but not within age groups. Significant individual differences in preference for random shapes were reported; however, correlations between preference and socio-economic status, intelligence, verbal and mathematical aptitude and sex were insignificant. Nor was preference correlated with delinquency (MMPI scale) or anxiety, although Munsinger* stated that he felt preference would be related to anxiety, and to the Guilford tests of divergent thinking, since subjects who preferred complexity appeared to be more creative.

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*Personal communication, May 31st, 1968.

From Munsinger's suggestions it seemed possible that these differences in preference for complexity might be comparable to those obtained on the scales of the Welsh Figure Preference Test: on these scales differences in preference have been significantly correlated with creativity and personality variables. However, although Barron refers to this stimulus dimension as complexity-simplicity it is confounded with asymmetry-symmetry. It has also been shown that on the BWAS neither complexity-simplicity nor asymmetry-symmetry was independently a major determinant of preference since each of these dimensions accounted for only a minor proportion of the variance (Moyles et al., 1965). The lack of rigour in defining what constitutes a complex stimulus has also been pointed out by Bieri (1961) who commented that:

"...the personality characteristics associated with preference for complexity are too closely tied to stimuli reflecting aesthetic tastes. These tastes could reflect little more than socially acceptable preferences of a 'sophisticated' nature." (1961, Page 377)

It was therefore decided to use random asymmetrical polygons and sequences of letters and words as stimuli since they are constructed so that complexity-simplicity is varied along one dimension. Previous research indicated that there are marked differences in preference for complexity-simplicity which are associated with differences in other areas of cognitive functioning, and the aim of this experiment is to discover whether similar differences are obtained when these stimuli are used.

It is proposed to examine subjects' preference for complex or simple stimuli and individual and group differences in preference. Individual differences are to be investigated through examining the correlates of preference for complexity; and group differences are to be examined by comparing the preferences of groups who would be expected to differ in personality, creativity or experience with spatial or verbal stimuli.

This is essentially an exploratory investigation where many variables are examined and many hypotheses tested. Some of the hypotheses are judged by the writer to be null and others directional; the reasoning behind these judgements is in some cases based on theory and experimental results and in other cases is based on intuition or speculation. Therefore the hypotheses will not be stated formally. The experiment is designed to investigate complexity-simplicity preference in the following manner.

1. Individual differences in preference:

a) To test whether preference for complexity of polygons and preference for complexity of verbal sequences are related.

b) To examine whether individual differences in preference for complexity of polygons and of verbal sequences are related to individual differences in: intelligence

field-independence

creativity

personality

2. Group differences in preference:

a) To test whether the following groups differ in preference for complexity of polygons and verbal sequences:

male psychology students

female psychology students

engineering students

art students

b) To test whether the above groups differ in:

intelligence

field-independence

creativity

personality

3. A test of the 'Dember and Earl' hypothesis:

To test whether subjects have a preferred level of complexity and whether preference decreases as distance from this level increases.

CHAPTER III

EXPERIMENTAL METHOD

III.1 EXPERIMENTAL DESIGN

The experiment was designed to examine some of the propositions outlined in the preceding section. I has three parts:

i) Individual differences in preference for complexity-simplicity (C/S).

ii) Group differences in preference for C/S.

iii) A test of the Dember and Earl hypothesis.

i) Individual differences in preference for C/S

This part was aimed to test the relation of preference for C/S of spatial stimuli and preference for C/S of verbal stimuli to the following variables: verbal intelligence; non-verbal intelligence; verbal creativity; non-verbal creativity (or field-independence); and personality.

ii) Group differences in preference for C/S

This was designed to assess the differential effects of training and personality on preference for C/S. It was decided to choose groups who might differ in experience, training or bias for dealing with spatial stimuli. It was expected that art students would have the most training for dealing with spatial stimuli, psychology students the least and engineering students an intermediate amount of training. The selection of groups with different knowledge of English was not specifically included in the experimental design as all students would be expected to have a fairly good mastery of the English language, but psychology students might be expected to have a comparatively high verbal ability and have more experience with verbal as opposed to non-verbal media.

iii) A test of the Dember and Earl hypothesis

This was designed to examine whether Ss who have a preferred level of complexity show a decrease in preference as distance from the preferred level increases. It was also decided to investigate group preference as a function of stimulus complexity and relate this to Munsinger and Kessen's propositions.

III.1.1 Selection of Subjects

First year students were chosen to serve as Ss for this experiment because:

i) it was hoped to reduce the influence of extraneous variables such as length of time at university.

ii) a relatively large but homogeneous sample of females could only be obtained in the introductory psychology course.

iii) a large sample was required and first year students were the easiest to obtain in large groups.

The rationale for choosing psychology, engineering and art students was described in III.1 on the previous page.

The sample consisted of 87 Ss from the following groups:

25 male Ss from introductory psychology (20 behavioural science, 5 systems analysis).

25 female Ss from introductory psychology (20 behavioural science, 5 systems analysis).

25 male Ss from engineering courses (12 civil engineering, 7 electrical engineering, 4 mechanical engineering, 2 production engineering).

12 Ss (6 male, 6 female) from art courses (5 three dimensional design, 5 theatre design, 1 jewellery design, 1 furniture design).

The psychology and engineering students[1] were from the University of Aston and the art students were from the City of Birmingham College of Art[2].

III.1.2 Selection of Tests

Three main criteria were applied to the selection of all tests: they should be suitable for a student population and not too time consuming or expensive. In addition there were specific reasons for choosing each test: these will be given below.

The AH5 was selected to measure intelligence because it is designed for use with highly intelligent subjects and it has verbal and non-verbal scales. The AH5 consists of two parts: Part I is verbal/numerical, Part II is diagrammatic. Each part takes twenty minutes. There are separate scores for Parts I and II and these are combined to give a total score.

Uses for Things (from Getzels and Jackson, 1962) was chosen as a verbal measure of creativity. The subject is required to list different uses for five common objects: a brick, pencil, paper clip, toothpick and a sheet of paper (see Appendix 1). This test (or a modified form of it) has been used in most creativity test batteries. Guilford (1967) referred to the Uses tests as a measure of "spontaneous flexibility" since the subject suggests different uses of his own accord. This was chosen as an appropriate test since it can be used to measure fluency and originality as well as flexibility. Also it is cheap to reproduce and relatively easy to administer

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[1] The engineering students were participating in an investigation for Dr. James Rushton of the Education Department, University of Aston, who allowed me to administer the tests in the same session. The AH5 and OPI were given to all subjects in collaboration with Dr. Rushton.

[2] I wish to thank Mr. Peter Ford of the City of Birmingham College of Art for his co-operation in obtaining the sample of art students.

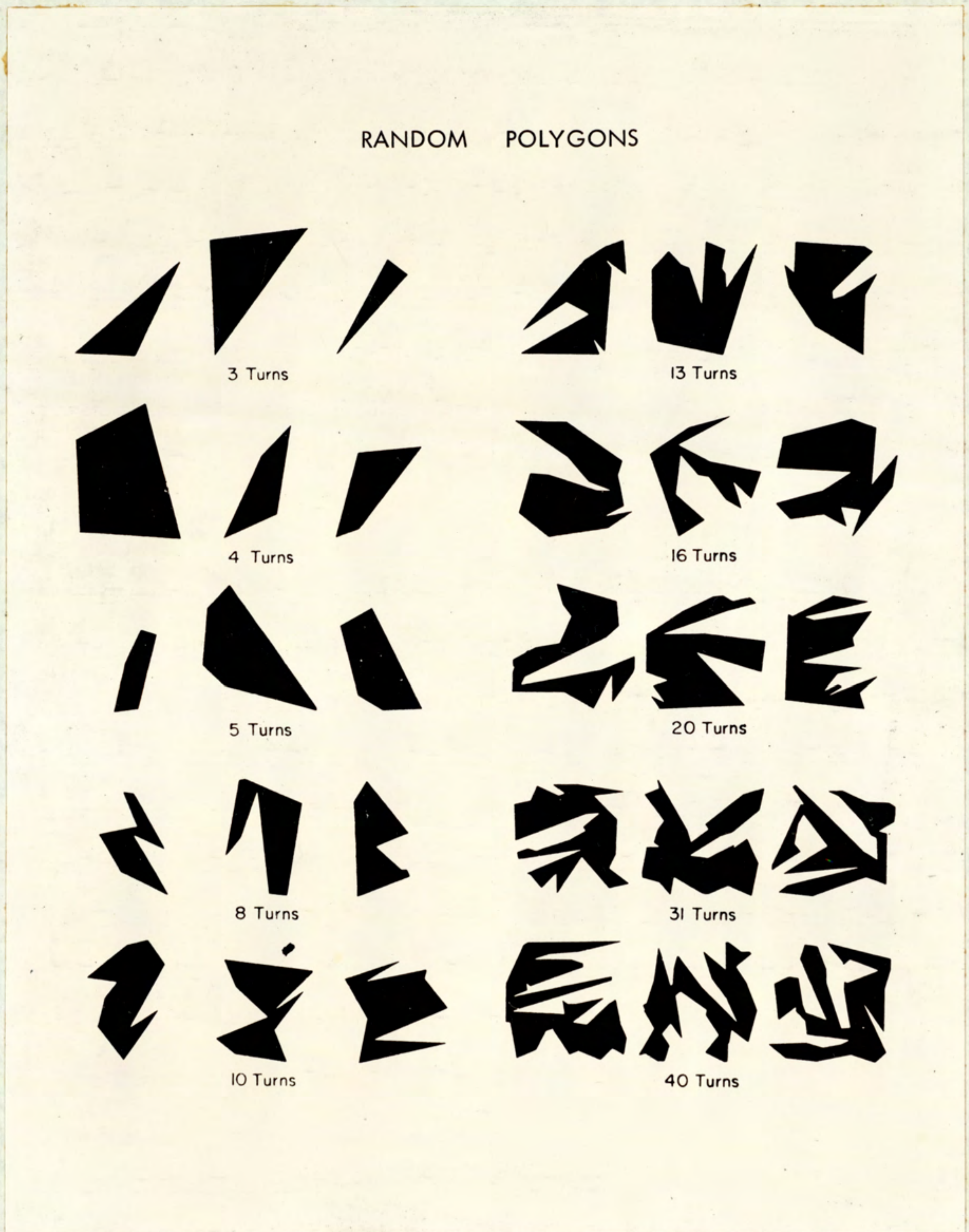
to groups and although it is untimed most subjects complete the test in fifteen to twenty minutes.

The Hidden Figures Test (HFT) from the 'Kit of Reference Tests for Cognitive Factors' (French et al., 1963) was chosen to serve a dual purpose of measuring field-independence and flexibility of closure. The test requires the subject to locate one of five simple figures (given at the top of the page) in a series of complex figures. The test consists of two parts, each part has sixteen items and takes ten minutes (see Appendix 1). This HFT correlated .56 with an individual EFT (Jackson et al., 1964). Several investigators have used Hidden Figures Tests as part of a creativity test battery and it was therefore intended that the HFT would act as a non-verbal measure of creativity.

The Omnibus Personality Inventory (OPI) Form F was used to assess personality. This is a True/False questionnaire which has three hundred and eight-five items and the following fourteen scales: Thinking Introversion, Theoretical Orientation, Estheticism, Complexity, Autonomy, Religious Orientation, Social Extraversion, Impulse Expression, Personal Integration, Anxiety Level, Altruism, Practical Outlook, Masculinity-Femininity and Response Bias (see Appendix 1 for a description of these scales). This test was already being administered to the sample of engineering students and some of the psychology students and it was decided to give it to the other subjects as it measured some relevant personality dimensions.

III.1.3 Selection and Preparation of Stimuli

The stimulus materials presented by Munsinger and Kessen (1964) were chosen for this experiment since one of the aims was to attempt a replication and extension of their experiment. The stimuli are illustrated in photographs 1 and 2.



Photograph 1

Polygons used in Study I

S E Q U E N C E S O F L E T T E R S A N D W O R D S

STIMULUS VARIABILITY	SET I	SET II
Redundant Letters	DDDDDD DDDDDD DDDDDD DDDDDD DDDDDD	YYYYYY YYYYYYY YYYYYY YYYYYY YYYYYY
Redundant Words	current current current current current	plant plant plant plant plant
Prose	A short time at Alexandria is fine	The moon is our nearest neighbour
Fourth-order Phrases	Students always the next room are	On my rug is deep with snow
Second-order Phrases	Him and substance was a piano is	Is that game since he lives in school
First-order Phrases	want square chimney the wants	especially much was said cake
Random Words	obeisance cordial dip long bed hammer	forget lethargy fluted watch attend
Third-order Words	birs gorcid ponde nome the	in no lst lat why cratict froure
Second-order Words	incore st be S deamy thall	on ei are ansoutinys T
Random Letters	ffjecyk cqsgx ydahn bixz xmrfj	sjoml rxklr jffjuj zlp wcfckeyj

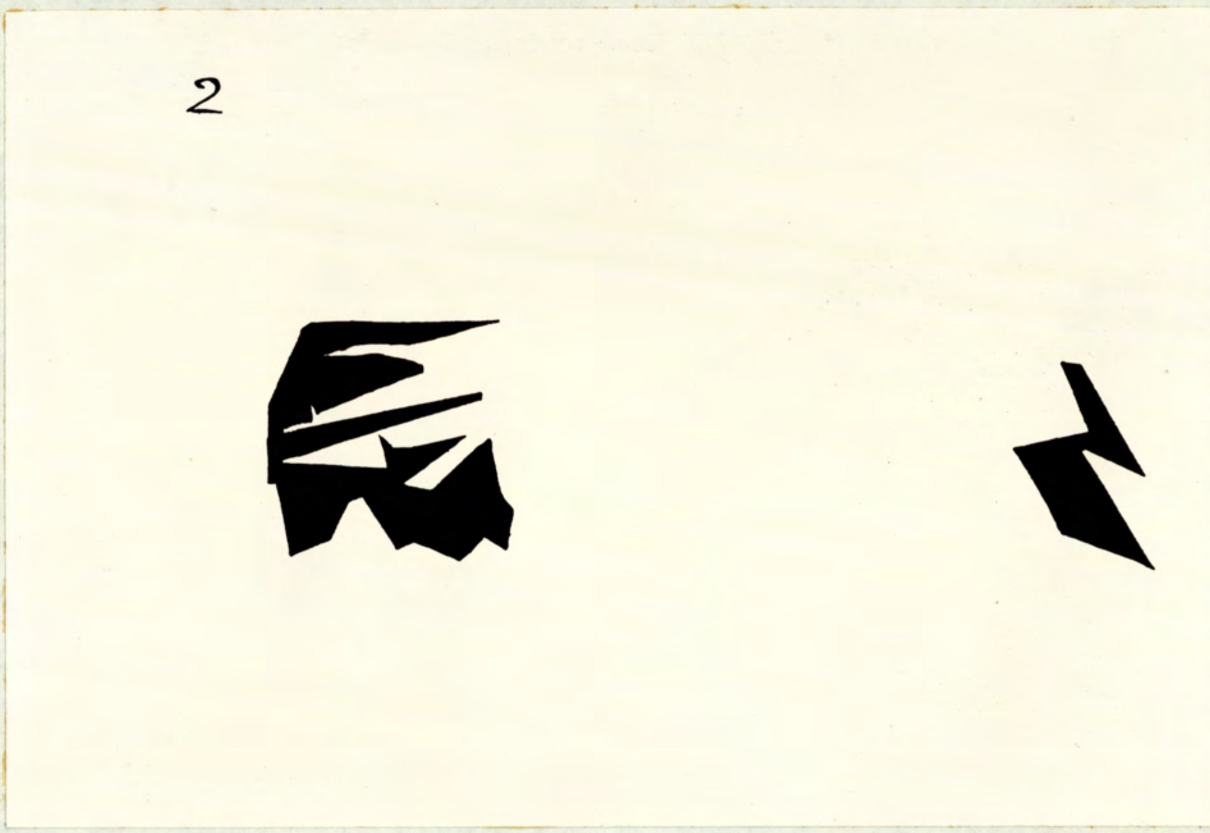
Photograph 2

Sequences of letters and words used in Study I

Polygons: all the stimulus shapes were asymmetrical polygons which had been randomly constructed (see Munsinger and Kessen, 1964, for details). They varied from 3 to 40 independent turns (angles or points) and there were ten levels of complexity with three examples at each level.

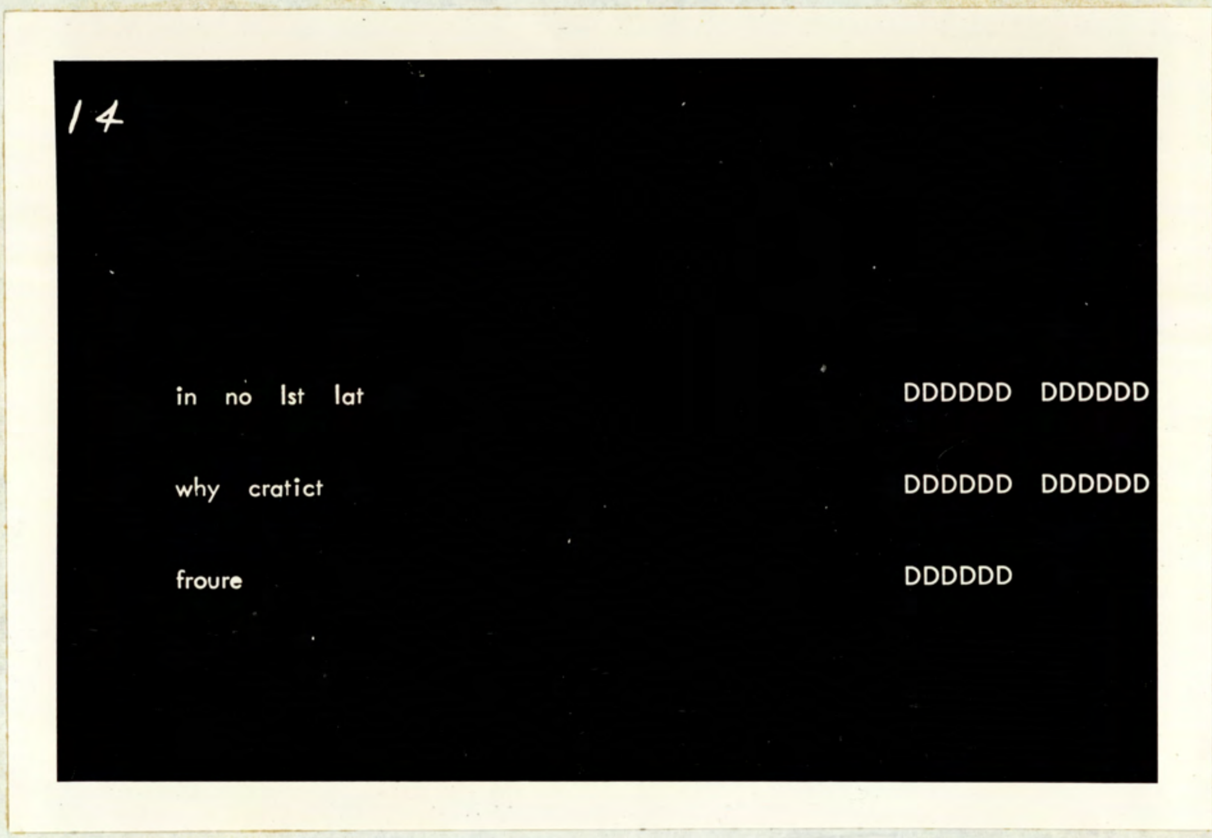
Verbal sequences: the verbal stimuli consisted of sequences of letters and words varying in redundancy and approximations to English, which had been selected from Miller and Selfridge (1950). The sequences ranged from redundant letters through prose and random words to random letters; there were ten levels in all with two examples at each level. Munsinger and Kessen used twelve levels of stimulus variability in their original experiment but it was decided to use ten levels in this investigation. The reasons for this were to offset possible satiation or boredom among the Ss and to keep the time of administration short whilst maintaining the total range of stimuli (having ten levels instead of twelve reduces the number of pairs of stimuli from 66 to 45 in the design employed here). Figures of 6 and 25 turns were omitted from the polygonal stimuli as the figures of very few, very many, and of about 10 turns were the most important stimuli. Among the verbal stimuli the redundant and random sequences and prose were retained as they acted as 'anchor points' in the list. One level of approximations to phrases and one level of approximations to words were omitted: these were third-order phrases and first-order words.

Preparation. The order of presentation of stimuli was determined before their preparation because they were to be presented in a paired comparison design. The ordering procedure suggested by Ross (1934) was followed. This procedure is designed to maintain the maximum distance between the same items and avoid repetitions and it is balanced to remove time and space errors. To follow the above procedure the lowest level of complexity was numbered one and the highest level ten: the order of the 45 pairs was then obtained from Ross. The examples at each level were lettered (a, b or c for polygons and a or b for verbal sequences) and the order and side of presentation of each figure were counterbalanced. Once the order was determined the stimuli were prepared (see Appendix 1 for details). The polygons were prepared as 2" x 2" slides of pairs of black polygons on a white background (see photograph 3). The verbal sequences were prepared as 2" x 2" slides of pairs of sequences of letters or words written in white on a black background (see photograph 4).



Photograph 3

Example of a pair of polygons



Photograph 4

Example of a pair of letter sequences

III.2 EXPERIMENTAL PROCEDURE

III.2.1 Materials

The materials consisted of the items listed below:

The AH5, HFT, Uses for Things and OPI.

Forty-five slides of pairs of polygons.

Forty-five slides of pairs of verbal sequences.

Kodak Carousal projector.

Stopwatch: to time the tests and presentation of the slides.

Subjects' response sheets for the preference tests. The response sheets contained instructions and numbers from 1 to 45. Opposite each number were the capital letters L and R. The response sheets for polygon preference were gold and those for verbal preference were white (see Appendix 1).

Scoring sheets for the responses to the preference tests. Like the response sheets the scoring sheets listed the numbers 1 to 45. Opposite each of these numbers were the numbers corresponding to the level of complexity of the two stimuli. The scoring sheets also contained a 10 x 10 matrix to which the response scores were transferred. The sheets for polygon preference were gold and those for verbal preference were white (see Appendix 1).

III.2.2 Pilot Study

Prior to the main experiment all the tests were given to volunteer Ss for practice in administration. The slides of the polygons and verbal sequences were presented to individual Ss to determine the optimal exposure time for the stimuli; the times chosen were 6 seconds for polygons and 10 seconds for verbal sequences. The slides of polygons followed by the slides of verbal sequences were shown to a sample of 10 Ss (4 in social science, 3 in engineering and 3 in design) who were asked to record their preference on the subjects' response sheets. The Ss were then asked about the reasons for their choice and any modifications they might suggest to the presentation of the slides.

It was not feasible to investigate the nature of individual differences in polygon and verbal preference but the results indicated that there were considerable individual differences in preference for C/S. There were also some group differences. In polygon preference the social science group showed a definite preference for polygons of moderate to high complexity, the engineering group preferred polygons of low or moderate complexity and the design group preferred moderate to high complexity. In verbal preference the social science group showed a slightly higher preference for the more complex verbal sequences, the engineering group showed a definite preference for prose and approximations to phrases and the design group showed a high preference for approximations to words.

III.2.3 Procedure

<u>Test administration</u>. The tests were administered to the psychology, engineering and art students separately as described below:
The engineering students completed all the tests in a three hour testing session (with a break half way through). The tests were given in the following order: AH5, Polygon Preference, Uses for Things, OPI, Verbal Preference, HFT.

The psychology students completed the tests as follows:
The Polygon Preference, HFT and Verbal Preference were given to Ss at the start of psychology practical classes when they were in six separate groups. The AH5 was given in a psychology lecture. The OPI was given after the

AH5 and Ss were asked to complete it in their own time[1]. Uses for Things was given 20 minutes before the end of a psychology lecture.

Only 17 females completed all the tests so 8 females from the next incoming year were asked to make up the sample. These Ss completed the AH5 and OPI in one session and the Polygon Preference, HFT, Verbal Preference and Uses for Things in another session[2].

The art students were given the Polygon and Verbal Preference tests in their studio. (It was initially intended to have 25 art students who would complete all the tests but this was found impossible without payment).

For all groups: the AH5, OPI and HFT were administered according to the instructions in the manuals.

Uses for Things: Ss were asked to read the instructions on the form, then the experimenter said, "There is no time limit for this but most people find about 15 to 20 minutes is enough." Most Ss finished in less than 20 minutes but 5 of the psychology students spent between half an hour to an hour on the test.

Presentation of polygons and verbal sequences. E introduced this part of the experiment by saying she was interested in finding out what kinds of shapes people like. (No mention was made of preference for complexity-simplicity or of individual differences). All groups were given the Polygon Preference before the Verbal Preference test.

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[1] As many Ss did not hand in the OPI the ten shillings payment for participation in a further experiment (see Study II) was made conditional upon the completion of the OPI.

[2] It was not possible to show the slides of the verbal sequences to these Ss and they were shown copies of the cards from which the slides were made. The result of a Mann-Whitney U test applied to the preference scores of the two groups was insignificant so the data were combined.

Polygon preference: each S was given a response sheet and was asked to read the instructions on it. The instructions were:

"I will show you a series of figures two at a time. I want you to indicate which of the two shapes you like better. You circle the L if you prefer the left figure and the R if you prefer the figure on the right."

E. asked if everyone understood. If Ss asked on what grounds the choice should be made they were told to choose the one which they preferred. No other indication was given for the basis of their choice.

E then said:

"Make sure you always choose one of each pair and circle the one you choose. Please do not leave any items blank. The slides will be shown for 6 seconds each. Make your choice during that time. You will find it is quite enough time."

The lights were then turned down and the slides were projected onto a screen on the front wall of the room. The presentation of the slides was timed with a stopwatch. They were shown for 6 seconds each and there was a blank after every 10 slides. The total presentation time was 4 minutes 54 seconds.

Verbal preference: each S was given a response sheet and asked to read the instructions. The instructions were identical to those for polygon preference except that "sequences of letters" was inserted for "shapes". E then said

"This is similar to what you did before, but this time I will show you sequences of letters and words. Read them and then circle the one you prefer. Remember to always circle one of each pair. Please do not leave any items blank. The slides will be shown for 10 seconds each. Make your choice during that time."

The slides were presented according to the same procedure as the previous slides except these were shown for 10 seconds each. The total presentation time was 8 minutes 10 seconds.

III.3 TECHNIQUES FOR SCORING THE TESTS

The AH5, HFT and OPI were scored according to the manuals.

Uses for Things: All the responses were read and those which were irrelevant were discarded.

The fluency score was the total number of relevant responses excluding the examples.

The flexibility score - which refers to the different kinds of uses suggested - was more difficult to obtain as there was no standardized form for marking this test. The scoring procedure adopted was as follows:

After writing all the responses on separate sheets of paper and discussing them with colleagues, and 'ad hoc' list of categories was prepared for each of the five objects (e.g. brick - "construction" or "weight"). Each response was then placed in one category as far as this was possible. The categories were then redefined to account for responses which fitted into two or more, or none of the categories. The resulting categories were based on the functions of the object defined either by its physical properties (e.g. brick - "porous" or "heatable") or in terms of more abstract uses (e.g. brick - "construction" or "plaything"). E then marked all the scripts for each object according to this scoring system. For each object the categories to which the examples belonged were not counted. The flexibility score was the number of different categories of use which were given.

It was intended to score the test for originality but due to lack of time this was not possible. It was decided to omit this measure rather than any other because originality would be expected to be highly correlated with flexibility and fluency. This is due to a) the fact that Ss who are most fluent tend to give more uncommon responses (Christensen et al., 1957), and

b) method variance in scoring the test (see Eisenman, 1969).

Scoring of Preference Data

The responses of preference for polygons and verbal sequences were scored in a similar manner. The responses were transcribed from the response sheets onto scoring sheets (see Appendix 1). The layout of these forms was the same except that on the scoring form numbers from one to ten were used instead of L or R (as before one referred to the lowest and ten to the highest level of complexity). The responses were then transferred onto a 10 x 10 matrix on the scoring sheet. The Choice (C) scores were then obtained by counting the number of times each stimulus was chosen over every other stimulus. The C scores were entered in the row below the matrix.

From these scores total scores for polygon or verbal preference were calculated as follows:

Polygons: since there is not a standardized scoring technique for deriving total preference scores, two scores were derived so that they could be compared and evaluated before deciding which to use for further analysis. The 'point' score is taken from Eisenman (1967c) and the 'weighted' score from Rump (1968).

Point score: in this method the total number of points (independent turns) on the three most preferred polygons were summed (M) as were the total number of points on the three least preferred polygons (L). (In the case of a tie the mean number of points was used). Then the number of points on the three least preferred polygons was subtracted from the number of points on the three most preferred (M - L). Scores could range from -79 to +79 so a constant of 80 was added to all scores to make them all positive. The possible range was then 1 to 159.

Weighted score: this method used the data from the paired comparisons matrix.

It consisted of summing the products of the level of complexity (one to ten) and the number of choices at that level. The possible range of scores was 165 to 330. A constant of 165 was subtracted so the range was 0 to 165.

Verbal sequences: it was more difficult to derive a total preference score for the verbal sequences owing to the lack of objective scaling of these stimuli along the simplicity-complexity dimension. It was thought that the weighted score would be most appropriate for these data where redundant letters would be numbered as one and random letters as ten, as in the paired comparisons matrix. This numbering scheme was discussed with colleagues who were also asked to judge the complexity of the stimuli. It was then decided to number prose as one since it was considered to be the simplest. As redundant words were considered to be less complex than redundant letters these levels were numbered two and three respectively. Levels from four (fourth-order phrases) upwards were kept in the original order as they were more objectively based. This ordering corresponds to the ordering of stimuli for ease of recall found by Munsinger and Kessen (1966a); this may be interpreted as lending some support to the numbering scheme adopted here. (These points will be dealt with in greater detail in the Discussion). The total scores of verbal preference were then derived in the same way as the 'weighted' scores for polygon preference and had a possible range of 0 to 165.

C H A P T E R I V

R E S U L T S

IV.1 STATISTICAL ANALYSIS

The experiment was designed to use parametric statistics for the data analysis. It was intended to use analysis of variance on the preference data to examine the effects and interactions of individual and group differences on preference for C/S. The preference data were not normally distributed, the scores of the engineering Ss were heavily skewed towards preference for simplicity and the scores of the psychology Ss were skewed towards preference for complexity, hence it was not appropriate to use analysis of variance. Individual and group differences in preference were therefore treated separately.

The results will be presented in three parts:

1. Individual differences in preference for C/S.
2. Group differences in preference for C/S.
3. Preference for C/S as a function of distance from the most preferred level of complexity. (A test of the Dember and Earl hypothesis).

In the statistical analysis the significance level adopted is $p \leq .05$. If $p \leq .10$ it may be referred to as a significant trend. Two-tailed tests are used unless otherwise stated.

IV.2 INDIVIDUAL DIFFERENCES IN PREFERENCE FOR COMPLEXITY-SIMPLICITY

Product moment correlations were computed between all the variables. The intercorrelations of the measures of intelligence, field-independence, creativity, personality, and complexity preference are shown in Table IV.1. (Intercorrelations of the parts and part-whole correlations of field-independence, creativity, polygon preference, and verbal preference are given in Appendix 2).

Complexity Preference

There is a highly significant positive correlation between preference for polygon complexity and verbal complexity ($p<.01$).

The point total and weighted total scores of polygon preference are very highly correlated ($p<.01$). The correlations of the two total scores with the scores for the ten levels of complexity are given in Appendix 2 and it can be seen that their correlations with the ten levels are very similar. The correlations of the point and weighted scores of polygon preference with all other variables in Table IV.1 are also almost identical. Polygon preference does not correlate with intelligence or field-independence and the correlations with creativity just fail to reach significance ($p<.10$). Some of the correlations with the OPI scales are significant. Polygon preference correlates positively with Estheticism ($p<.01$) and Complexity ($p<.05$) and correlates negatively with Masculinity-Femininity ($p<.01$), Response Bias ($p<.01$) and Practical Outlook ($p<.05$).

Verbal preference does not correlate significantly with intelligence, field-independence or creativity but it does correlate significantly with several of the OPI scales. The significant positive correlations are with Thinking Introversion ($p<.01$), Estheticism ($p<.01$), Complexity ($p<.01$), Autonomy

TABLE IV.1

Intercorrelations of measures of intelligence, field-independence, creativity, personality and complexity preference (N - 75)

		AH5			HFT	Uses for Things		OPI														Complexity Preference		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	AH5																							
1	Total		**84	**87	**50	-10	-16	-11	-09	-09	-21	-03	-14	07	-13	09	03	-05	06	00	Q1	-01	-02	-04
2	Part I			**45	**34	-07	-16	-07	-13	-05	-06	08	-14	02	-01	02	-02	-07	-02	-07	-15	08	07	09
3	Part II				**50	-10	-12	-12	-03	-09	*-29	-13	-10	90	-19	14	07	-01	13	07	15	-09	-09	-15
	HFT																							
4	Total					09	10	08	11	03	-19	-09	-10	20	-17	22	21	17	00	08	*28	-03	-04	-10
	Uses For Things																							
5	Flexibility						**94	**38	*29	**35	**37	*25	17	-13	15	-13	-07	15	**-31	*-37	-04	20	22	09
6	Fluency							**31	*28	*27	**33	15	20	-09	15	-08	-02	10	-20	-15	-02	19	21	03
	OPI																							
7	Thinking Introversion								**46	**63	**53	**57	04	18	*24	-12	-16	**46	**-73	**-51	07	13	12	**39
8	Theoretical Orientation									19	*25	21	21	04	21	-05	-06	12	-21	00	*29	-09	-09	08
9	Estheticism										**55	**45	09	15	**39	*-23	*-23	22	**-55	**-70	-13	**32	**34	**33
10	Complexity											**67	*26	14	**70	**-48	**-36	05	**-65	**-42	**-44	*27	*26	**48
11	Autonomy												20	05	*28	-16	*-24	*29	**-79	**-49	**-33	15	15	**36
12	Religious Orientation													-15	15	-21	-20	-22	-03	13	*-28	12	14	21
13	Social Extraversion														**34	*25	16	**32	-04	-19	00	06	07	13
14	Impulse Expression															**-43	**-30	*-28	-20	-17	**-43	20	18	*27
15	Personal Integration																**64	**46	22	*25	**51	-20	-17	*-29
16	Anxiety Level																	*28	21	*29	**54	-22	-22	**-37
17	Altruism																		**43	**-33	**32	04	05	08
18	Practical Outlook																			**58	17	*-25	*-23	**-43
19	Masculinity/Femininity																				19	**-37	**-37	**-32
20	Response Bias																					**-31	**-31	**-31
	Complexity Preference																							
21	Polygon Point Total																							
22	Polygon Weighted Total																						**98	**47
23	Verbal Weighted Total																							**46

* p 0.05
** p 0.01

Decimal points have been omitted

(p <.01), and Impulse Expression (p <.05). The significant negative correlations are with Anxiety Level (p<.01), Practical Outlook (p<.01), Masculinity-Femininity (p<.01), Response Bias (p<.01), and Personal Integration (p<.05).

Intelligence

The AH5 measures are all significantly intercorrelated (p<.01). The high correlations of Parts I and II with the Total are to be expected because the parts contribute equally to the total score. The AH5 correlates significantly with the HFT (p<.01). Part I and the Total do not correlate significantly with any other variables. Part II correlates negatively with the Complexity scale on the OPI (p<.05).

Field-Independence

The HFT correlates significantly with the AH5 (p<.01) and with Response Bias (p<.05) on the OPI. All other correlations are insignificant.

Creativity

The measures of flexibility and fluency on Uses for Things are very highly intercorrelated (p<.01). This is partly because the same test items may contribute to both scores. Neither flexibility nor fluency is significantly correlated with the AH5, HFT or complexity preference but they are significantly correlated with some of the OPI scales. Flexibility is correlated positively with Thinking Introversion (p<.01), Estheticism (p<.01), Complexity (p<.01), Theoretical Orientation (p<.05), and Autonomy (p<.05). It is correlated negatively with Practical Outlook (p<.01) and Masculinity-Femininity (p<.05). Fluency is correlated positively with Thinking Introversion (p<.01), Complexity (p<.01), Theoretical Orientation (p<.05), and Estheticism (p<.05). The patterning of the correlations with flexibility and fluency are very similar but generally the correlations with flexibility are stronger.

Personality

Many of the intercorrelations of the 14 OPI variables are highly significant. These results are accounted for in part by the scale construction; since there is item overlap the scales would be expected to intercorrelate. The correlations of the OPI with the other variables have been presented in the preceding paragraphs.

Although several correlations between the preference measures and other variables are significant, in most cases they account for only 5% to 20% of the variance. It was therefore decided to analyse the data further by taking groups who differed in complexity preference and comparing them on intelligence, field-independence, creativity, and personality.

Three measures of complexity preference were used:- polygon preference, verbal preference, and polygon and verbal preference. The point total scores were used as the measure of polygon preference for all further analysis. The point and weighted total scores were almost identical; the former was chosen because it was more objectively based, and on this measure a score of 80 indicated equal like and dislike of complexity, a score above 80 indicated preference for complexity and a score below 80 preference for simplicity. For verbal preference the weighted total scores were used. To obtain the scores for polygon and verbal preference the Ss' total scores for polygon and verbal complexity were ranked separately and then the two ranks for each S were combined to give an overall rank of complexity preference.

The groups were selected as follows:

	Complexity Preference		
	Polygon	Verbal	Polygon and Verbal
High	20%	20%	20%
Medium	20%	20%	20%
Low	20%	20%	20%

From psychology males, psychology females and engineers the 5 Ss (20%) with the highest and the 5 Ss (20%) with the lowest complexity ranks were chosen as the groups preferring high and low complexity. It was intended to include groups of Ss (20%) preferring a medium amount of complexity but it was not possible to obtain a group of 5 engineering Ss preferring a moderate amount of complexity because their scores were so skewed. It was therefore decided to compare groups, composed of psychology male and female and engineering Ss, preferring high and low complexity. Psychology and engineering Ss differed so much in complexity preference it was decided to also compare separately psychology Ss preferring high, medium and low complexity and engineering Ss preferring high and low complexity. This design was employed as shown below for polygon preference, verbal preference, and polygon and verbal preference.

Complexity Preference		Psychology males, females and engineers	Psychology males and females	Engineers
High	20%	n=15	n=10	n=5
Medium	20%		n=10	
Low	20%	n=15	n=10	n=5

To compare these groups on intelligence, field-independence, creativity and personality, *t* tests were used to test for differences between means.

Tables IV.2 to IV.4 give the means, standard deviations and results of *t* tests on the AH5, HFT, Uses for Things and OPI for psychology male and female and engineering Ss preferring high complexity and low complexity. The OPI group profiles are shown in standard scores in Figures IV.1 to IV.3.

Table IV.2 shows that Ss preferring high polygon complexity differ significantly from Ss preferring low polygon complexity on Response Bias ($p<.01$), Anxiety Level ($p<.02$) and Masculinity-Femininity ($p<.05$). The differences on Estheticism, Complexity and Personal Integration just fail to

Table IV.2.

Comparison of two groups of Ss preferring high polygon complexity/low polygon complexity.

Variables	High Complexity		Low Complexity		t	p
	Mean	S.D.	Mean	S.D.		
AH5						
Part I	19.87	4.12	19.00	3.61	0.60	
Part II	20.13	4.58	20.27	2.24	0.10	
Total	40.00	7.62	39.27	4.80	0.30	
HFT						
Total	14.33	5.20	16.00	6.48	0.75	
Uses						
Flexibility	24.93	19.42	17.53	8.66	1.29	
Fluency	45.13	31.24	32.87	12.92	1.36	
OPI						
Thinking Introversion	25.47	10.34	20.87	9.95	1.20	
Theoretical Orientation	18.80	6.16	17.87	4.58	0.45	
Estheticism	14.00	4.69	10.33	5.74	1.85	.10
Complexity	19.60	5.83	15.27	7.07	1.77	.10
Autonomy	31.20	7.14	28.53	8.49	0.90	
Religious Orientation	16.53	6.00	13.80	7.00	1.10	
Social Extraversion	19.33	8.12	21.73	6.78	0.85	
Impulse Expression	33.53	11.27	30.47	10.77	0.73	
Personal Integration	28.00	8.19	33.73	8.78	1.79	.10
Anxiety Level	10.73	4.90	14.73	3.00	2.68	.02
Altruism	18.67	6.08	18.93	6.08	0.03	
Practical Outlook	10.27	6.56	13.93	6.93	1.44	
Masculinity-Femininity	23.73	5.57	29.07	6.08	2.42	.05
Response Bias	10.27	3.16	14.20	4.12	2.83	.01

Means, standard deviations and results of t tests on AH5, HFT, Uses for Things and OPI. (n = 15 in each group)

Table IV.3.

Comparison of two groups of Ss preferring high verbal complexity/low verbal complexity.

Variables	High Complexity		Low Complexity		t	p
	Mean	S.D.	Mean	S.D.		
<u>AH5</u>						
Part I	19.73	4.69	19.00	2.83	0.50	
Part II	19.73	4.12	21.33	4.12	1.03	
Total	39.47	7.87	40.33	6.40	0.32	
<u>HFT</u>						
Total	14.53	5.48	16.93	6.63	1.04	
<u>Uses</u>						
Flexibility	21.60	15.30	20.73	11.45	0.17	
Fluency	39.07	23.28	38.13	14.25	0.13	
<u>O.P.I.</u>						
Thinking Introversion	26.93	9.33	20.33	9.95	1.82	.10
Theoretical Orientation	18.40	5.20	19.27	5.00	0.45	
Estheticism	12.33	5.29	9.47	3.87	1.63	
Complexity	20.20	4.90	12.73	5.57	3.77	.001
Autonomy	32.00	6.40	27.00	7.14	1.95	.10
Religious Orientation	18.27	5.29	14.93	7.14	1.40	
Social Extraversion	19.60	8.31	17.07	6.93	0.88	
Impulse Expression	32.67	9.33	25.40	10.95	1.89	.10
Personal Integration	28.87	9.70	33.87	6.56	1.60	
Anxiety Level	10.67	4.69	14.60	3.61	2.49	.02
Altruism	18.73	6.40	19.07	4.47	0.16	
Practical Outlook	9.73	5.48	15.27	6.32	2.47	.05
Masculinity-Femininity	26.07	5.66	28.60	6.08	1.14	
Response Bias	10.13	3.00	15.27	2.65	4.09	.001

Means, standard deviations and results of <u>t</u> tests on AH5, HFT, Uses for Things and O.P.I. (n = 15 in each group)

Table IV.4.

Comparison of two groups of Ss preferring high polygon and verbal complexity/low polygon and verbal complexity.

Variables	High Complexity		Low Complexity		t	p
	Mean	S.D.	Mean	S.D.		
AH5						
Part I	20.07	4.12	19.47	4.12	0.39	
Part II	19.40	4.69	20.67	3.74	0.79	
Total	39.47	7.81	40.13	6.78	0.24	
HFT						
Total	14.73	5.48	16.20	6.48	0.65	
Uses						
Flexibility	21.67	15.46	17.20	9.85	0.91	
Fluency	39.40	24.05	31.67	12.73	1.06	
OPI						
Thinking Introversion	24.87	10.54	21.00	10.54	0.97	
Theoretical Orientation	19.07	6.25	17.13	4.12	0.98	
Estheticism	12.53	5.30	10.27	4.69	1.20	
Complexity	19.87	5.20	14.93	6.25	2.28	.05
Autonomy	31.80	6.40	29.60	7.87	0.81	
Religious Orientation	18.00	5.57	14.20	6.63	1.64	
Social Extraversion	18.40	8.37	18.47	6.86	0.02	
Impulse Expression	33.47	10.72	29.13	9.33	1.14	
Personal Integration	28.40	8.89	31.93	8.78	1.06	
Anxiety Level	10.33	4.35	13.40	3.61	2.03	.10
Altruism	18.33	7.14	18.87	6.93	0.20	
Practical Outlook	10.13	6.16	13.33	7.68	1.22	
Masculinity-Femininity	26.73	5.00	27.67	6.40	0.43	
Response Bias	10.40	3.32	13.07	4.36	1.83	.10

Means, standard deviations and results of <u>t</u> tests on AH5, HFT, Uses for Things and OPI (n = 15 in each group)

Figure IV.1.

O.P.I. group profiles of Ss preferring high polygon complexity / low polygon complexity.

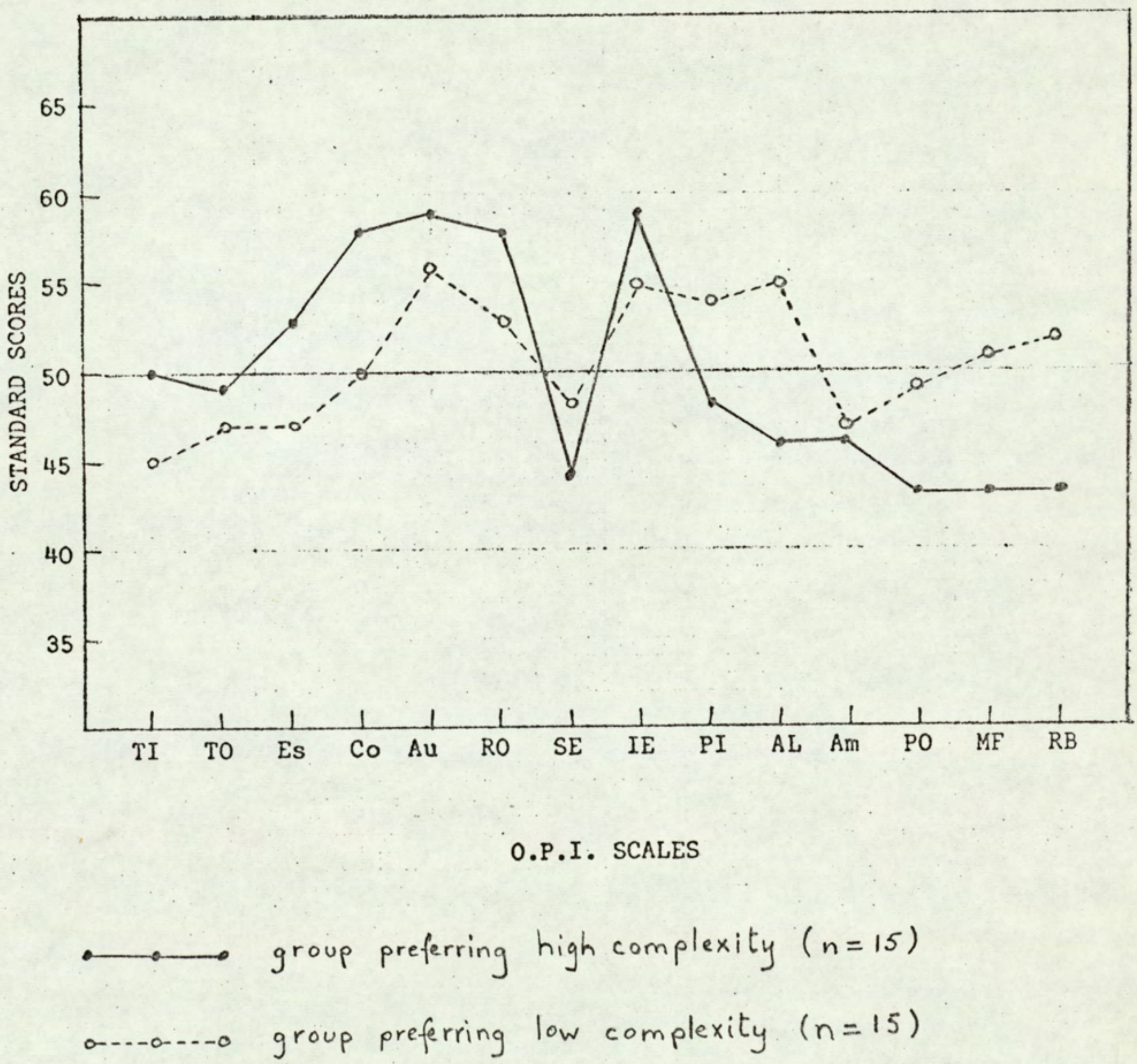


Figure IV.2.

O.P.I. group profiles of Ss preferring high verbal complexity / low verbal complexity.

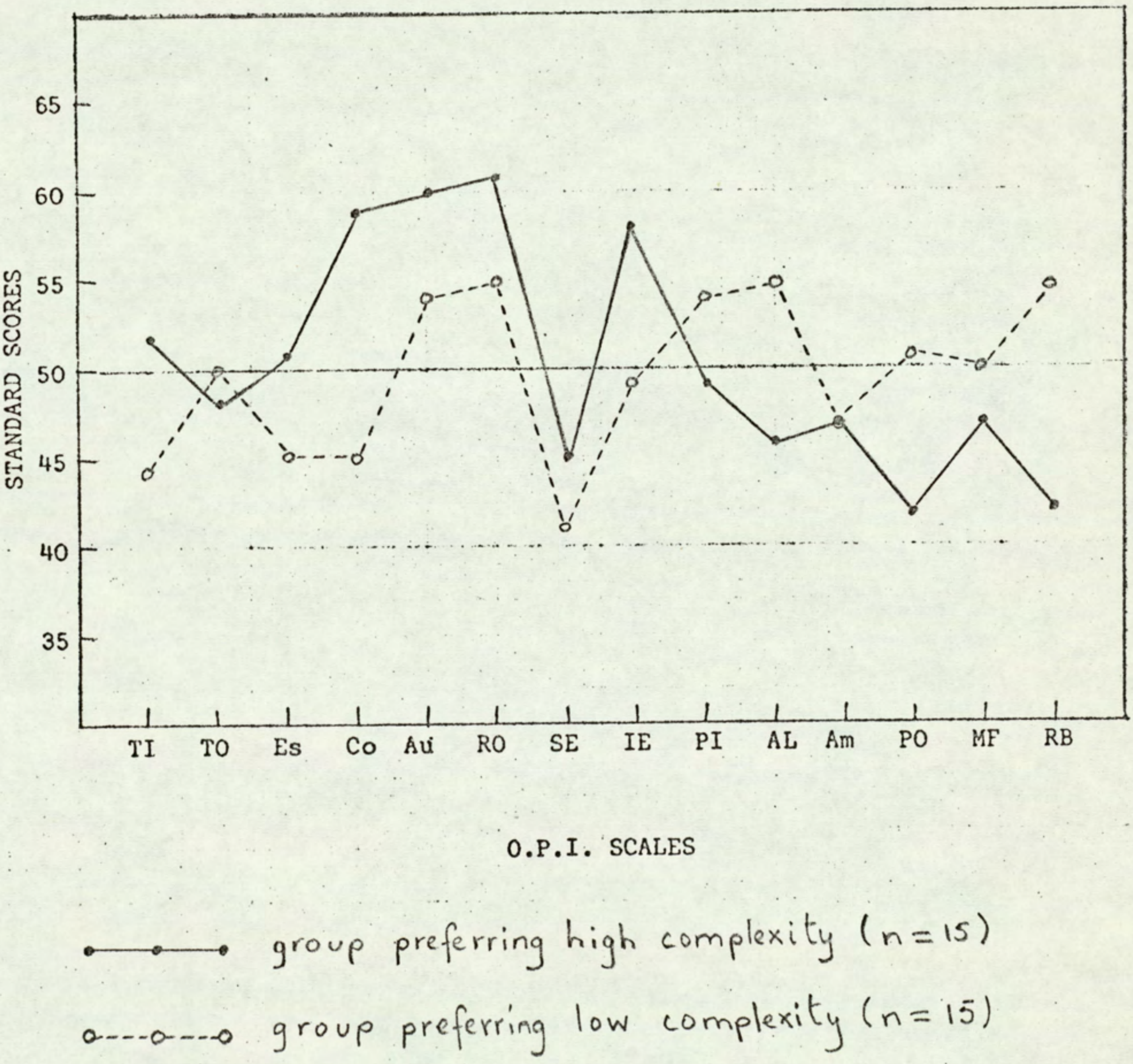
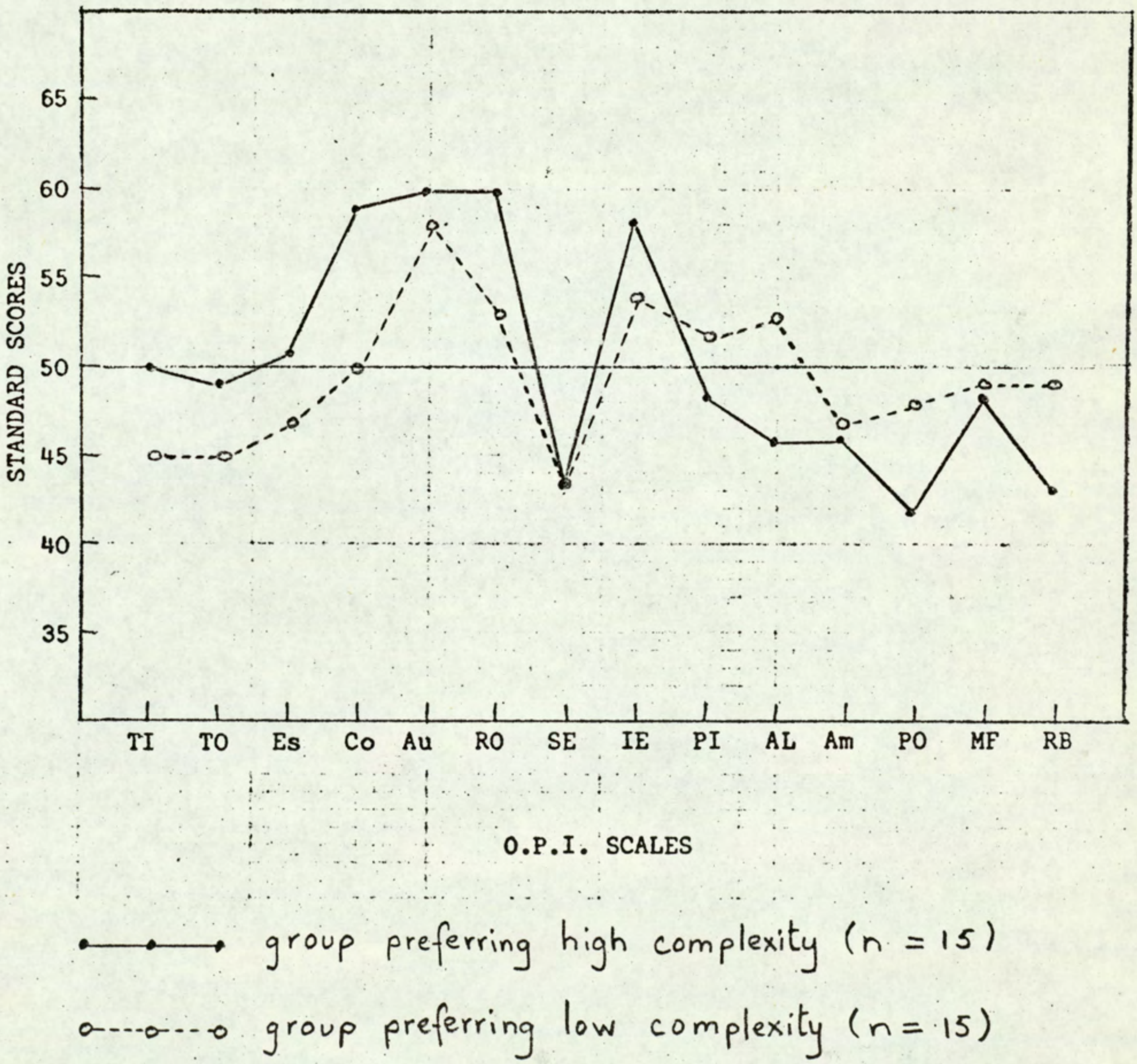


Figure IV.3.

O.P.I. group profiles of Ss preferring high polygon and verbal complexity / low polygon and verbal complexity.



reach significance ($p<.10$). Ss preferring high and Ss preferring low verbal complexity (Table IV.3) differ significantly on Complexity ($p<.001$), Response Bias ($p<.001$), Anxiety Level ($p<.02$) and Practical Outlook ($p<.05$). The differences on Thinking Introversion, Autonomy and Impulse Expression just fail to reach significance ($p<.10$). Ss preferring high and Ss preferring low polygon and verbal complexity (Table IV.4) differ significantly only on Complexity ($p<.05$), the differences on Anxiety Level and Response Bias failed to reach significance ($p<.10$).

Tables IV.5 to IV.7 give the means, standard deviations and results of t tests on the AH5, HFT, Uses for Things and OPI for psychology Ss preferring high, medium and low complexity. The OPI group profiles are shown in standard scores in Figures IV.4 to IV.6.

Table IV.5 shows that the only significant difference between psychology Ss preferring high and low polygon complexity is on Masculinity-Femininity ($p<.02$); the difference on Anxiety Level failed to reach significance ($p<.10$). The group preferring medium complexity does not differ significantly from groups preferring medium complexity does not differ significantly from groups preferring high or low complexity on any variables. The only difference approaching significance is between the medium and low groups on Theoretical Orientation ($p<.10$). Figure IV.4 shows that the OPI profile of the group preferring medium complexity resembles the profile of the group preferring high complexity, and on seven of the fourteen OPI scales the medium group scores intermediate between the high and low complexity groups.

Psychology Ss preferring high verbal complexity and low verbal complexity (Table IV.6) differ significantly on Complexity ($p<.01$), Response Bias ($p<.01$), Autonomy ($p<.05$) and Practical Outlook ($p<.05$); the difference on Anxiety Level does not reach significance ($p<.10$). The group preferring medium verbal complexity does not differ significantly from the high complexity group on any variables; it differs significantly from the low com-

Table IV.5.

Comparison of three groups of psychology Ss preferring high polygon complexity/ medium polygon complexity/low polygon complexity.

Variables	1 High Complexity		2 Medium Complexity		3 Low Complexity		1 v 3		1 v 2		2 v 3	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	t	p	t	p	t	p
AH5												
Part I	20.40	3.16	19.50	4.69	20.30	3.16	0.07		0.47		0.43	
Part II	20.40	4.06	22.00	2.65	20.70	2.24	0.19		0.99		0.68	
Total	40.80	5.29	41.50	6.33	41.00	4.80	0.08		0.37		0.29	
HFT												
Total	14.80	4.80	15.30	5.10	16.30	6.56	0.55		0.22		0.36	
Uses												
Flexibility	29.50	22.47	20.70	6.86	20.40	8.25	1.14		1.12		0.08	
Fluency	50.30	36.74	34.20	13.19	36.10	11.92	1.10		1.24		0.32	
OPI												
TI	29.50	6.56	26.70	5.74	25.20	8.49	1.20		0.97		0.44	
TO	19.80	6.63	21.20	3.74	17.30	5.20	0.89		0.55		1.81	<.10
Es	15.40	4.24	12.30	4.12	13.00	5.00	1.10		1.56		0.32	
Co	20.80	6.00	19.00	4.47	17.00	6.56	1.28		0.71		0.76	
Au	33.40	5.66	34.00	3.16	32.00	6.33	0.49		0.28		0.85	
RO	16.10	6.86	19.30	3.87	15.20	6.78	0.28		1.22		1.57	
SE	19.40	8.19	21.80	3.60	22.60	7.21	0.91		0.80		0.31	
IE	32.80	10.30	33.60	8.78	31.30	11.53	0.38		0.20		0.48	
PI	28.10	6.93	26.40	11.09	33.20	9.64	1.29		0.39		1.39	
AL	10.70	4.90	10.90	6.56	14.60	3.46	1.96	<.10	0.07		1.50	
Am	21.70	3.13	20.00	4.47	20.10	6.93	0.63		0.93		0.04	
PO	7.30	4.58	9.20	4.24	11.40	6.86	1.50		0.92		0.82	
MF	20.90	4.12	25.20	7.00	26.20	3.87	2.82	<.02	1.59		0.38	
RB	10.90	2.96	11.10	4.58	13.20	4.58	1.26		0.11		0.96	

Means, standard deviations and results of t tests on AH5, HFT, Uses for Things and OPI (n = 10 in each group).

Table IV.6.

Comparison of three groups of psychology Ss preferring high verbal complexity/ medium verbal complexity/low verbal complexity.

Variables	1 High Complexity		2 Medium Complexity		3 Low Complexity		1 v 3		1 v 2		2 v 3	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	t	p	t	p	t	p
AH5												
Part I	20.80	4.36	19.30	3.00	19.70	3.06	0.62		0.85		0.28	
Part II	19.70	3.32	19.70	5.39	22.50	4.47	1.44		0.00		1.21	
Total	40.50	6.40	39.00	7.75	42.20	7.07	0.53		0.45		0.92	
HFT												
Total	15.80	4.36	16.10	6.25	17.50	6.95	0.62		0.09		0.45	
Uses												
Flexibility	23.20	18.47	31.30	16.46	24.10	12.53	0.12		0.98		1.43	
Fluency	40.50	28.35	52.70	29.41	40.80	16.46	0.03		0.90		1.06	
OPI												
TI	28.90	8.43	27.20	6.33	23.80	8.83	1.25		0.48		0.94	
TO	19.10	5.48	20.40	6.16	19.00	5.39	0.04		0.47		0.51	
Es	13.00	5.66	14.90	3.87	11.10	3.32	0.87		0.84		2.25	<.05
Co	21.40	4.24	20.00	2.65	14.00	5.83	3.13	<.01	0.45		1.77	<.10
Au	34.60	2.12	32.50	7.00	29.00	7.55	2.13	<.05	0.86		1.05	
RO	18.30	6.25	17.60	4.95	15.40	7.21	0.96		0.26		0.75	
SE	20.40	7.62	23.40	4.69	18.80	7.00	0.47		1.01		1.64	
IE	32.40	9.70	34.70	12.33	27.90	11.23	0.91		0.44		1.22	
PI	30.30	9.00	28.40	12.69	34.50	6.78	1.11		0.37		1.27	
AL	10.80	5.20	13.30	5.92	15.00	3.61	1.98	<.10	0.95		1.17	
Am	20.80	6.08	20.10	5.00	21.00	4.12	0.08		0.27		0.42	
PO	7.80	3.46	10.00	4.47	13.70	7.07	2.24	<.05	1.38		1.32	
MF	24.30	6.00	24.10	5.04	26.40	5.29	0.79		0.07		0.95	
RB	10.60	2.98	11.30	4.58	14.80	8.78	3.09	<.01	0.38		1.96	<.10

Means, standard deviations and results of t tests on AH5. HFT, Uses for Things and OPI. (n = 10 in each group).

Table IV.7.

Comparison of three groups of psychology Ss preferring high polygon and verbal complexity/medium polygon and verbal complexity/low polygon and verbal complexity.

Variables	1 High Complexity		2 Medium Complexity		3 Low Complexity		1 v 3		1 v 2		2 v 3	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	t	p	t	p	t	p
AH5 Part I	20.40	3.32	20.60	4.12	20.50	3.74	0.06		0.11		0.05	
Part II	18.90	4.12	23.60	3.61	21.00	4.12	1.07		2.55	<.05	1.41	
Total	39.30	5.75	44.20	7.21	41.50	7.42	0.71		1.60		0.78	
HFT												
Total	15.50	5.20	18.60	6.78	17.20	7.00	0.59		1.09		0.43	
Uses												
Flexibility	23.50	18.52	19.20	5.57	18.90	11.09	0.64		0.67		0.07	
Fluency	42.30	28.20	33.20	9.85	32.80	13.38	0.82		0.91		1.16	
OPI												
TI	28.10	8.78	22.80	6.40	24.80	9.80	0.76		1.47		0.51	
TO	20.30	6.71	18.00	5.57	16.80	4.70	1.28		0.79		0.50	
Es	13.30	5.57	9.90	3.16	12.10	4.36	0.51		0.90		0.61	
Co	21.20	4.90	15.90	5.83	16.40	6.48	1.77	<.10	2.10	<.05	0.17	
Au	34.50	7.35	31.00	7.28	32.10	7.81	0.67		1.37		0.65	
RO	18.50	6.33	17.50	5.92	14.10	6.33	1.48		0.35		1.19	
SE	18.60	7.87	20.70	6.86	20.30	6.71	0.49		0.60		0.13	
IE	32.10	10.44	28.40	7.21	30.20	9.27	0.41		0.88		0.46	
PI	30.00	7.48	30.30	9.60	32.00	8.54	0.53		0.07		0.40	
AL	10.60	4.58	10.90	6.78	14.20	2.90	1.98	<.10	0.11		1.34	
Am	21.40	5.57	22.00	3.74	21.50	6.63	0.04		0.27		0.20	
PO	7.40	4.36	10.30	4.90	10.90	8.25	1.13		1.34		0.19	
MF	25.40	5.39	26.90	6.69	25.00	5.10	0.16		0.56		0.71	
RB	11.20	3.32	12.70	5.39	12.70	4.24	0.84		0.71		0.00	

Means, standard deviations and results of t tests on AH5, HFT, Uses for Things and OPI (n = 10 in each group).

Figure IV.4.

O.P.I. group profiles of psychology Ss preferring high polygon complexity / medium polygon complexity / low polygon complexity.

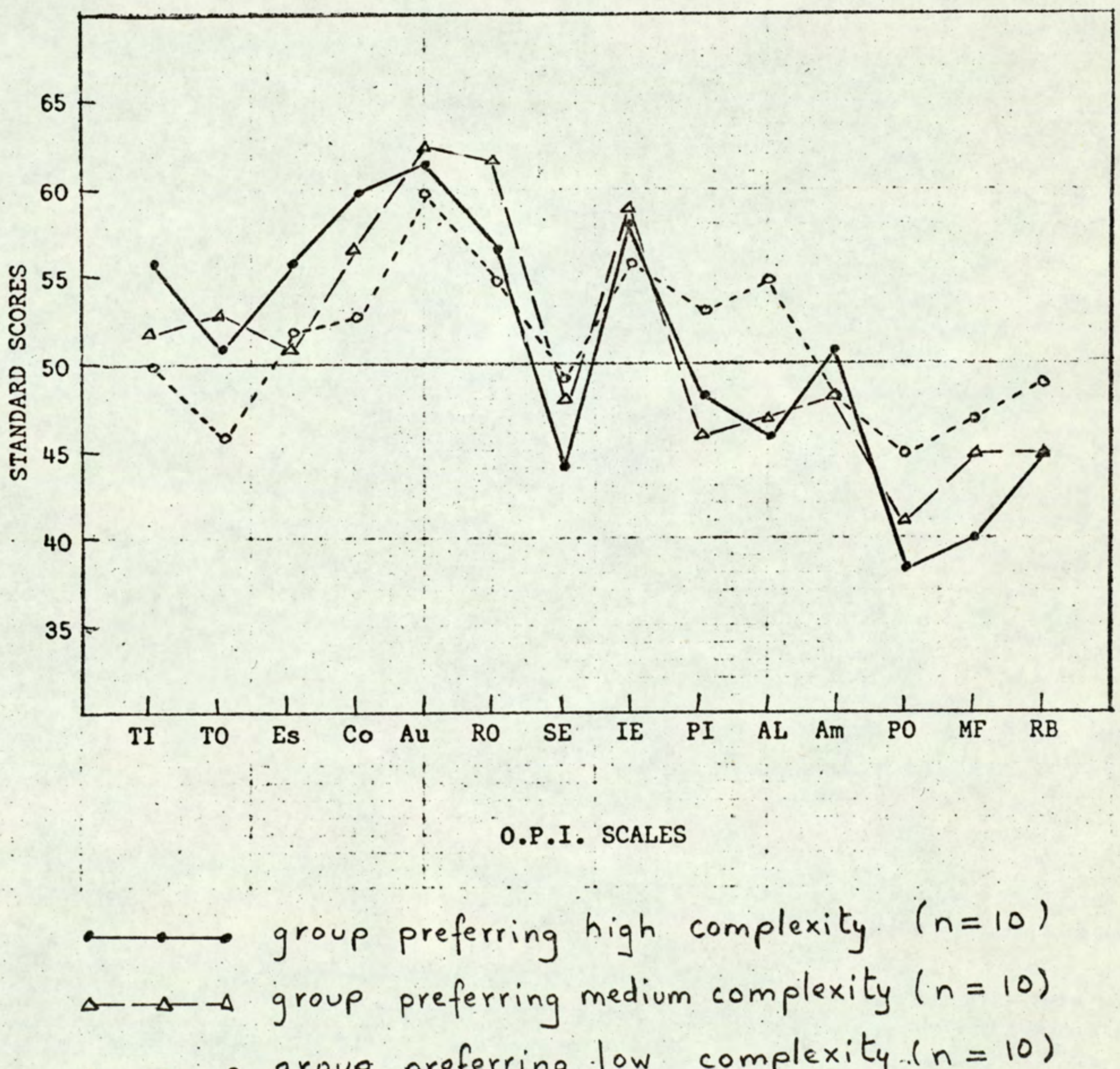


Figure IV.5.

O.P.I. group profiles of psychology Ss preferring high verbal complexity / medium verbal complexity / low verbal complexity.

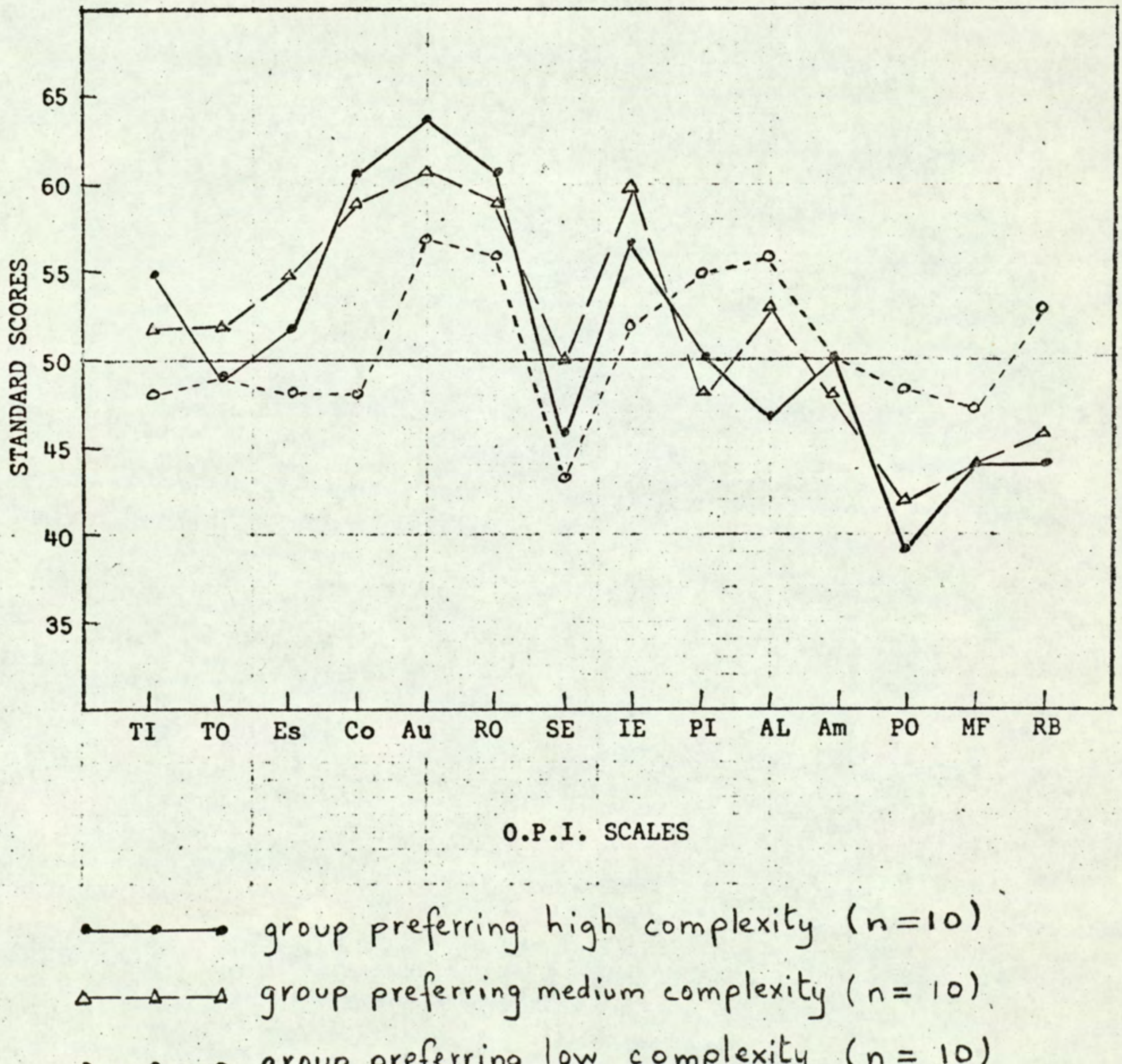
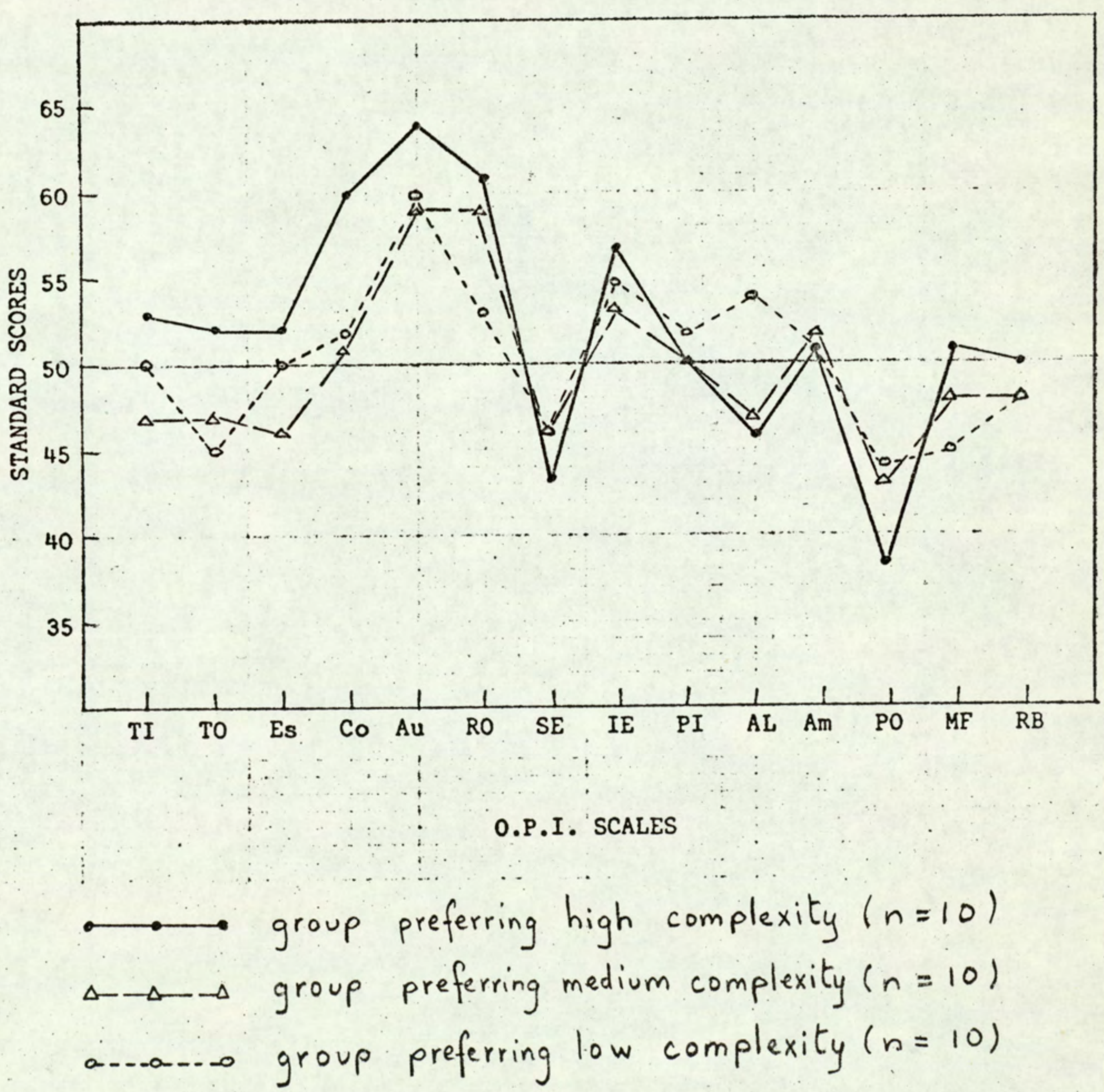


Figure IV.6.

O.P.I. group profiles of psychology Ss preferring high polygon and verbal complexity / medium polygon and verbal complexity / low polygon and verbal complexity.



plexity group only on Estheticism ($p<.05$), and the differences on Complexity and Response Bias just fail to reach significance ($p<.10$). The OPI profile of the medium complexity group resembles the high complexity group and on seven of the OPI scales the medium group scores intermediate between the high and low complexity groups (Figure IV.5).

In Table IV.7 the only differences between groups preferring high polygon and verbal complexity and low polygon and verbal complexity which approach significance are on Complexity and Anxiety Level ($p<.10$). The group preferring medium verbal complexity does not differ significantly from the low complexity group on any variables but it differs significantly from the high complexity group on Part II of the AH5 ($p<.05$) and Complexity on the OPI ($p<.05$). The OPI profile (Figure IV.6) of the medium complexity group resembles the low complexity group except for Anxiety Level, and on six of the OPI scales the medium group scores intermediate between the high and low complexity groups.

Tables IV.8 to IV.10 present the means, standard deviations and results of $\underline{t}$ tests on the AH5, HFT, Uses for Things and OPI for engineering Ss preferring high and low complexity. The OPI profiles are shown in standard scores in Figures IV.7 to IV.9.

Engineering Ss preferring high polygon complexity and low polygon complexity (Table IV.8) differ significantly on Response Bias ($p<.01$) and Estheticism ($p<.05$). Engineering Ss preferring high verbal complexity and low verbal complexity (Table IV.9) differ significantly only on Response Bias ($p<.01$); the differences on Complexity and Impulse Expression just fail to reach significance ($p<.10$). None of the differences between engineering Ss preferring high polygon and verbal complexity and low polygon and verbal complexity are significant (Table IV.10).

Table IV.8.

Comparison of two groups of engineering Ss preferring high polygon complexity/low polygon complexity.

Variables	High Complexity		Low Complexity		t	p
	Mean	S.D.	Mean	S.D.		
AH5						
Part I	18.80	5.83	16.40	3.61	0.64	
Part II	19.60	6.08	19.40	2.00	0.04	
Total	38.40	11.70	35.80	2.44	1.18	
HFT						
Total	13.40	6.40	15.40	7.00	0.42	
Uses						
Flexibility	15.80	5.39	11.80	6.93	0.91	
Fluency	34.80	13.45	26.40	13.67	0.92	
OPI						
Thinking Introversion	17.40	12.45	12.20	6.63	0.74	
Theoretical Orientation	16.80	5.10	19.00	3.32	0.72	
Estheticism	11.20	4.69	5.00	2.45	2.33	.05
Complexity	17.20	5.39	11.80	7.55	1.16	
Autonomy	26.80	8.49	21.60	8.49	0.87	
Religious Orientation	17.40	4.24	11.00	7.42	1.50	
Social Extraversion	19.20	9.11	20.00	6.25	0.14	
Impulse Expression	35.00	14.35	28.80	10.20	0.71	
Personal Integration	27.80	11.45	34.80	7.61	1.02	
Anxiety Level	10.80	5.48	15.00	2.00	1.44	
Altruism	12.60	6.25	16.60	3.32	1.13	
Practical Outlook	16.20	6.25	19.00	3.74	0.77	
Masculinity-Femininity	29.40	3.00	34.80	6.00	1.67	
Response Bias	9.00	3.61	16.20	2.00	3.50	.01

Means, standard deviations and results of t tests on AH5, HFT, Uses for Things and OPI. (n = 5 in each group)

Table IV.9.

Comparison of two groups of engineering Ss preferring high verbal complexity/low verbal complexity.

Variables	High Complexity		Low Complexity		t	p
	Mean	S.D.	Mean	S.D.		
AH5						
Part I	17.60	5.00	17.60	1.41	0.00	
Part II	19.80	5.92	19.00	2.44	0.17	
Total	37.40	10.86	36.60	2.00	0.13	
HFT						
Total	12.00	7.00	15.80	2.00	0.79	
Uses						
Flexibility	18.40	5.66	14.00	4.47	1.22	
Fluency	36.20	8.60	32.80	6.93	0.62	
OPI						
Thinking Introversion	23.00	10.58	13.40	8.94	1.39	
Theoretical Orientation	17.00	4.90	19.80	4.36	0.85	
Estheticism	11.00	5.00	6.20	3.00	1.64	
Complexity	17.80	5.74	10.20	4.58	2.07	.10
Autonomy	26.80	9.11	23.00	4.58	0.75	
Religious Orientation	18.20	3.16	14.00	7.62	1.02	
Social Extraversion	18.00	10.30	13.60	6.08	0.77	
Impulse Expression	33.20	9.33	20.40	9.38	1.93	.10
Personal Integration	26.00	11.40	32.60	6.63	1.00	
Anxiety Level	10.40	3.87	13.80	3.74	1.26	
Altruism	14.60	5.57	15.20	2.24	0.20	
Practical Outlook	13.60	6.93	18.40	3.00	1.27	
Masculinity-Femininity	29.60	2.82	33.00	5.48	1.10	
Response Bias	9.20	3.00	16.20	2.23	3.50	.01

Means, standard deviations and results of t tests on AH5, HFT, Uses for Things and OPI. (n = 5 in each group)

Table IV.10.

Comparison of two groups of engineering Ss preferring high polygon and verbal complexity/low polygon and verbal complexity.

Variables	High Complexity		Low Complexity		t	p
	Mean	S.D.	Mean	S.D.		
AH5						
Part I	19.40	5.83	17.40	4.47	0.54	
Part II	20.40	6.08	20.00	2.83	0.12	
Total	39.80	11.79	37.40	4.90	0.38	
HFT						
Total	13.20	6.40	14.20	5.57	0.24	
Uses						
Flexibility	18.00	6.16	13.80	6.40	0.94	
Fluency	33.60	12.69	29.40	12.41	0.47	
OPI						
Thinking Introversion	18.40	11.70	13.40	8.00	0.71	
Theoretical Orientation	16.60	4.90	17.80	2.83	0.42	
Estheticism	11.00	5.00	6.60	3.00	1.51	
Complexity	17.20	5.39	12.00	5.20	1.40	
Autonomy	26.40	8.83	24.60	5.83	0.34	
Religious Orientation	17.00	3.87	14.40	8.00	0.81	
Social Extraversion	18.00	10.30	14.80	6.16	0.53	
Impulse Expression	36.20	12.08	27.00	10.04	1.17	
Personal Integration	25.20	11.45	31.80	10.34	0.86	
Anxiety Level	9.80	4.12	11.80	4.80	0.63	
Altruism	12.20	6.25	13.60	3.87	0.38	
Practical Outlook	15.60	5.92	18.20	2.82	0.79	
Masculinity-Femininity	29.40	3.00	33.00	5.84	1.15	
Response Bias	8.80	3.32	13.80	5.20	1,62	

Means, standard deviations and results of _t_ tests on AH5, HFT, Uses for Things and OPI. (n = 15 in each group)

Figure IV.7.

O.P.I. group profiles of engineering Ss preferring high polygon complexity / low polygon complexity.

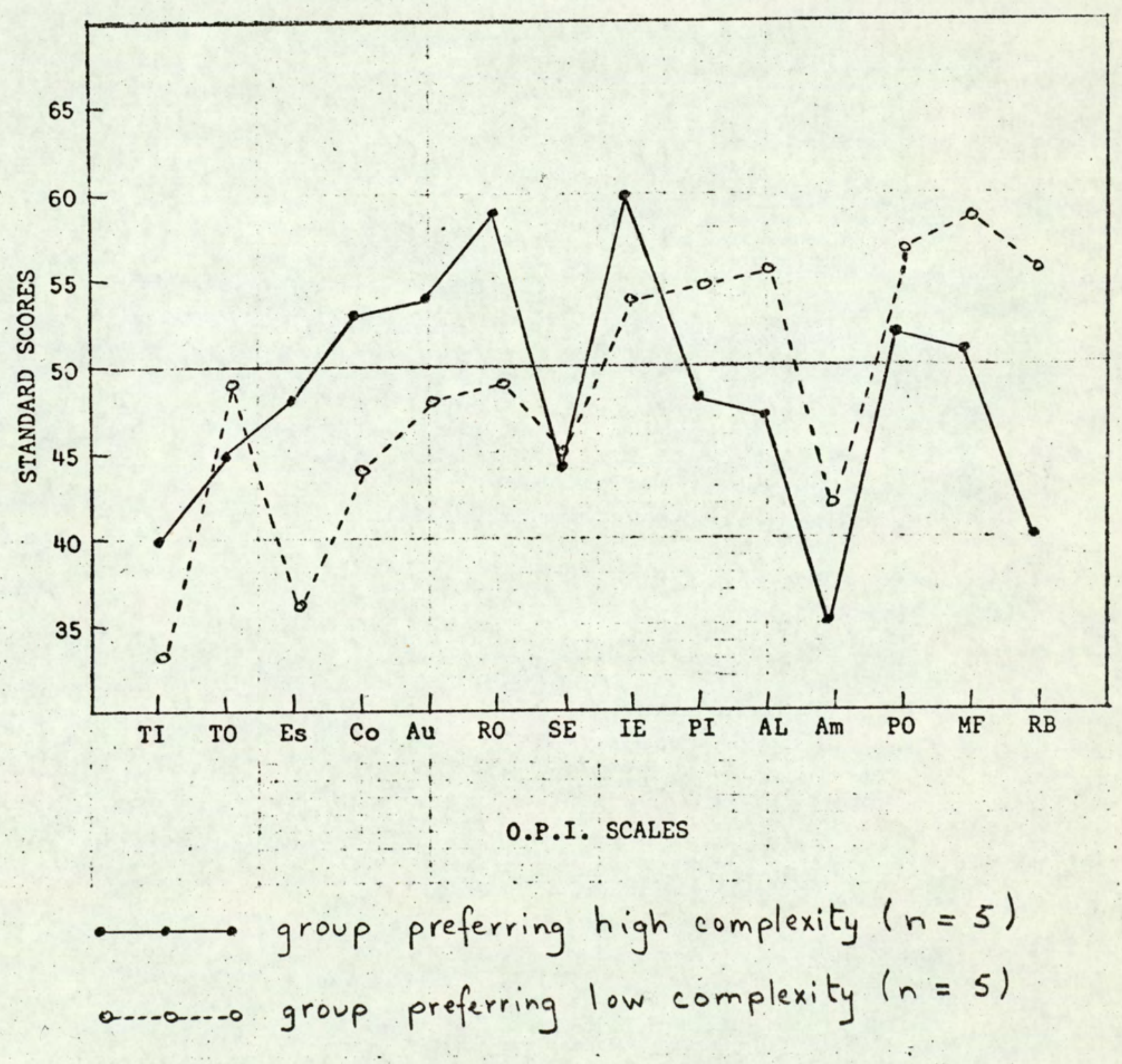


Figure IV.8.

O.P.I. group profiles of engineering Ss preferring high verbal complexity / low verbal complexity.

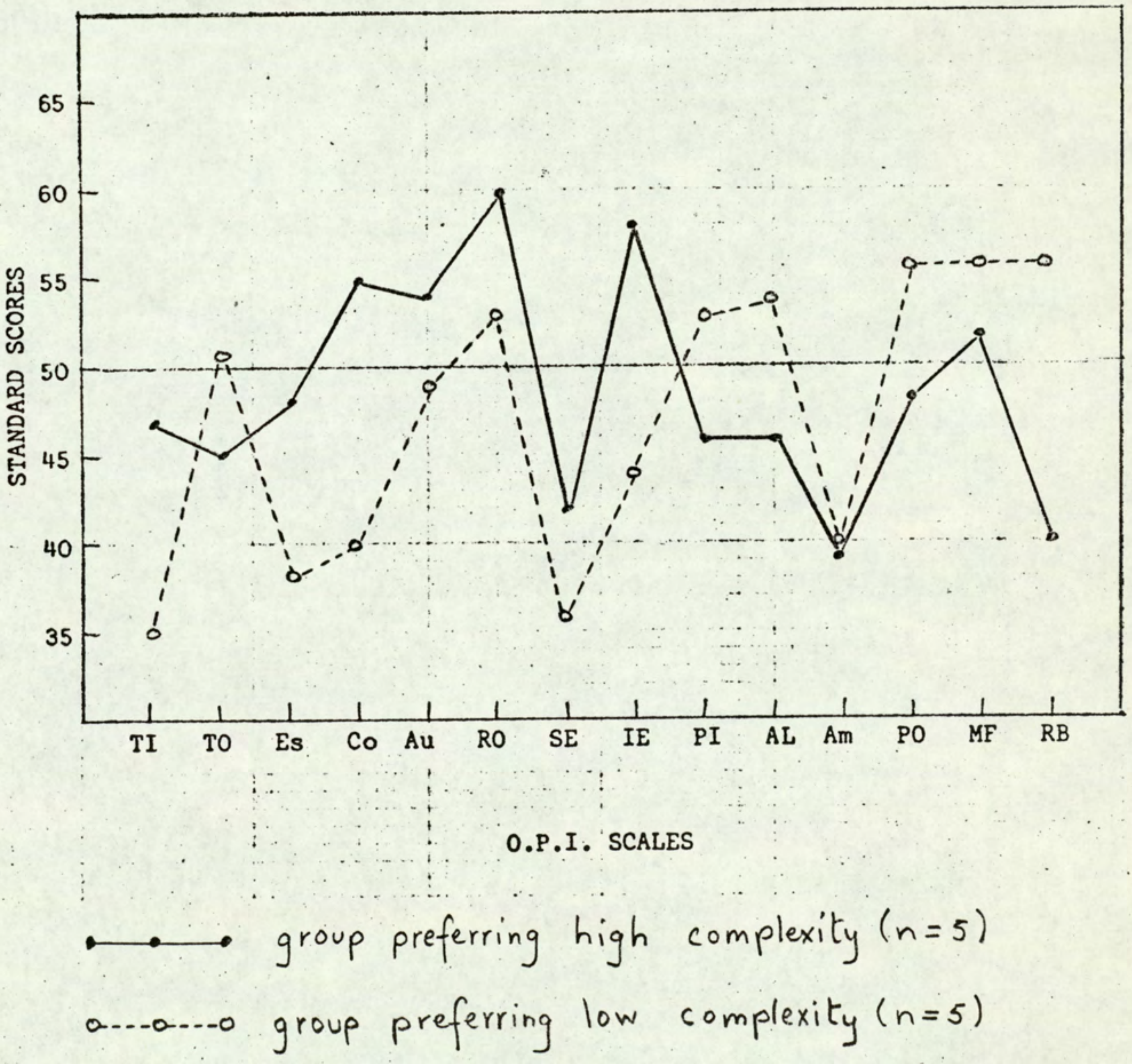
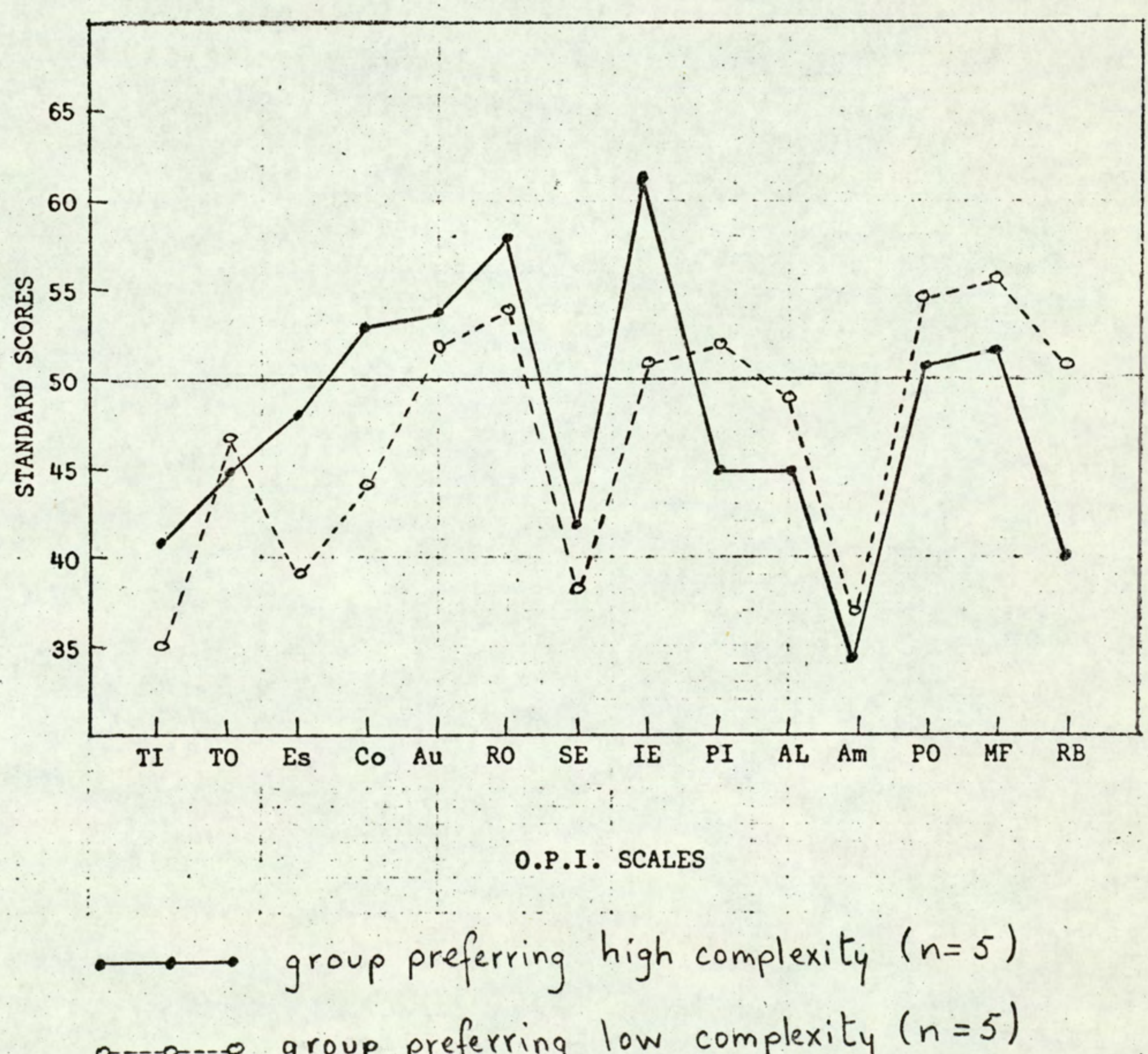


Figure IV.9.

O.P.I. group profiles of engineering Ss preferring high polygon and verbal complexity / low polygon and verbal complexity.



Summary

The results of the individual differences in preference for C/S are summarised below.

AH5: Intelligence and preference for C/S are not significantly related.

HFT: Field-independence and preference for C/S are not significantly related. However all high complexity groups score lower on the HFT than low complexity groups.

Uses for Things: Creativity and preference for C/S are not significantly related. There is a non-significant trend for Ss preferring high polygon complexity to have high scores on flexibility and, to a lesser extent, on fluency.

OPI: Several OPI scales are significantly related to C/S preference.

Preference for polygon complexity is most strongly related to bad response bias (RB) and high feminity (MF); it is also significantly related to aestheticism (Es), complexity tolerance (Co), high anxiety level (AL) and lack of practical outlook (PO).

Preference for verbal complexity is most strongly related to bad response bias (RB), complexity tolerance (Co), high anxiety level (AL) and lack of practical outlook (PO); it is also significantly related to thinking introversion (TI), aestheticism (Es), autonomy (Au), femininity (MF), impulse expression (IE) and high personal integration (PI).

Preference for polygon and verbal complexity is significantly related only to complexity tolerance (Co).

The differences between high and low complexity groups among psychology and engineering Ss are generally very similar.

IV.3 GROUP DIFFERENCES IN PREFERENCE FOR COMPLEXITY-SIMPLICITY

Polygon Preference

The mean preference of all Ss (N = 87) for polygons varying in complexity is shown in Figure IV.10. Percentage preference is plotted against the number of independent turns on the polygons. No definite trend is apparent on this graph which is almost W shaped. Preference for polygons of 3 and 4 turns is high, there is a sharp drop for polygons of 5 turns, then a rise to a maximum preference for polygons of 10 turns, thereafter preference tends to drop again until a slight rise for polygons of 31 and 40 turns.

Figure IV.11 shows the preference functions of all the Ss when broken down into psychology (n = 50), engineering (n = 25) and art (n = 12) groups. The data of psychology males and females have been combined on this graph and are shown separately in Figure IV.12. In Figure IV.11 the psychology group shows a general rise in preference with increasing complexity except for polygons of 5 turns where there is a sharp drop in preference. Psychology males and females (Figure IV.12) have the same preference functions but females show steeper peaks and troughs. The engineering group shows a definite decrease in preference with increasing complexity except for a point of inflection at 10 turns. The art group shows a fairly equal preference for all polygons except for a sharp drop in preference for polygons of 5 turns. The groups differ in their range of preference scores. In the psychology group the range is from 61% for polygons of 40 turns to 33% for polygons of 5 turns. In the engineering group the range is from 68% for polygons of 3 turns to 32% for polygons of 40 turns. In contrast in the art group the range is only from 57% for polygons of 4 and 8 turns to 43% for polygons of 5 turns.

Figure IV.10.

Percentage scores of preference for polygons varying in number of independent turns. (N = 87).

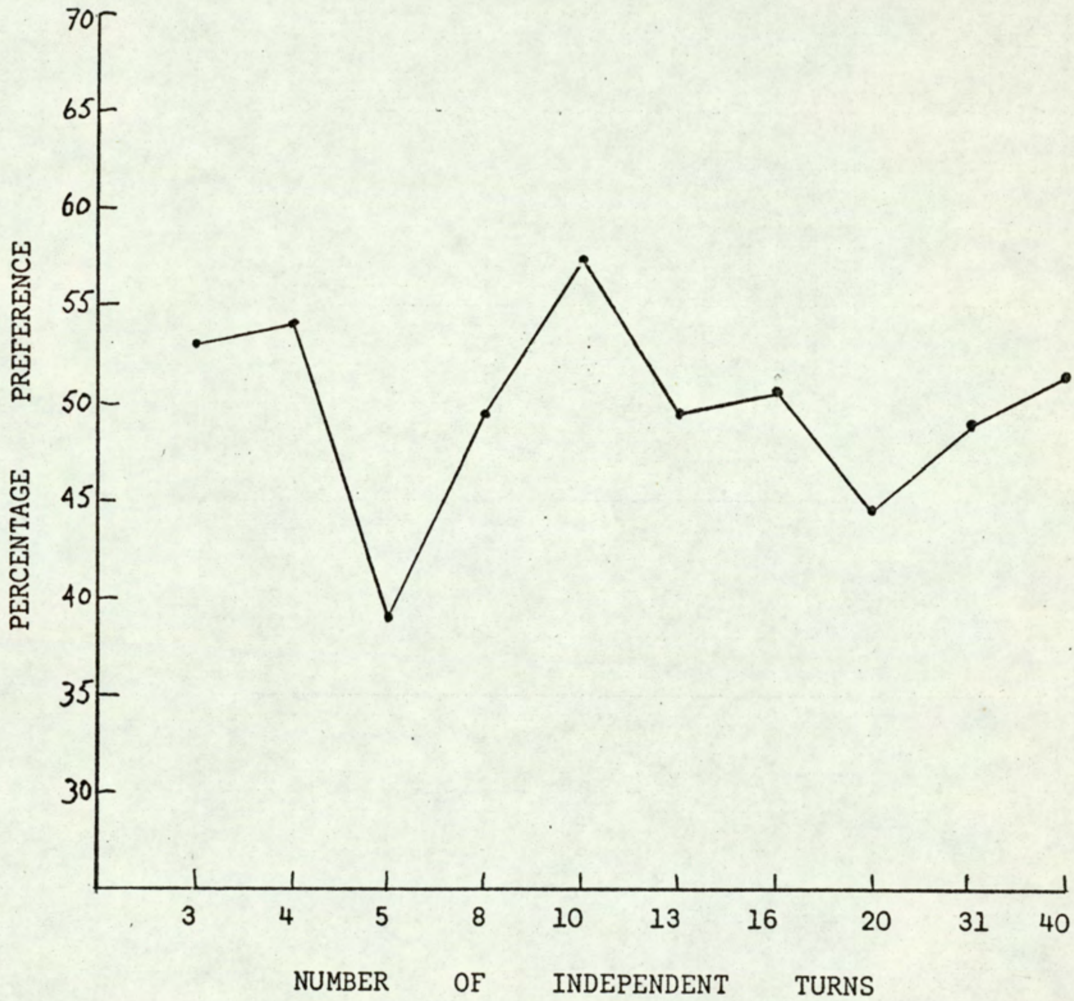


Figure IV.11.

Percentage scores of preference for polygons varying in number of independent turns. A comparison of psychology, engineering and art Ss.

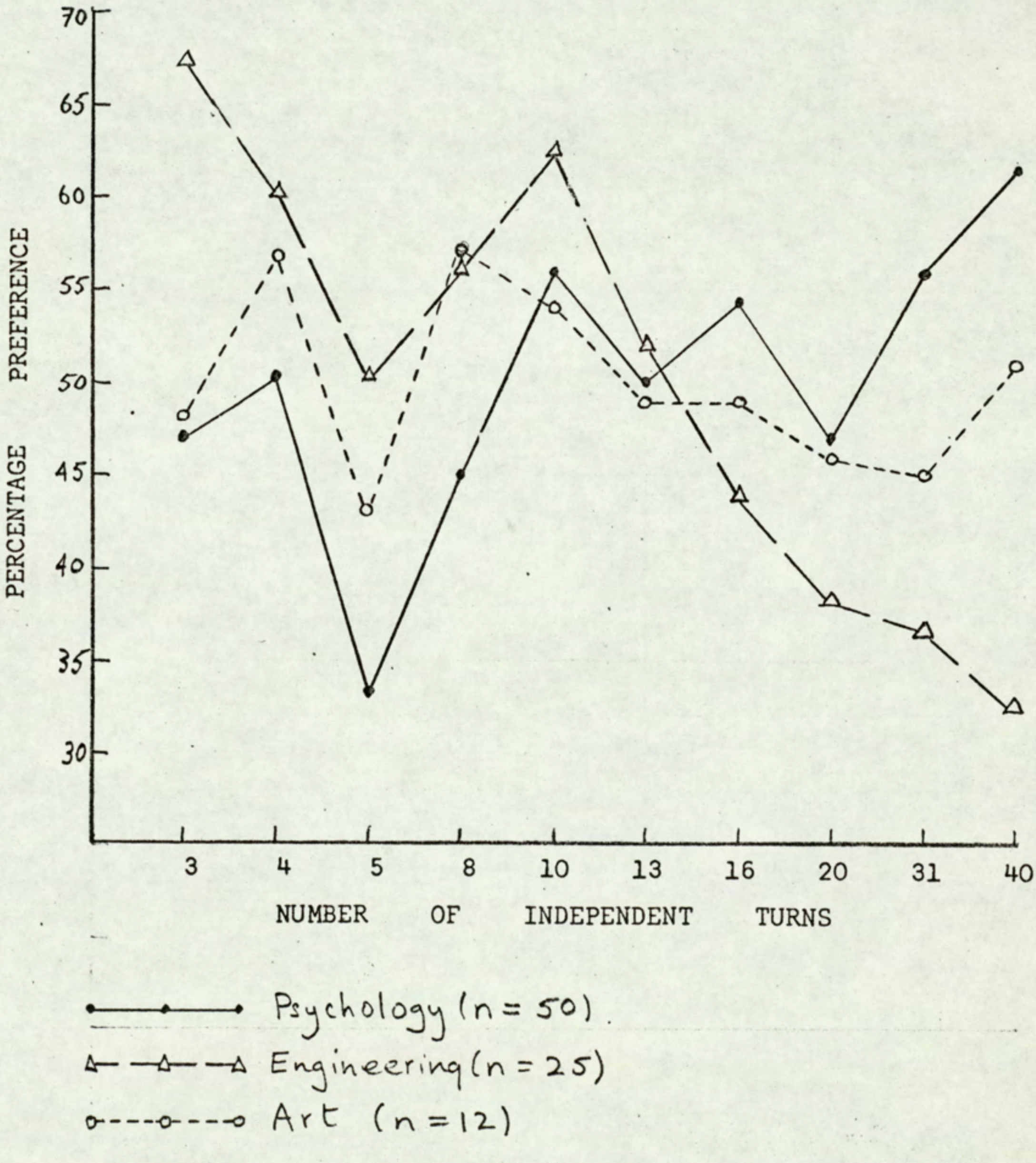


Figure IV.12.

Percentage scores of preference for polygons varying in number of independent turns. A comparison of male and female psychology Ss.

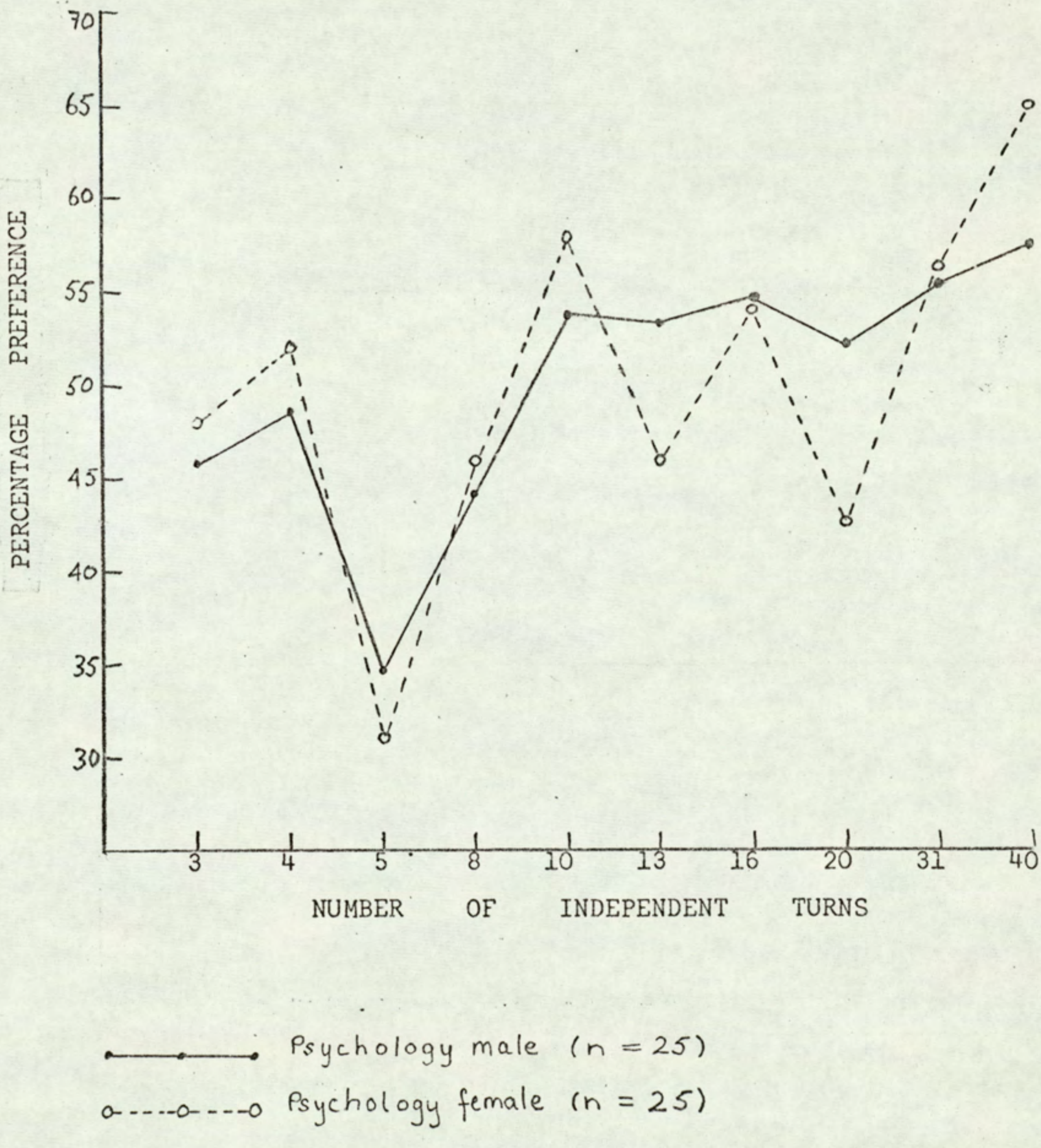


Table IV.11 gives the means and standard deviations of the choice scores (from which the percentage scores were derived) and the point total scores of polygon preference for psychology male, psychology female, engineering, and art Ss. On the majority of the choice scores the standard deviations of the art group are lower than the other groups. The psychology and engineering groups' choice scores have particularly high standard deviations at extreme levels of complexity or simplicity. The mean point scores of polygon preference are above 80 for the two psychology groups, indicating that on average they like more complexity than they dislike. The scores of the engineering and art groups are below 80, indicating that they dislike more complexity than they like, especially the engineering group. However the high standard deviations show that there are very great individual differences in preference within the groups.

The total preference scores of the groups were not normally distributed therefore nonparametric statistics were used to analyse the data. Comparing all four groups with a Kruskal-Wallis one-way analysis of variance by ranks gave the result: $H = 10.46$, with $df = 3$, $p < .02$. Mann-Whitney U tests were then used to compare each group with every other group and the results are given in Table IV.12. The engineering group preferred significantly less complexity than psychology males and females. The differences between the engineering group and art group approached significance ($p < .10$) but all other differences were nonsignificant.

Verbal Preference

The mean preference of all Ss (N = 87) for verbal sequences is shown in Figure IV.13. Percentage preference is plotted against level of approximation to English. Redundant letters and prose are most preferred, then there is a general decline in preference with increasing complexity except for random words which are relatively highly preferred.

Table IV.11.

Means and standard deviations of polygon preference scores for psychology male, psychology female, engineering and art Ss.

Number of turns on polygons	Psychology Male(n=25)		Psychology Female(n=25)		Engineering (n=25)		Art (n=12)	
	Choice Scores		Choice Scores		Choice Scores		Choice Scores	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
3	4.12	3.11	4.32	2.76	6.08	2.91	4.33	2.34
4	4.40	2.84	4.68	1.97	5.48	2.57	5.17	1.63
5	3.12	2.30	2.84	2.53	4.52	2.79	3.83	2.58
8	3.96	1.67	4.16	1.72	5.04	1.72	5.17	1.58
10	4.84	0.97	5.24	1.45	5.64	1.22	4.83	1.63
13	4.80	2.04	4.12	1.36	4.56	1.39	4.42	1.56
16	4.92	1.71	4.88	1.76	4.00	1.73	4.42	1.56
20	4.68	1.72	3.80	2.12	3.48	1.39	4.17	1.73
31	4.96	2.62	5.12	2.29	3.32	2.76	4.09	1.33
40	5.20	3.36	5.84	2.54	2.88	3.30	4.58	1.68
Total Point Score	91.32	58.31	93.48	47.22	52.40	57.71	74.75	35.64

Table IV.12.

Comparisons of total polygon preference scores between psychology male, psychology female, engineering and art Ss.

Groups	Significance Z	P
Psychology male v Psychology female	0.19	0.8494
Psychology male v Engineering	2.69	0.0072**
Psychology male v Art	0.88	0.3788
Psychology female v Engineering	2.47	0.0136*
Psychology female v Art	1.25	0.2112
Engineering V Art	-1.78	0.0750

Results of Mann-Whitney U tests

* p 0.05

** p 0.01

Figure IV.13

Percentage scores of preference for verbal sequences varying in approximation to English. (N = 87).

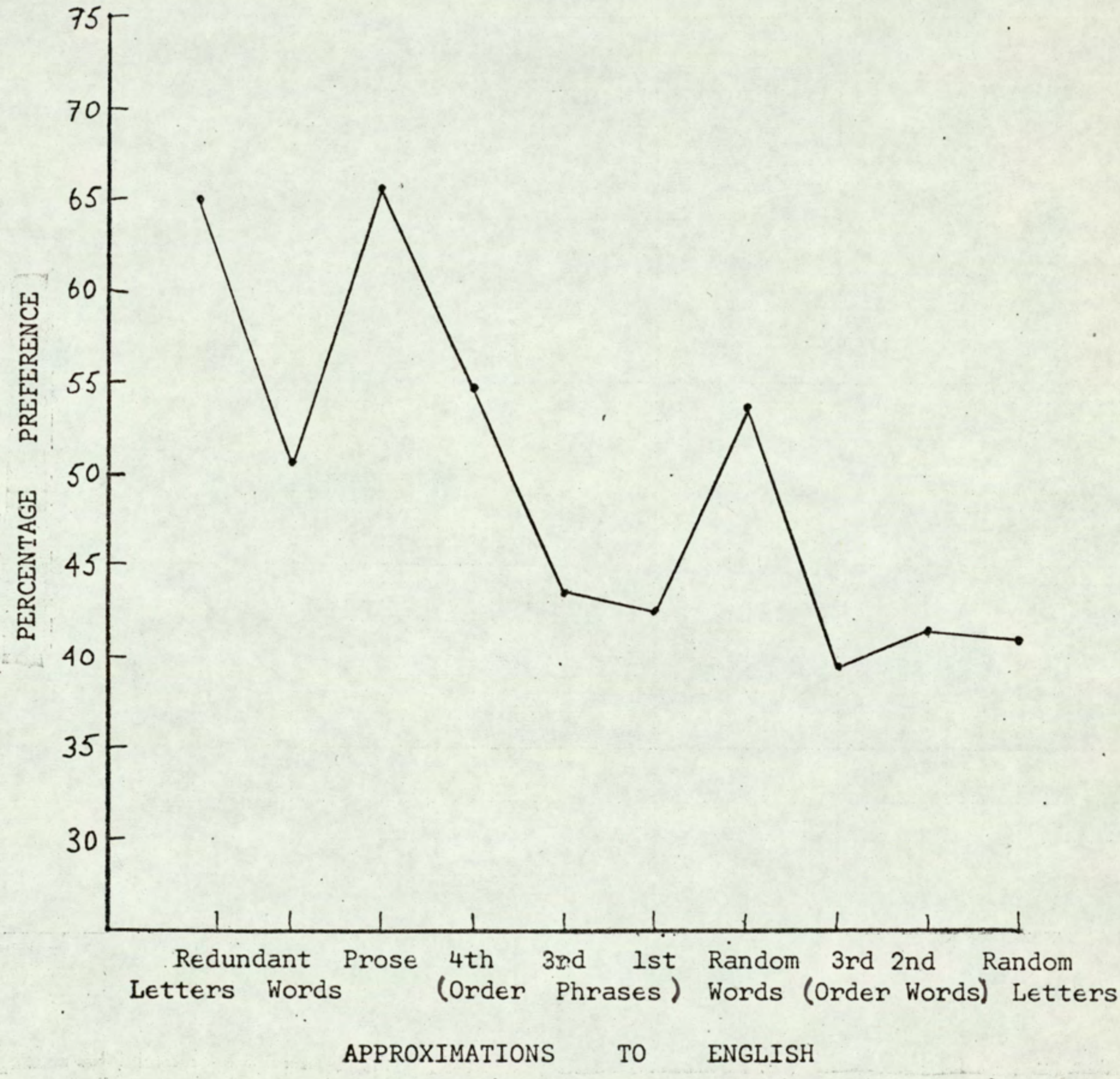


Figure IV.14.

Percentage scores of preference for verbal sequences varying in approximation to English. A comparison of psychology, engineering and art Ss.

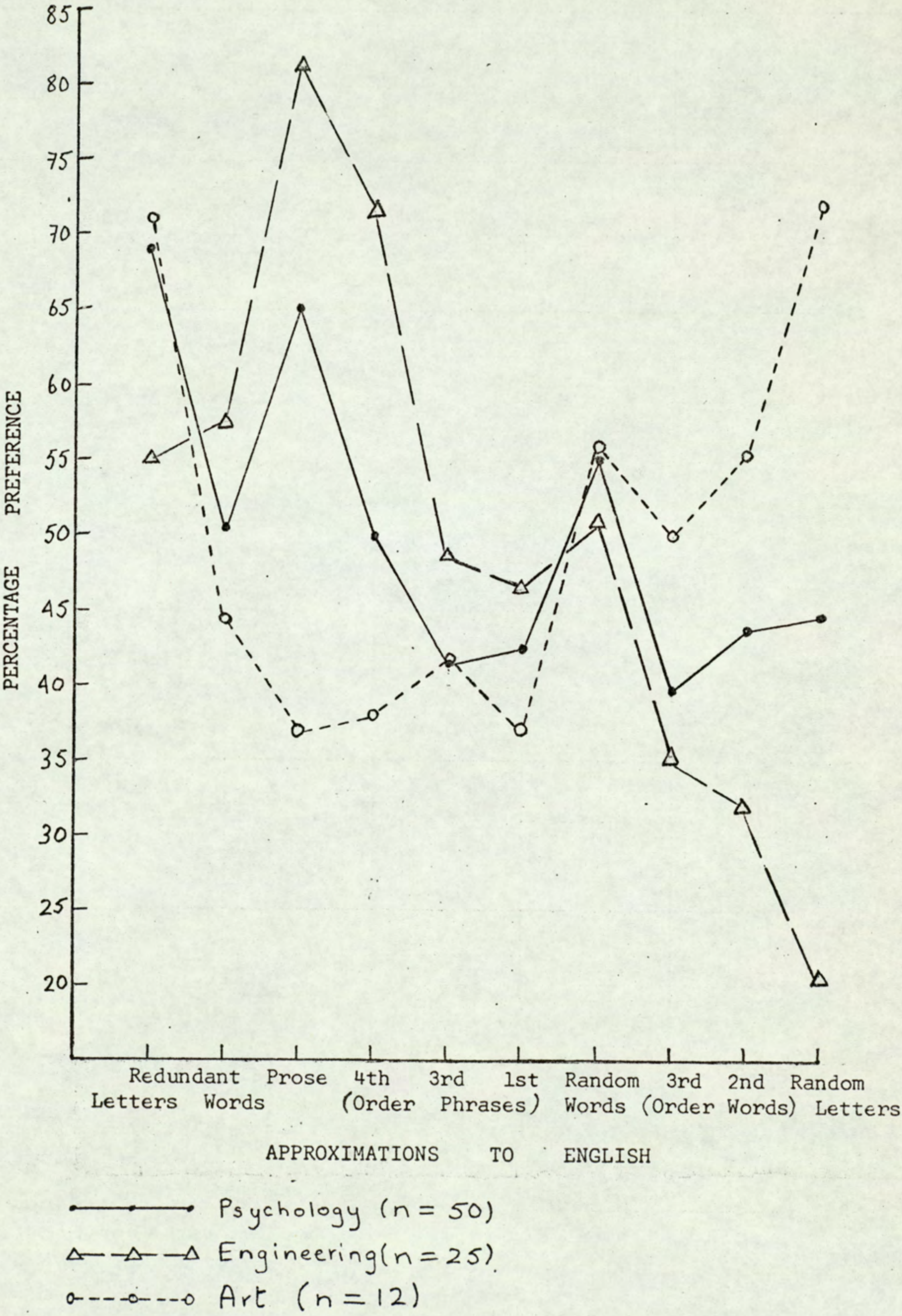


Figure IV.15.

Percentage scores of preference for verbal sequences varying in approximation to English. A comparison of male and female psychology Ss.

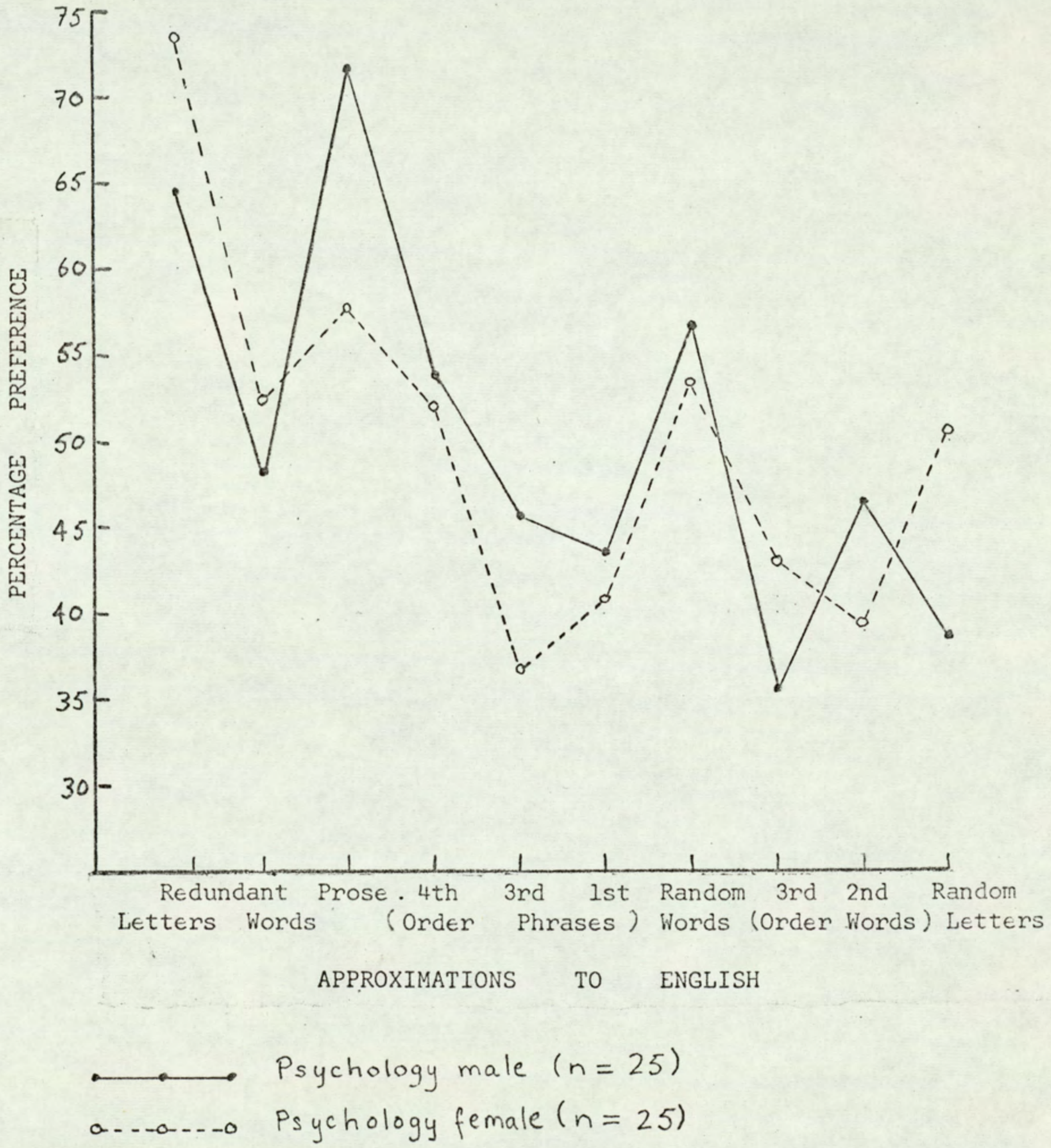


Figure IV.14 shows the preference functions of all Ss when broken down into psychology (n = 50), engineering (n = 25) and art (n = 12) groups. The data of psychology males and females have been combined on this graph and are shown separately in Figure IV.15. Figure IV.14 shows that for the psychology group redundant letters are most preferred, followed by prose, then preference drops and levels out at under 50% except for random words which are more highly preferred. Males and females (Figure IV.15) show fairly similar preference functions although males tend to prefer the approximations to phrases and females the approximations to words. The preference of the engineering group is an inverted U shaped function of complexity. They show an overwhelming preference for prose and a rejection of the approximations to words. The preference of the art groups is a U shaped function of complexity. They prefer redundant and random letters most and prose and first-order phrases least. The range of scores of verbal preference is very large. In the psychology group the range is from 69% for redundant letters to 35% for third-order words. In the engineering group the range is from 81% for prose to 20% for random letters. In the art group the range is from 72% for random letters to 37% for prose and first-order phrases.

Table IV.13 gives the means and standard deviations of the choice scores (from which the percentage scores were derived) and total weighted scores of verbal preference for psychology male, psychology female, engineering and art groups. The standard deviations, whilst not as high for polygon preference, are fairly large, indicating strong individual differences in preference. The art group has the highest mean total score, psychology females and psychology males intermediate scores, and engineers the lowest score.

Comparing the total scores of all four groups with a Kruskall-Wallis one-way analysis of variance by ranks gave the result: $H = 16.95$, with $df = 3$, $p<.001$. Mann-Whitney $\underline{U}$ tests were then used to compare each group with every other group and the results are given in Table IV.14. The art group prefers

Table IV.13.

Means and standard deviations of verbal preference scores for psychology male, psychology female, engineering and art students.

Approximations to English	Psychology Male(n=25)		Psychology female(n=25)		Engineering (n=25)		Art (n=12)	
	Choice Scores		Choice Scores		Choice Scores		Choice Scores	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Redundant letters	5.80	2.42	6.60	2.77	4.96	2.87	6.42	2.22
Redundant Words	4.32	2.85	4.72	2.61	5.20	2.61	4.00	1.96
Prose	6.44	1.76	5.20	2.45	7.32	1.44	3.33	2.27
Fourth-order phrases	4.40	2.57	4.68	1.70	6.48	1.69	3.42	1.39
Second-order phrases	4.12	2.17	3.32	1.78	4.36	2.02	3.75	1.59
First-order phrases	3.92	2.08	3.68	1.44	4.20	1.61	3.33	1.68
Random words	5.12	1.94	4.80	1.73	4.60	1.53	4.92	1.94
Third-order words	3.20	1.63	3.88	1.96	3.16	1.70	4.42	1.98
Second-order words	4.20	2.72	3.56	2.18	2.88	2.42	4.92	2.36
Random letters	3.48	2.87	4.56	1.02	1.84	1.91	6.50	2.00
Total weighted scores	62.04	33.17	69.04	41.47	41.44	27.51	97.42	32.56

Table IV.14.

Comparisons of total verbal preference scores between psychology male, psychology female, engineering and art Ss.

Groups	Significance Z	P
Psychology male v Psychology female	-0.48	0.6312
Psychology male v Engineering	2.20	0.0278*
Psychology male v Art	2.64	0.0150*
Psychology female v Engineering	2.48	0.0132*
Psychology female v Art	2.04	0.0414*
Engineering v Art	4.06	<0.0001**

Results of Mann - Whitney *U* tests

* p 0.05

** p 0.001

significantly more complexity than the engineering group ($p<.0001$), psychology males ($p<.05$) and psychology females ($p<.05$). The engineering group prefers significantly less complexity than psychology males ($p<.05$) and females ($p<.05$). Psychology males and females do not differ significantly.

The order of the items making up the verbal preference measure was not always based on the objective complexity of the items. Therefore it was decided to compare the groups (who differ significantly on their total scores) on the ten levels of approximation to English in order to discover at which levels the groups differ. The results of the Mann-Whitney U tests are presented in Table IV.15 and the significant differences are summarized below.

Prose: The engineering, psychology male and psychology female groups prefer significantly more prose than the art group.

Engineering v art ($p<.0001$)

Psychology male v art ($p<.001$)

Psychology female v art ($p<.05$)

Fourth-order phrases: The engineering group prefers significantly more fourth-order phrases than the psychology male, psychology female and art groups.

Engineering v art ($p<.0001$)

Engineering v psychology female ($p<.001$)

Engineering v psychology male ($p<.01$)

The psychology female group prefers significantly more than the art group ($p<.05$).

Second-order words: The art group prefers significantly more second-order words than the engineering group ($p<.05$).

Random letters: The art, psychology male and psychology female groups prefer

TABLE IV.15

Comparison of preference scores for ten levels of approximation to English between psychology male, psychology female, engineering and art Ss.

GROUPS	APPROXIMATIONS TO ENGLISH																			
	Redundant Letters		Redundant Words		Prose		Fourth		Second ORDER PHRASES		First ORDER PHRASES		Random Words		Third ORDER WORDS		Second ORDER WORDS		Random Letters	
	z	p	z	p	z	p	z	p	z	p	z	p	z	p	z	p	z	p	z	p
Psychology male v Engineering	1.19		-1.18		- .27		-2.94	** .0032	- .32		- .61		1.41		.30		1.73	.0836	1.98	* .0478
Psychology male v Art	- .76		.37		3.36	*** <.0006	1.51		.68		.71		.62		-1.78	.0750	- .88		-2.81	** .005
Psychology female v Engineering	1.44		- .65		-1.85	.0644	-3.46	*** <.0006	-1.74	.0818	-1.27		.32		1.42		1.74	.0818	3.11	** .0018
Psychology female v Art	.78		.79		2.08	* .0376	2.08	* .0376	.78		.52		-.15		- .60		-1.48		-1.59	
Engineering v Art	-1.31		1.40		4.09	**** <.0001	4.04	**** <.0001	.83		1.46		-.47		-1.71	.0872	-2.21	* .0272	-4.30	**** <.0001

Results of Mann-Whitney U test

* p<.05
** p<.01
*** p<.001
**** p<.0001

significantly more random letters than the engineering group.

Art _v_ engineering (p<.0001)

Psychology female _v_ engineering (p<.01)

Psychology male _v_ engineering (p<.05)

The art group prefers significantly more than the psychology male group (p<.01).

Table IV.16 gives the means, standard deviations and results of _t_ tests on the AH5, HFT, Uses for Things and OPI for the psychology male, psychology female and engineering groups. There are no significant differences between the groups on the AH5 or HFT. On Uses for Things the psychology male group scores significantly higher than the psychology female and engineering groups on flexibility (p<.05; p<.01) and on fluency (p<.05; p<.05). On the OPI psychology males and females differ significantly on Impulse Expression (p<.01), Masculinity-Femininity (p<.01), Complexity (p<.05), and Religious Orientation (p<.05). The psychology male and engineering groups differ on Thinking Introversion (p<.001), Complexity (p<.001), Estheticism (p<.002), Autonomy (p<.002), Impulse Expression (p<.01), Practical Outlook (p<.01), and Masculinity-Femininity (p<.01). The psychology female and engineering groups differ significantly on the OPI scales of Autonomy (p<.001), Practical Outlook (p<.001), Masculinity-Femininity (p<.001), Estheticism (p<.002), Thinking Introversion (p<.01), Complexity (p<.05), and Altruism (p<.05).

The OPI profiles of the three groups are shown in standard scores in Figure IV.16. The psychology male and female groups have similar profiles. The males deviate considerably from the norms for Complexity (+), Autonomy (+), Religious Orientation (+), Impulse Expression (+), and Practical Outlook (-). The females deviate most markedly on Autonomy (+), Religious Orientation (+), Practical Outlook (-) and Masculinity-Femininity (-). The engineering group's major deviations are on Thinking Introversion (-), Estheticism (-), Religious Orientation (+), Social Extraversion (-) and Altruism (-). The shapes of

Table IV.16.

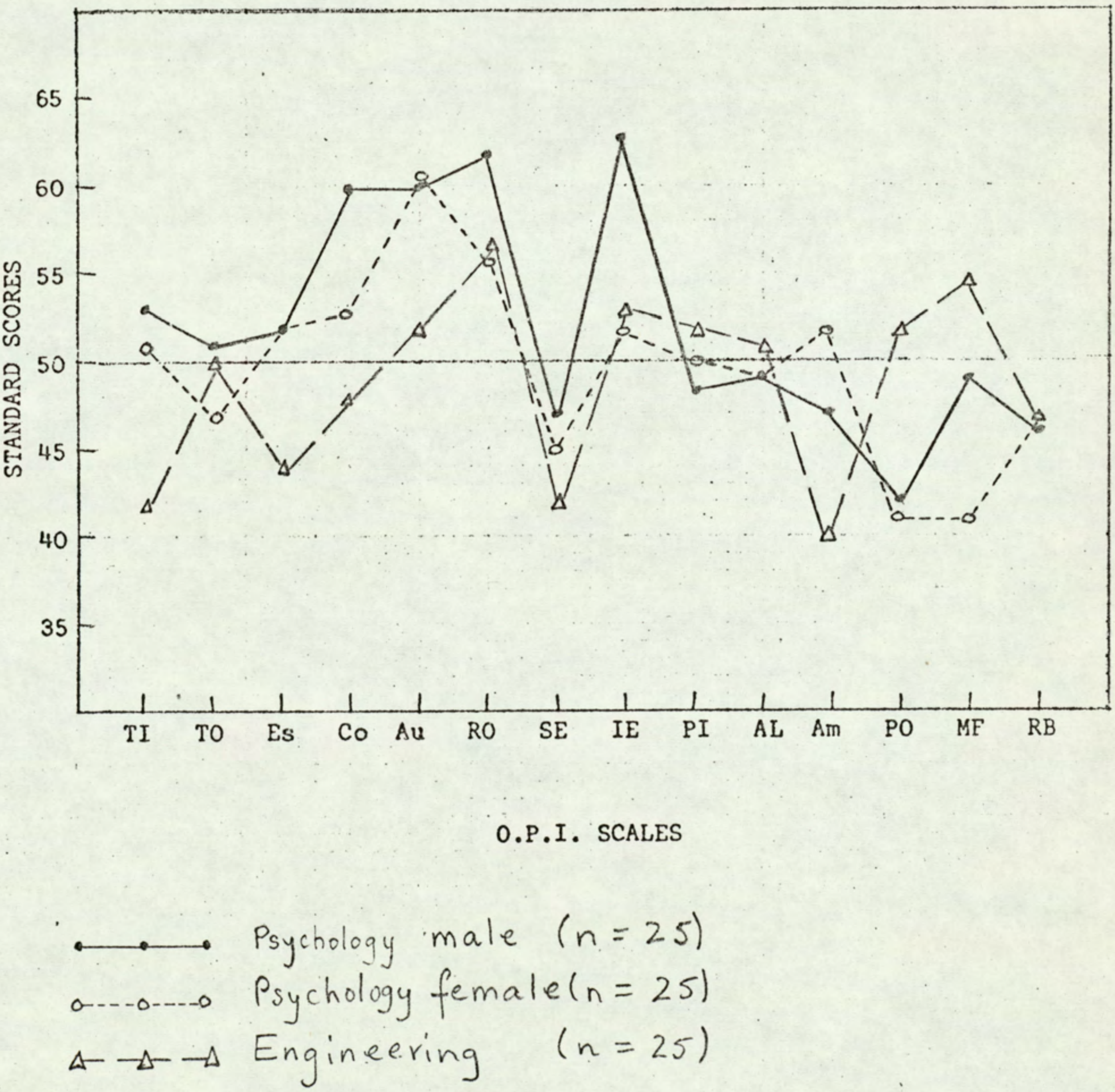
Comparisons of psychology male, psychology female and engineering Ss on intelligence, field independence, creativity and personality.

Variables	1 Psychology males		2 Psychology females		3 Engineering males		1 v 2		1 v 3		2 v 3	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	t	p	t	p	t	p
AH5												
Part I	20.12	4.24	19.48	3.46	17.96	3.74	0.57		1.87		1.46	
Part II	21.36	4.90	20.40	3.87	20.08	4.12	0.76		0.96		0.31	
Total	41.48	7.68	39.88	6.17	38.04	6.71	0.79		1.65		0.99	
HFT												
Total	17.76	6.16	16.20	5.75	15.16	6.33	0.91		1.44		0.59	
Uses												
Flexibility	27.48	16.73	19.44	7.62	17.08	6.23	2.14	<.05	2.85	<.01	1.17	
Fluency	47.60	26.35	33.16	4.12	34.84	12.73	2.45	<.05	2.13	<.05	0.48	
OPI												
TI	27.64	7.21	25.60	8.54	18.52	8.36	0.89		4.05	<.001	2.90	<.01
TO	20.16	5.75	18.20	4.58	19.52	4.36	1.30		0.43		1.02	
Es	13.08	4.36	13.36	5.00	8.80	4.24	0.21		3.45	<.002	3.40	<.002
Co	20.60	6.63	16.92	4.80	13.84	5.39	2.20	<.05	3.89	<.001	2.14	<.05
Au	32.40	6.93	33.28	4.96	25.40	6.86	0.52		3.52	<.002	4.69	<.001
RO	18.96	5.48	15.40	5.75	16.36	5.92	2.20	<.05	1.59		0.57	
SE	20.60	6.86	20.16	6.33	17.68	7.07	0.23		1.45		1.28	
IE	37.28	9.38	28.40	10.15	28.64	10.39	3.15	<.01	3.02	<.01	0.81	
PI	28.16	9.33	30.28	9.49	31.76	8.54	0.78		1.40		0.57	
AL	12.00	4.47	11.80	5.20	12.80	3.74	0.14		0.67		0.76	
Am	19.24	4.47	21.76	6.00	15.48	5.20	1.08		1.93		2.40	<.05
PO	9.88	5.83	9.12	4.58	16.36	4.80	0.33		2.73	<.01	4.00	<.001
MF	27.52	5.66	22.36	5.20	32.08	5.10	3.29	<.01	2.94	<.01	6.57	<.001
RB	11.60	4.24	11.88	4.12	12.28	4.00	0.23		0.57		0.34	

Means, standard deviations and results for *t* tests on AH5, HFT, Uses for Things and OPI (n = 25 in each group)

Figure IV.16.

O.P.I. group profiles of psychology male , psychology female and engineering Ss.



the three OPI group profiles appear to be fairly similar up to Anxiety Level; this is mainly due to the relatively high scores on Religious Orientation and Impulse Expression in contrast to the low scores on Social Extraversion for all groups.

IV.4 COMPLEXITY PREFERENCE AND DISTANCE FROM THE MOST PREFERRED COMPLEXITY LEVEL - A TEST OF THE DEMBER AND EARL HYPOTHESIS

Dember and Earl (1957) hypothesized that each S has his own preferred level of complexity, and that preference for other levels of complexity decreases as their distance from the most preferred level increases. To test this hypothesis the paired comparison choice scores of 75 Ss (from psychology and engineering) for polygon preference and verbal preference were analysed.

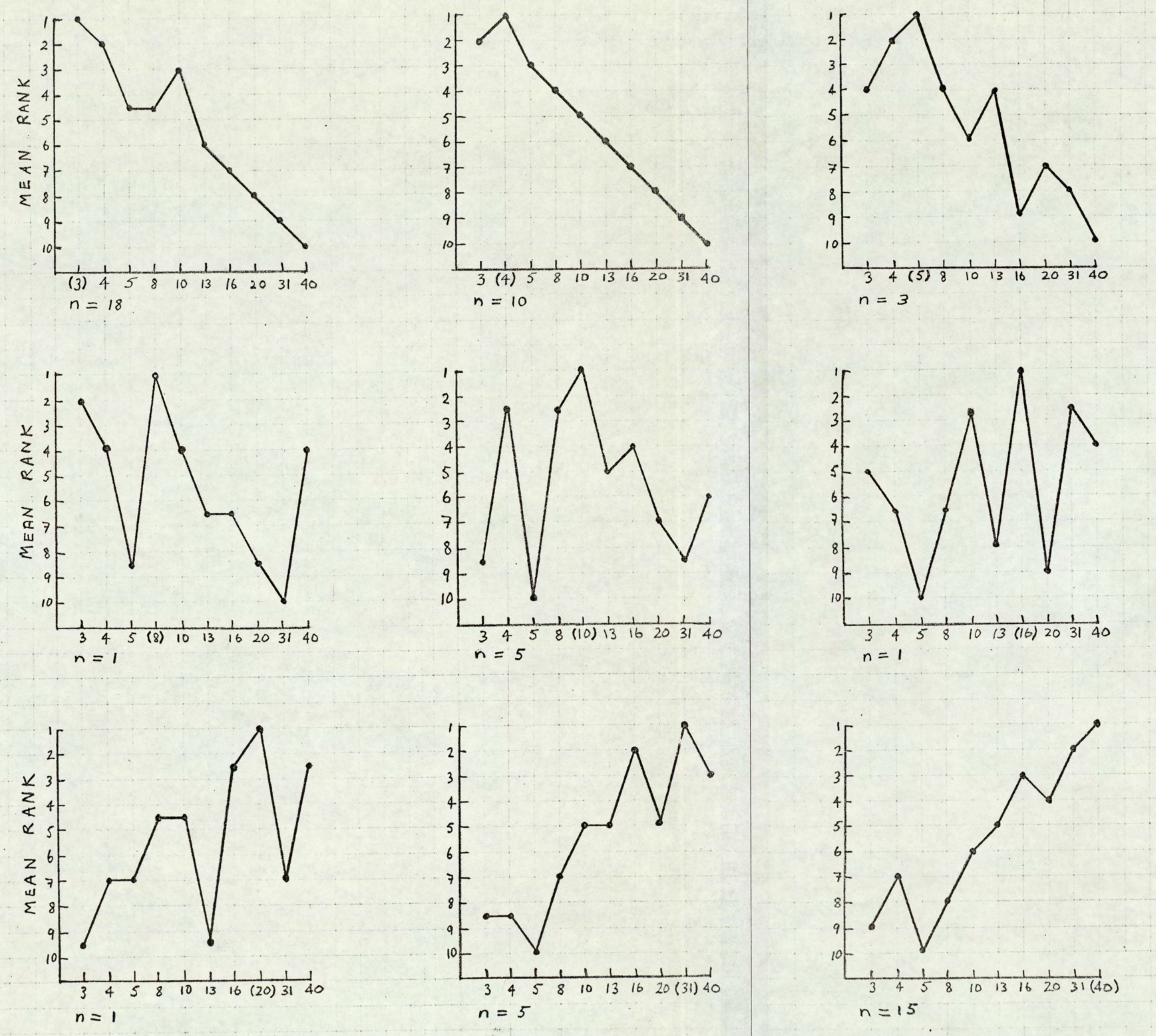
Polygon Preference

59 Ss had one level of complexity which was most preferred (16 Ss had ties at the most preferred levels and they were omitted). The Ss were grouped according to their most preferred level of complexity; every level of complexity except polygons of 13 turns was preferred most by at least 1 S. The choice scores of the Ss in each group were summed at each level of complexity and then the mean rank of preference for each level was obtained (the level with the highest score was ranked 1 and the lowest 10). The preference functions of the nine groups are shown in Figure IV.17. Mean rank of preference is plotted against number of independent turns on the polygons. The most preferred level is bracketed.

The majority of the graphs show that preference does decrease as distance from the most preferred level of complexity increases. The trend is most obvious for groups having polygons of 3 or 4 turns as their most preferred and it is also apparent for groups having polygons of 5, 10, 20, 31 or 40 turns as their most preferred. No definite trend emerges for Ss having polygons of 8 or 16 turns as their most preferred.

To find out how the groups' preference rankings compared with the rankings suggested by the Dember and Earl hypothesis, Spearman rank correlations were computed between the obtained and hypothesized preference rankings. The

FIGURE IV.17



Mean ranks of preference for polygons varying in number of independent turns. (Ordinate is preference; abscissa is polygon complexity).

The 9 graphs are the mean ranks of Ss whose most preferred polygons occurred at the level of stimulus complexity indicated by brackets.

TABLE IV.17

Correlations between hypothesized and obtained ranks of polygon preference for groups having a most preferred level of complexity.

Most Preferred Polygon		Number of Independent Turns of Polygons										rho	p
		3	4	5	8	10	13	16	20	31	40		
3 turns	H	( )	1	2	3	4	5	6	7	8	9	.95	<.01
(n = 18)	O	( )	1	3.5	3.5	2	5	6	7	8	9		
4 turns	H	1.5	( )	1.5	3	4	5	6	7	8	9	.996	<.01
(n = 10)	O	1	( )	2	3	4	5	6	7	8	9		
5 turns	H	3.5	1.5	( )	1.5	3.5	5	6	7	8	9	.87	<.01
(n = 3)	O	3	1	( )	3	5	3	8	6	7	9		
8 turns	H	5.5	3.5	1.5	( )	1.5	3.5	5.5	7	8	9	.13	
(n = 1)	O	1	3	7.5	( )	3	5.5	5.5	7.5	9	3		
10 turns	H	7.5	5.5	3.5	1.5	( )	1.5	3.5	5.5	7.5	9	.42	<.05
(n = 5)	O	7.5	1.5	9	1.5	( )	4	3	6	7.5	5		
16 turns	H	9	8	7	5.5	3.5	1.5	( )	1.5	3.5	5.5	-.04	
(n = 1)	O	4	5.5	9	5.5	1.5	7	( )	8	1.5	3		
20 turns	H	9	8	7	6	5	3.5	1.5	( )	1.5	3.5	.45	<.05
(n = 1)	O	8.5	6	6	3.5	3.5	8.5	1.5	( )	6	1.5		
31 turns	H	9	8	7	6	5	4	3	1.5	( )	1.5	.87	<.01
(n = 5)	O	7.5	7.5	9	6	4	4	1	4	( )	2		
40 turns	H	9	8	7	6	5	4	3	2	1	( )	.90	<.01
(n = 15)	O	8	6	9	7	5	4	2	3	1	( )		

H = Hypothesized ranks

O = Obtained ranks

One-tailed tests

most preferred level of complexity was omitted from these rankings as it would inflate the correlation coefficient. The hypothesized and obtained ranks are given with the results of the correlations in Table IV.17. The correlations are significant at the .01 level for groups who have polygons of 3, 4, 5, 31 or 40 turns as their most preferred and at the .05 level for groups who have polygons of 10 or 20 turns as their most preferred.

The results of the correlations support the trends inferred from the graphs. It is clear from Figure IV.17 and Table IV.17 that the majority of Ss choose very simple or very complex polygons as their most preferred and the preference rankings of the groups liking extremes of complexity or simplicity correspond most closely to the hypothesized rankings.

Verbal Preference

The procedure for selecting the groups of Ss and obtaining the mean preference ranks was the same as for polygon preference. Ss were grouped according to their most preferred level of approximation to English. 61 Ss had one most preferred level of complexity and each level except third-order words was preferred most by at least 1 S. The preference functions of the nine groups are shown in Figure IV.18. Mean rank of preference is plotted against level of approximation to English. The number representing the most preferred level is bracketed.

The majority of the graphs indicate that preference tends to decrease as distance from the most preferred level of complexity increases. The trend is most obvious for groups having prose (3), fourth-order phrases (4) or second-order phrases (5) as their most preferred verbal sequences. The trend is apparent to a lesser degree in all the other graphs except those of groups having random words (7) or second-order words (9) as their most preferred verbal sequences, where preference appears to be generally random.

Correlations between hypothesized and obtained ranks were not computed due

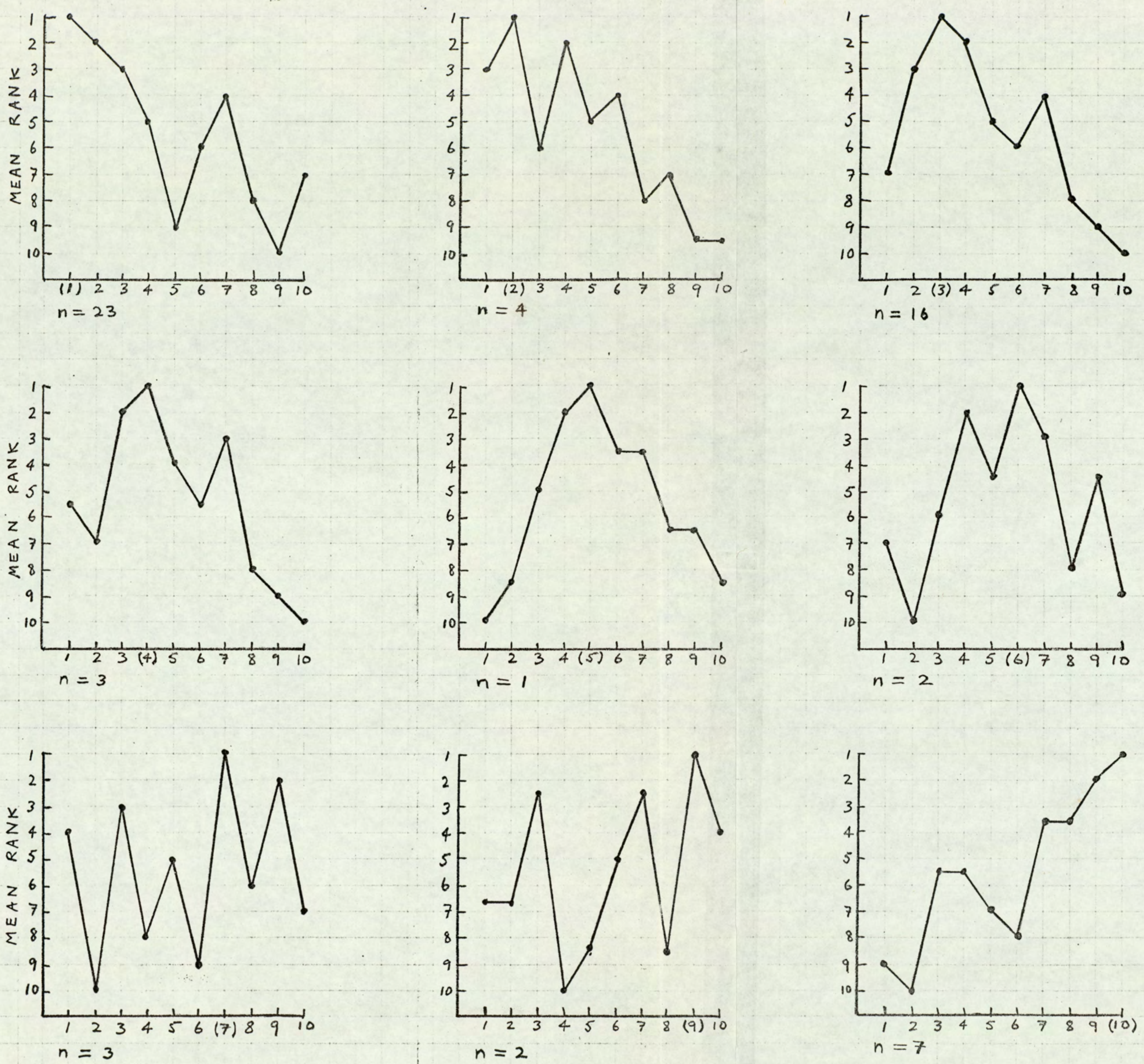


FIGURE IV.18

Mean rank of preference for verbal sequences varying in approximation to English.

The 9 graphs are the mean ranks of Ss whose most preferred verbal sequences occurred at the level of complexity indicated by brackets.

Ordinate is preference; abscissa is level of approximation to English.

1 = Redundant letters
2 = Redundant words
3 = Prose
4 = Fourth-order phrases
5 = Second-order phrases
6 = First-order phrases
7 = Random words
8 = Third-order words
9 = Second-order words
10 = Random letters.

TABLE IV.18

Mean preference ranks of approximations to English for groups having a most preferred level of verbal complexity

Most preferred Approximation to English	APPROXIMATION TO ENGLISH									
	Redundant Letters	Redundant Words	Prose	Fourth Order Phrases	Second Order Phrases	First Order Phrases	Random Words	Third Order Words	Second Order Words	Random Letters
Redundant Letters (n = 23)	1	2	3	5	9	6	4	8	10	7
Redundant Words (n = 4)	3	1	6	2	5	4	8	7	9.5	9.5
Prose (n = 16)	7	3	1	2	5	6	4	8	9	10
Fourth-Order Phrases (n = 3)	5.5	7	2	1	4	5.5	3	8	9	10
Second-Order Phrases (n = 1)	10	8.5	5	2	1	3.5	3.5	6.5	6.5	8.5
First-Order Phrases (n = 2)	7	10	6	2	4.5	1	3	8	4.5	9
Random Words (n = 3)	4	10	3	8	5	9	1	6	2	7
Second-Order Words (n = 2)	6.5	6.5	2.5	10	8.5	5	2.5	8.5	1	4
Random Letters (n = 7)	8	10	5.5	5.5	7	9	4	2	3	1

to the lack of objectivity in the ordering of the complexity levels of the verbal sequences. The obtained ranks for each of the nine groups are given in Table IV.18. It can be seen in Figure IV.18 or Table IV.18 that the majority of Ss choose the simpler verbal sequences and a few choose the most complex.

C H A P T E R V

D I S C U S S I O N

V.1 APPRAISAL OF THE TESTS

Polygon Preference

The intercorrelations among the ten levels of complexity and their correlations with the total scores of polygon preference suggest that the ordering of the ten levels on the complexity-simplicity dimension is satisfactory. The very low preference for polygons of 5 turns is possibly due to the three examples used. None of them has re-entrant angles, and Eysenck (1968) has pointed out that polygons with non re-entrant angles are usually disliked.

The strong individual differences in polygon preference, evidenced by the large standard deviations in Table IV.11 and the graphs in Figure IV.17, compare with differences reported by Barron and Welsh (1952) and Munsinger and Kessen (1964) and generally represent the tendency to prefer complexity or simplicity.

Verbal Preference

The intercorrelations among the ten levels of complexity and their correlations with the total score suggest that the ordering of the items on this dimension needs some refinement to be a pure measure of complexity-simplicity. The original ordering was based on the information content of the verbal sequences although it was pointed out that the redundant and random sequences might be equally meaningless (Munsinger and Kessen, 1964). However the stimuli appear to have other "collative properties" (Berlyne, 1969) on which they may differ - such as surprisingness, novelty, incongruity, or irregularity - and these properties probably affect preference. Another method of analysis would be to consider the items as sequences of words or sequences of letters. Sequences of words would consist of redundant words, prose, fourth-order phrases, second-order phrases, first-order phrases, and random words; sequences of letters would consist of redundant letters, third-order words, second-order words, and random letters.

There are noticeable individual differences in verbal preference although they are not as marked as in polygon preference. Generally there is a higher preference for the more complex sequences than would be expected. The reasons for this may be in part methodological. The stimuli were typed with an IBM Executive typewriter (see Photograph 2) which has a modern typeface and looks "artistic" to some Ss. Also, to keep testing conditions the same, all Ss expressed their preference for polygons first and verbal sequences second and this may have affected preference by giving Ss a set to look at the patterns of the letters as well as their content.

Intelligence

The distribution of the AH5 scores is comparable to the university norms given in the manual (Heim, 1956). There are no differences between the groups on this test.

Field-independence

No norms are available for a comparison of the HFT scores. There are no group differences or sex differences on this test; the latter result is surprising as Witkin et al. (1962) reported consistent sex differences in field-independence.

This HFT was chosen because it is a convenient group test, the validity of the test is not given but it does not appear to be a very valid measure of field-independence. It correlates .56 with Witkin's EFT (Jackson et al., 1964) and the correlations with the RFT and TRTC are probably lower. The processes involved in reaching a solution on the EFT and HFT differ. On the EFT the S sees the complex figure first, then the simple figure, and relying on his memory of the simple figure, he tries to break down the Gestalt of the complex figure to locate the simple figure in it. On the

HFT the S is given five simple figures and has to find which one is located in the complex figure. Thus different approaches may be involved in the solution of these items, and as Gordon et al. (1961) pointed out different approaches may be related to different personality characteristics. The only personality variable with which the HFT correlates significantly is Response Bias (field-independence is associated with giving a good impression); this correlate supports previous results of field-independents having high self-acceptance, but none of the 13 other personality variables is significantly correlated with the HFT.

The HFT is very significantly correlated with all the measures of intelligence, including verbal/numerical. Guilford (1956) at first considered the HFT to be a test of divergent production - either adaptive flexibility or flexibility of closure, but he later changed it to be a test of convergent production of figural transformations (Guilford, 1967). This may well be a more appropriate description of the HFT as it does not appear to be a sufficiently valid measure of field-independence nor of non-verbal creativity to be used in creativity test batteries.

Creativity

No norms of Uses for Things are available for comparison. The scores are negatively skewed and the standard deviation is large. Flexibility and fluency are very highly correlated as expected, and the correlations with the personality variables are more significant for flexibility than for fluency. The significant correlations of both flexibility and fluency with Thinking Introversion, Theoretical Orientation, Estheticism and Complexity, and of flexibility with Autonomy, Practical Outlook and Masculinity-Femininity give some evidence of the construct validity of the test.

Personality

The group differs from the norms on some of the OPI scales, notably

Autonomy, Religious Orientation, Social Extraversion, and Impulse Expression; this may be because the norms are American. Some of the high intercorrelations among the scales are due partly to item overlap but also presumably to the similarity of the characteristics being measured.

V.2 INDIVIDUAL DIFFERENCES IN PREFERENCE FOR COMPLEXITY-SIMPLICITY

The significant correlation between polygon and verbal complexity preference corresponds to previous results relating preference for complexity or simplicity over different stimuli (Eisenman, 1965b; Eysenck, 1942). This result supports the proposition that preference for C/S is a perceptual decision of the individual (Barron, 1952).

Polygon and verbal preference have fairly similar correlates among both psychology and engineering Ss. In the statistical analysis of psychology Ss differing in complexity preference groups preferring medium complexity were included. The differences between the medium groups and the high and low complexity groups are nearly all insignificant and they will not be discussed in detail. For polygon preference and for verbal preference the scores of the medium complexity groups on the other variables resemble the scores of the high complexity groups, but for polygon and verbal preference combined the scores of the medium complexity group on the other variables resemble more closely the scores of the low complexity group.

Before discussing the individual differences related to preference for C/S it should be mentioned that although the use of a fairly homogeneous sample may tend to detract from the significance of the results, a large number of statistical tests has been used in the analysis, hence the probability of obtaining significant results is increased even for independent samples. The relation of preference for C/S to intelligence, field-independence, creativity, and personality will be discussed next.

Neither polygon nor verbal preference is related to intelligence; this is similar to previous results (Eisenman, 1968c; Littlejohn, 1967; Munsinger and Kessen, 1964). As in most previous research the Ss are of above average intelligence so this result cannot be generalized to the whole population.

Field-independence is not related to either polygon or verbal preference. It was thought that field-independence might be associated with preference for polygon complexity since field-independents are able to structure ambiguous, unorganized fields, and performance on tests of field-independence is usually most strongly related to other perceptual tests (see II.2). The lack of relationship may be because the test is not sufficiently valid or because complexity preference is not dependent on this kind of structuring ability.

There is a significant trend for polygon preference, but not for verbal preference, to be correlated with creativity, although there is less difference on creativity between the groups preferring complexity and simplicity. A significant relation between complexity preference and creativity would be expected on the basis of previous theorizing (Barron, 1963b; MacKinnon, 1962) and experimental results (see II.3.9). However, the measures of complexity preference which have been most significantly related to creativity are the WFPT scales which vary in asymmetry-symmetry as well as complexity-simplicity; the results of experiments using polygon preference are generally less significant. Nevertheless it is interesting that in this sample the personality correlates of creativity and complexity preference are fairly similar. It would possibly have been better, instead of using just Uses for Things, to have used a battery of creativity tests including non-verbal tests such as Line Meanings or Pattern Meanings (Wallach and Kogan, 1965).

The most significant correlates of complexity preference are on the OPI scales. A comparison of the personality characteristics which differentiate groups preferring complexity and groups preferring simplicity in polygon preference, verbal preference and polygon and verbal preference combined are listed in Tables V.1, V.2 and V.3. The scales included are those on which the complexity and simplicity groups differ significantly, or those where there is a significant trend for the groups to differ supported by a significant correlation between the scales and C/S preference (except for polygon and verbal preference combined).

BLE V.1

comparison of the personality characteristics of a group preferring complexity d a group preferring simplicity on polygon preference.

	Complexity	Simplicity
(.01)	Give a bad impression of themselves.	Give a good impression of themselves.
(.02)	Generally tense and highly-strung and often experience some difficulty adjusting in their social environment.	Deny they have feelings or symptoms of anxiety, and do not admit to being nervous or worried.
(.05)	Stronger aesthetic and social inclinations, admit to greater sensitivity and emotionality.	Deny interests in aesthetic matters, admit to few adjustment problems, feelings of anxiety, or personal inadequacies. Less socially inclined and more interested in scientific matters.
(.10)	Diverse interest in, and appreciation of, artistic matters and activities.	Less interest in, or appreciation of, artistic matters and activities.
(.10)	Prefer to deal with complexity and diversity. Tolerant of ambiguities and uncertainties. Fond of novel situations and ideas. Disposed to seek out and enjoy unusual, ambiguous events and experiences.	Prefer to deal with simplicity and structure. Less tolerant of ambiguities and uncertainties. Less fond of novel situations and ideas. Less disposed to seek out and enjoy unusual, ambiguous events and experiences.

ABLE V.2

comparison of the personality characteristics of a group preferring complexity nd a group preferring simplicity in verbal preference.

	Complexity	Simplicity
o(.001)	Prefer to deal with complexity and diversity. Tolerant of ambiguities and uncertainties. Fond of novel situations and ideas. Disposed to seek out and enjoy unusual, ambiguous events and experiences.	Prefer to deal with simplicity and structure. Intolerant of ambiguities and uncertainties. Not fond of novel situations and ideas. Not disposed to seek out and enjoy unusual, ambiguous events and experiences.
B(.001)	Give a bad impression of themselves.	Give a good impression of themselves.
L(.02)	Generally tense and highly-strung, and often experience some difficulty adjusting in their social environment.	Deny they have feelings or symptoms of anxiety and do not admit to being nervous or worried.
PO(.05)	Less interested in practical, applied activities. Place less value on material possessions, concrete accomplishments and the immediate utility of ideas and things. Less authoritarian and conservative and have more intellectual interests.	Interested in practical, applied activities, and tend to value material possessions and concrete accomplishments. Evaluate ideas and things in terms of immediate utility. Often authoritarian, conservative and have nonintellectual interests.
I(.10)	Like reflective thought and academic activities. Interest in a broad range of ideas and in a variety of areas. Thinking less dominated by objective conditions and generally accepted ideas.	Prefer overt action and tend to evaluate ideas on the basis of their practical, immediate application. Thinking more dominated by objective conditions and generally accepted ideas.
u(.10)	Independent of authority. Tolerant of view points other than their own, nonjudgemental, realistic and intellectually liberal.	More authoritarian and less need for independence.
E(.10)	Active imagination. Value sensual reactions. Thinking and behaviour have permissive overtones of feelings and fantasies.	Less ready to express impulses and to seek gratification either in conscious thought or in overt action.

ABLE V.3

 comparison of personality characteristics of a group preferring complexity
nd a group preferring simplicity in verbal and polygon preference.

	Complexity	Simplicity
o(.05)	Prefer to deal with complexity and diversity. Tolerant of ambiguities and uncertainties. Fond of novel situations and ideas. Disposed to seek out and enjoy unusual, ambiguous events and experiences.	Prefer to deal with simplicity and structure. Intolerant of ambiguities and uncertainties. Not fond of novel situations and ideas. Not disposed to seek out and enjoy unusual, ambiguous events and experiences.
L(.10)	Generally tense and highly-strung, and often experience some difficulty in adjusting in their social environment.	Deny feelings or symptoms of anxiety, and do not admit to being nervous or worried.
B(.10)	Give a bad impression of themselves.	Give a better impression of themselves.

The personality characteristics of Ss preferring complexity or simplicity on polygon preference are similar to, although less significant than, those reported by Barron (1953b) and Cashdan and Welsh (1966) (see II.3.4). Two characteristics which are more closely associated with polygon preference than with verbal preference are femininity and aestheticism, characteristics which frequently differentiate Ss preferring complexity and Ss preferring simplicity on the WFPT. The lower significance of the results here may be because the WFPT scales vary in dimensions other than C/S and appear to reflect aesthetic sophistication or "good taste" as well as the emotional qualities. This may also be the reason why other personality scales such as Autonomy, Impulse Expression and Practical Outlook fail to differentiate the complexity/simplicity groups in this investigation.

Some personality characteristics which only differentiate Ss choosing complexity and Ss choosing simplicity on verbal preference are Practical Outlook, Thinking Introversion, Autonomy and Impulse Expression. These scales appear to have in common an orientation toward intellectual activities, fantasy, independence and liberalism at one extreme, and at the other extreme an orientation toward overt action and dependence, and high regard for practicality and utility value. The Ss in the former category prefer more complex verbal sequences which are rather nonsensical, and the Ss in the latter category prefer the simpler verbal sequences which are more practical and sensible. The greater differences between the complexity and simplicity groups on verbal preference as compared to polygon preference may be related to the observation that the stimuli vary on dimensions other than C/S.

The combined measure of polygon and verbal complexity does not differentiate very well the personality characteristics of the complexity and simplicity groups. The only OPI scale on which the groups differ significantly is Complexity. However this suggests that preference for C/S does represent a general disposition toward complexity or simplicity.

he scales which differentiate most consistently between the complexity and implicity groups are Complexity, Anxiety Level and Response Bias; and in ddition Estheticism, Practical Outlook and Masculinity-Femininity are sig- ificantly correlated with polygon preference and verbal preference. These esults indicate that Ss preferring complexity are more open and frank about hemselves and admit to their emotions and inadequacies (cf. MacKinnon, 1962).

.3 GROUP DIFFERENCES IN PREFERENCE FOR COMPLEXITY-SIMPLICITY

ex Differences

omplexity-simplicity preference does not appear to be related to sex differences, ince male and female psychology students do not differ on either polygon or erbal preference, in fact their graphs show remarkably similar preference unctions. Munsinger and Kessen (1964) also found no sex differences in polygon reference (Figure V.1), although in other investigations females have been eported to prefer more complexity (Eisenman, 1967c; Schaefer, 1968).

olygon Preference

he polygon preference of psychology students and art students is quite different rom the results of most previous experiments. Munsinger and Kessen (1964) found hat psychology students preferred an intermediate amount of complexity Figure V.1) and art students showed a strong preference for very complex polygons Figure V.2). Similarly on the WFPT artists consistently prefer more complexity see II.3.5). No previous data were available for comparison with engineering tudents' preference. If preference is related to cognitive structure ngineering students would be expected to prefer fairly complex figures, but if t is related to personality and creativity they would be expected to prefer airly simple figures.

he comparatively high preference for complexity shown by male and female psychology tudents is possibly related to personality. Psychology students deviate from he norms on Complexity, Autonomy, Religious Orientation, Impulse Expression and ractical Outlook, and these are all characteristics which are frequently correlated with C/S preference.

ngineering students prefer simplicity and reject complexity, and in comparison ith psychology male and female students they score significantly lower on

Figure V.1

Polygon preference scores of male and female introductory psychology students

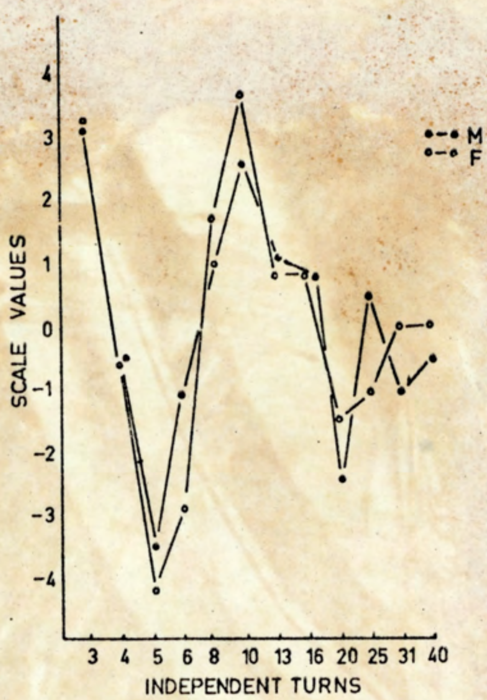


FIG. 5. Scale scores of preference for asymmetrical random shapes varying in number of independent turns from 3 to 40 (Study II). (Scores for men and women are shown.)

Figure V.2

Polygon preference scores of art students

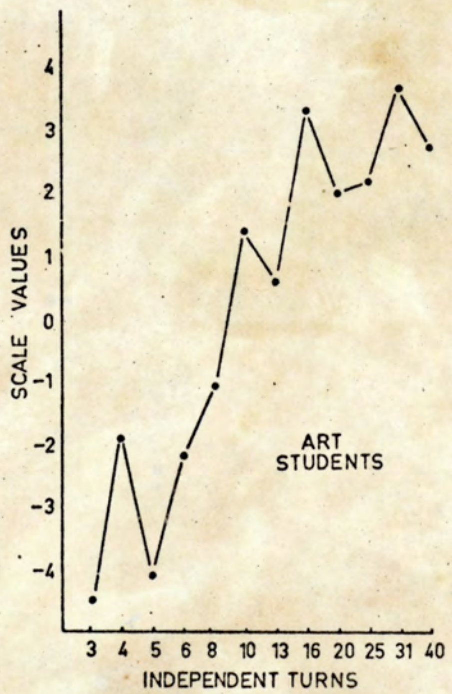


FIG. 12. Scale scores of preference of art students for asymmetrical random shapes varying in number of independent turns from 3 to 40 (Study VI).

(From Munsinger and Kessen, 1964, pages 11 and 17) hinking Introversion, Estheticism, Complexity and Autonomy, and significantly igher on Practical Outlook and Masculinity, as well as being significantly less reative than male psychology students. These characteristics are also often ssociated with C/S preference. Engineering students' polygon preference may be ffected by the kind of training they receive. A number of Ss commented that hey learn to evaluate positively shapes which are simple, practical and func- ional.

he distinguishing feature of the polygon preference of art students is the airly equal preference for most polygons. A few Ss explained that they con- idered the two polygons as making up one Gestalt and hence did not always choose he same polygons; others regarded the stimulus display as a white figure with black background. Thus it seems that for these art students C/S is not a ery important dimension for preference. It is interesting that most of the nvestigations in which art students prefer complexity have been conducted in he United States and the students were often in fine arts. In a recent xperiment conducted in England using a sample composed mainly of design students t was found that the design group preferred more simple polygons than a control roup (Eysenck and Castle 1970). Unfortunately personality data are not available for the rt students so their preference cannot be discussed in relation to personality. owever craft students have been reported to be intermediate between artists and ontrols on several personality characteristics (Cross et al., 1967). Since the rt students in this experiment are mainly in design they possibly do not have he more extreme personality characteristics of fine artists. It is also possible hat their training as design students may lead to a higher evaluation of elatively simple shapes.

erbal Preference

he group results on verbal preference are quite unexpected. In previous xperiments preference was repeatedly found to be an inverted U shaped function f complexity both for psychology students (Figure V.3) and for other samples

Figure V.3

Preference for sequences of letters and words

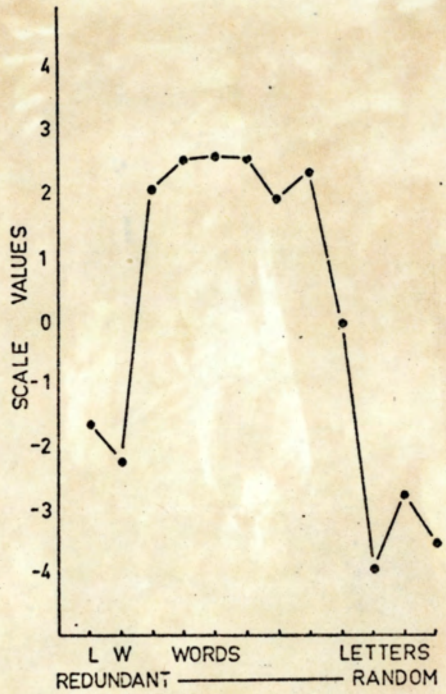


FIG. 4. Scale scores of preference for approximations to English (Study I). (Represented on the abscissa from left to right are redundant letters, redundant words, prose, fourth through first order approximations to English phrase structure, random words, third through first order approximations to English words, and random letters.)

(From Munsinger and Kessen, 1964 page 10)

Munsinger and Kessen, 1964, 1966a; Munsinger et al., 1964). It was suggested (in V.1) that the higher preference obtained here for the more complex sequences ight be due to methodological differences.

sychology students on average prefer the simple verbal sequences more than the omplex ones but they do not reject the redundant and the very complex sequences s much as the psychology students in Munsinger and Kessen's original inves- igation (1964). A few Ss who prefer the redundant or random letters appear to e basing their judgement on the pattern rather than the content of the stimuli, ince they commented that they "liked the look of them". Other Ss who liked the pproximations to words said these verbal sequences reminded them of foreign anguages or even Latin poetry. These Ss, and those who liked prose because it as meaningful, were basing their judgement more on the content. As for polygon reference the psychology students' greater preference for complexity may be related o personality.

he engineering students show a high preference for prose and the closest pproximations to it. They appear to prefer the most meaningful sequences and o dislike the most meaningless and complex sequences. This rigid acceptance of implicity and rejection of complexity is similar to, but even more pronounced han, their polygon preference, and it may well be related to their personality haracteristics. It is possible that the engineering students' preference for implicity might have been increased by them regarding polygon preference and erbal preference as 'tests', but the comments they gave makes this explanation eem unlikely.

he art students' preference for verbal sequences is a U shaped function of omplexity. They show a relatively high preference for both redundant and random equences, and for sequences of letters as opposed to sequences of words. From discussion with the art students it emerged that this does not necessarily epresent a preference for meaningless as opposed to meaningful verbal sequences, but rather a preference for patterned and well balanced sequences as opposed to ones with no pattern or balance. Art students are probably more disposed to react to stimuli in such a manner. Nevertheless it is interesting to speculate that some art students may prefer complexity or novelty, and this is more readily manifested in preference for verbal sequences than polygons.

V.4 COMPLEXITY PREFERENCE AND DISTANCE FROM THE MOST PREFERRED COMPLEXITY LEVEL

The results of polygon preference and verbal preference show that most Ss have a preferred level of complexity, and the results support the Dember and Earl hypothesis that preference decreases as distance from the most preferred level of complexity increases (cf. Dorfman and McKenna, 1966; Vitz, 1966 b). On polygon preference most Ss choose extremes of complexity or simplicity as their most preferred level. The preference rankings of these groups of Ss are the most highly correlated with the expected rankings; this is possibly because C/S is the most important criterion for their choice. Ss preferring a moderate amount of complexity do not show such a pronounced decrease in preference with increasing distance from the most preferred level. This may be because some Ss dislike simplicity and others dislike complexity, and also because some Ss may be using criteria other than C/S. The trends for verbal preference are not so definite, this is probably because the sequences are not ordered satisfactorily on the C/S dimension and vary in their subjective complexity for different Ss.

The analysis of the preference data in this manner illustrates that grouped preference data are composed of individuals with very different preference functions. Munsinger and Kessen (1964) concluded from grouped data that the point of inflection in preference at polygons of 10 turns represented a fixed limit on capacity to process the polygons. The results of the present analysis do not support this conclusion, since the high preference for polygons of 10 turns appears to be an artefact caused by the combination of data with apparent linear or curvilinear trends.

V.5 CONCLUSIONS

In this investigation it would appear that the assumptions of Munsinger and Kessen (1964) (cf. II.4), relating preference to processing ability built up through experience, do not receive support. On polygon preference psychology students, who are assumed to have less experience with such stimuli, prefer slightly more complexity than engineering students. On verbal preference the psychology, art and engineering students differ in complexity preference although they are assumed to have similar opportunities for experiencing English. Polygon preference is not related to nonverbal intelligence or field-independence, nor is verbal preference related to verbal intelligence or verbal creativity. These abilities might be expected to be associated with ability to process the stimuli, but it must be borne in mind that they are not measures of processing ability as such, and they do not preclude other means of coding the stimuli.

On polygon preference the grouped data show a point of inflection in preference for polygons of 10 turns. This may not be assumed to correspond to a limitation on ability to process the polygons (cf. II.4), since the data are composed of many individuals preferring extremes of complexity or simplicity and only a few preferring a moderate amount of complexity.

The examination of individual differences in preference for C/S on polygons and verbal sequences provides some support for Barron's (1952) proposition that preference for complexity or simplicity represents the individual's orientation towards experience; a decision to attend to complex, novel and uncertain phenomena or to simple, familiar and predictable phenomena.

V.6 SUGGESTIONS FOR FURTHER RESEARCH

The results of this study indicate that C/S preference for random polygons and verbal sequences are related to certain interrelated personality characteristics. It would be interesting to investigate these correlates further as it appears that C/S preference may represent a general disposition. The investigation would be best approached by using a larger and more representative sample than this one. It would be of interest to examine the personal histories of Ss preferring complexity or simplicity to relate this to environmental influences. The significant differences among groups for C/S preference obtained here suggest that it might be fruitful to compare C/S preference over a wide range of occupational groups; it would be particulraly interesting to compare male and female engineers.

In any future studies relating field-independence and creativity to C/S preference it would be advisable to use a more valid measure of field-independence and a battery of creativity tests including non-verbal tests such as Wallach and Kogan's (1965) Line Meanings or Pattern Meanings. It might then be feasible to compare Ss differing on both field-independence and creativity. For investigations of C/S preference for polygons it would be better to consider not only the total complexity scores but also the scores for most preferred and least preferred polygons; and an analysis of the individual polygons might yield informative results. There are several significant personality correlates of verbal preference and it would be interesting to see if they could be replicated in other samples. It would also be worthwhile to make an item analysis of the sets of verbal sequences to find out the ordering of the sequences on the C/S dimension; and to compare the effects on preference of different kinds of lettering for the stimuli.

S T U D Y I I

CHAPTER VI

SEMANTIC DESCRIPTIONS OF POLYGONS

VI.1 INTRODUCTION

VI.1.1 The Semantic Differential

The semantic differential is a technique which may be used to measure the connotative meaning of concepts or stimuli (Osgood, Suci and Tannenbaum, 1957). It consists of a series of bipolar adjectives, e.g. fair - unfair, hot - cold, which are used in rating selected concepts.

Factor analytic studies of the ratings on these bipolar adjectives have indicated that judgements on the semantic differential can be described in terms of three major dimensions or factors. These factors are: Evaluation, e.g. good - bad, honest - dishonest; Potency, e.g. strong - weak, masculine - feminine; Activity, e.g. active - passive, fast - slow. In addition to being a useful tool in discovering the main dimensions of meaning, the semantic differential may be used to compare the descriptions of different concepts or the descriptions of the same concept by various groups.

The semantic differential has been most frequently employed to measure meaningful verbal concepts such as myself, my ideal self or politician. But Osgood et al. (1957) report that it has also been used successfully to examine the connotation of non-verbal stimuli including sonar signals, abstract art, pictorial symbols and colours.

VI.1.2 Semantic Description of Polygons and Similar Stimuli

The experiments reported here are concerned with verbal descriptions of polygons and other spatial stimuli. The verbal descriptions may be oral or written, and may consist of a single judgement or comprehensive semantic differential ratings, but the aim in most cases is similar, to investigate the connotative meaning of the stimuli.

Elliott and Tannenbaum (1963) used a semantic differential of 20 scales on two sets of stimuli which varied on dimensions such as symmetry, total sides, area or curvature. They obtained four meaningful factors which were interpreted as follows:

Factor I - Complexity - activity

e.g. excitable - calm, simple - complex.

Factor II - Aesthetic - evaluative

e.g. ugly - beautiful, pleasant - unpleasant.

Factor III - Size or potency

e.g. light - heavy, large - small.

Factor IV - Hardness - angularity

e.g. hard - soft, rounded - angular.

The fourth factor is similar to one obtained by Bozzi and Flores D'Arcais (1967), who found that both nonsense figures and meaningful words showed high loadings along a factor of angularity - roundness. They also reported that figures and words rated as "fast" tend also to be described as "active" and "strong".

Berlyne's stimuli, which vary in collative properties, have been described on rating scales (cf. II.3.1). Berlyne (1963) found that more complex stimuli were judged to be more interesting but less pleasing than less complex shapes. In another experiment it was also found that pleasingness was related to less complex stimuli, and that interestingness was an inverted U shaped function of judged complexity (Day, 1965; see Berlyne, 1969). Similar results were obtained when these stimuli were rated on three semantic differential scales, beautiful - ugly, strong - weak and fast - slow. Mean ratings on the Evaluative and Potency scales were bimodal functions of judged complexity; and the mean ratings on the Activity dimension were an inverted U shaped function of judged complexity (Berlyne and Peckham, 1966).

These three semantic differential scales have also been used to describe symmetrical polygons of 4, 8 and 10 turns, and asymmetrical polygons of 4, 12 and 24 turns, and the results lend support to Berlyne. It was found that low complexity asymmetrical polygons are beautiful, strong and slow; high complexity asymmetrical polygons are ugly, slow and weak; symmetrical polygons are all beautiful and strong, but those of high complexity are fast and those of low complexity are slow (Eisenman, 1968d). Elsewhere Eisenman has reported that highly complex polygons are rated as more interesting than low complexity polygons but they do not differ on ratings of pleasingness (Eisenman, 1966a). He also found that rankings of novelty tend to be linearly related to complexity (1968e).

Day (1967) used asymmetrical random polygons which varied from 4 to 160 turns and asked Ss to compare them on subjective complexity, pleasingness and interestingness. He showed that subjective complexity increases monotonically with the number of turns; pleasingness describes a bimodal function, peaking at polygons of 6 and 28 turns, and then decreases with increasing complexity; and interestingness is an inverted U shaped function of complexity, peaking at 28 turns. In a further experiment he found that symmetrical polygons are rated as less complex, but more interesting and much more pleasing than their corresponding asymmetrical polygons (Day, 1968).

There have been a number of attempts to investigate the meaningfulness or association value of polygons. Vanderplas and Garvin (1959) examined the association value of random shapes which ranged from 4 to 24 turns, and reported an inverse relation between the complexity of the shapes and the number, content and heterogeneity of associations. The Ss in this experiment were required to respond verbally in a given period of time, and Eisenman (1966b) repeated the experiment under more relaxed conditions with the asymmetrical polygons of 4, 12 and 24 turns and symmetrical polygons of 4, 8 and 10 turns. He showed that Ss tend to give more associations and more content responses to the symmetrical than to the asymmetrical polygons, and that the polygons of 12 turns had higher association values than those of 4 or 24 turns. Munsinger and Kessen (1964) reported that with a range of polygons from 5 to 40 turns the most complex polygons are judged to be the most meaningful. In a further study it was found that when Ss judged which shapes reminded them more of "many things" meaningfulness was an increasing monotonic function of complexity; but when Ss judged which shapes reminded them more of "one thing" an inverse relation between meaningfulness and complexity was obtained (Munsinger and Kessen, 1965).

VI.1.3 Reasons for Present Investigation

This investigation is aimed as a supplementary experiment to Study I. It was thought that an examination of the connotative meaning of shapes, besides being a useful way of measuring general preference, might also throw some light on individual differences in preference. It was therefore decided to obtain semantic descriptions of a series of polygons to compare the ratings of polygons varying in C/S and to make a preliminary analysis of the main dimensions of meaning of these stimuli.

From talking to people about the polygons the writer observed that their descriptions often varied according to whether the shapes were liked or disliked. The complex polygons were described with adjectives such as "interesting" or "artistic" by those who liked them, but as "messy" or "unbalanced" by those who disliked them; the simple polygons were described as "balanced" or "clear" by those who liked them, and as "uninteresting" or "plain" by those who disliked them. It has been shown experimentally that shapes which are preferred tend to be rated more highly than non-preferred shapes on the semantic differential adjectives beautiful - ugly, strong - weak, and fast - slow (Eisenman and Rappaport, 1967). It was thought that a comparison of semantic differential ratings of preferred and non-preferred polygons might aid the understanding of the criteria used in preference judgements. Also it might show whether preference is related to ability to structure the stimuli in terms of meaningfulness.

Although in Study I there was only a trend for creativity to be related to polygon preference, previous research has suggested that highly creative individuals prefer and can possibly deal with more complexity than less creative individuals (see II.3.9). Artists have been reported to describe complex figures as "organic" and simple figures as "static", "dull" and "uninteresting" (Barron and Welsh, 1952); similarly artists described polygons of 3 and 4 turns as "dull", "plain" and "uninteresting" (Munsinger and Kessen, 1964). Taylor and Eisenman (1964) found that creative artists chose more complexity as preferred and meaningful than did the less creatives. It therefore seemed possible that more creative and less creative Ss might differ in their semantic descriptions of polygons.

Finally it was decided to examine the relation of C/S preference to stated preference for asymmetry-symmetry. Although Barron (1952) treats C/S and asymmetry-symmetry as the same dimension other investigators have suggested that they should not be equated (Eisenman and Rappaport, 1967; Moyles et al., 1965).

VI.2 EXPERIMENTAL METHOD

VI.2.1 Subjects

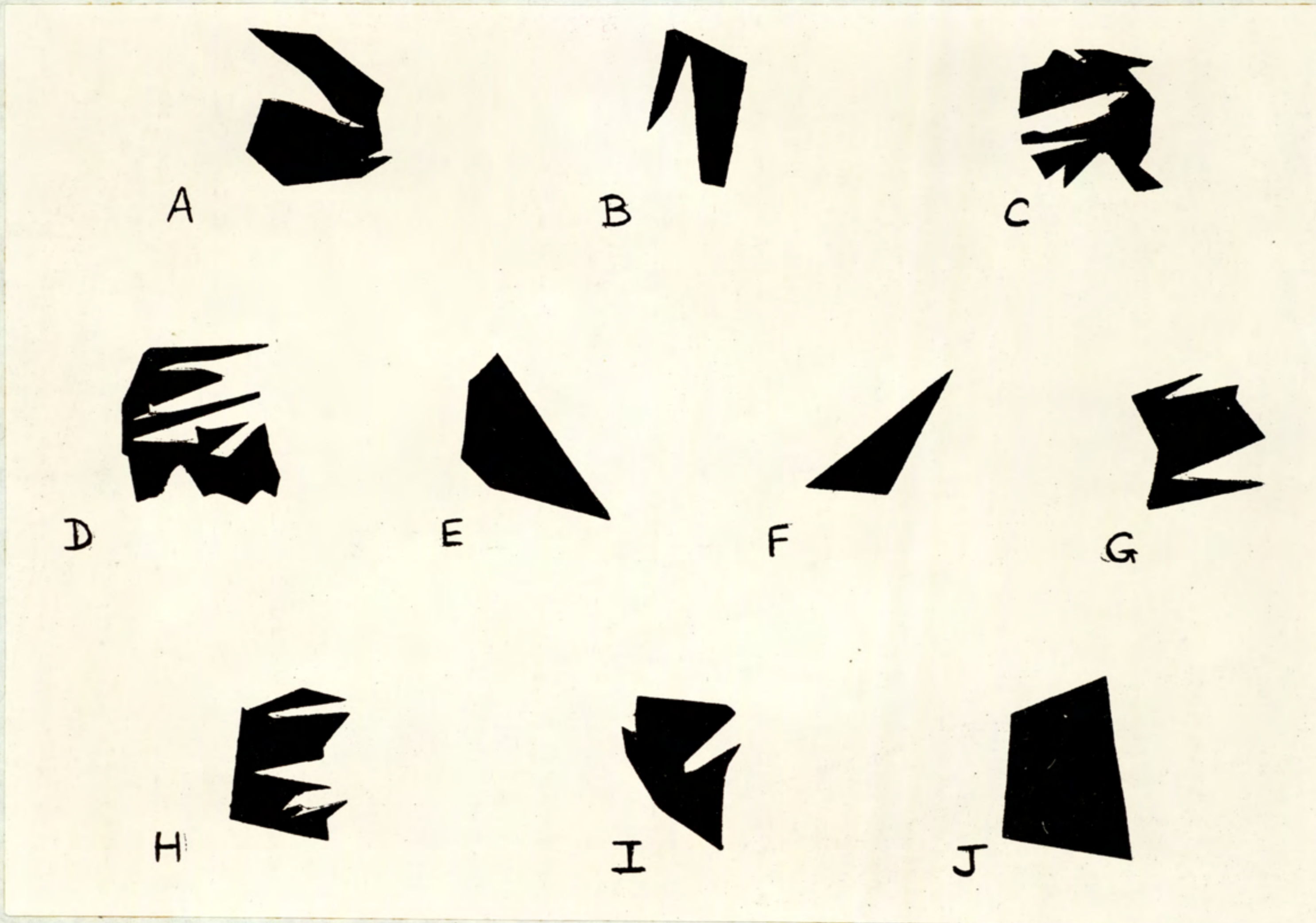
The Ss were 48 introductory psychology students, 25 male and 23 female, who had participated in Study I; (2 female Ss were unable to take part). All Ss received ten shillings payment for participation in the experiment.

VI.2.2 Stimulus Materials

Ten polygons varying in complexity from 3 to 40 turns were selected from the 30 employed in Study I. Using the data of the psychology Ss in Study I the mean choice score was calculated for each of the 30 polygons. At each of the ten levels of complexity the polygon with the mean choice score nearest to 4.5 (the grand mean) was chosen; this was to match them for preference value as far as possible. The 10 polygons were placed on a 7"x5" card with the order of complexity randomised; they were lettered A to J according to their order on the card (Photograph 5). The number of turns on each polygon was as follows: A=16, B=8, C=31, D=40, E=5, F=3, G=10, H=20, I=13, J=4 turns. Each polygon with its corresponding letter was also placed individually on a 2"x2" card.

VI.2.3 Semantic Differential Scales

The main criteria for the selection of the semantic differential scales were their relevance to the stimuli being judged and their factorial composition, as suggested by Osgood et al. (1957). A list of relevant adjectives was compiled from descriptions of the polygons given by several people, and from adjectives used in previous semantic differential investigations. Further scales which loaded on the Evaluation, Potency, Activity and Novelty dimensions were then selected (Osgood et al. 1957). Colleagues were then asked to rate the polygons on these provisional scales and to comment on the appropriateness of the scales. On the basis of these ratings and comments the adjectives on some scales were modified to make them more approp-



Photograph 5

Polygons used in Study II

riate, and the scales which were regarded as unrelated to the stimuli and therefore difficult to use were discarded.

The final list of semantic differential scales selected to be used for this experiment consisted of 16 pairs of bipolar adjectives arranged on a 7-point scale. The scales loading on the same dimension were altered in polarity direction and placed as far apart as possible on the list. The list of the adjectival scales in the order in which they were presented is given below and the semantic differential rating sheet is given in Appendix 3.

complete - incomplete
agitated - calm
new - old
regular - irregular
unpleasant - pleasant
strong -weak
interesting - boring
unartistic - artistic
meaningful - meaningless
light - heavy
confused - clear
slow - fast
familiar - strange
beautiful - ugly
complex - simple
balanced - unbalanced

VI.2.4 Procedure

The testing was conducted individually with each S. E explained to S that she was interested in how people perceive various shapes. The S was shown the card containing 10 polygons and was asked which were his 3 most and 3 least preferred shapes. E recorded the preference judgements. E. then gave S the instructions for using the semantic differential (given on follow-

SEMANTIC DIFFERENTIAL

Instructions

The purpose of this study is to measure how various people perceive certain shapes, by having them judge the shapes against a series of descriptive scales.

On each page you will have a different shape to be judged, and beneath it a set of adjectival scales. You are to rate the shape on each of these scales in order.

There are 7 positions on each scale - and this is how you use them:

Adjective X	EXTREMELY	QUITE	SLIGHTLY	NEITHER X OR Y	SLIGHTLY	QUITE	EXTREMELY	Adjective Y
e.g. hard	:______:	______:	______:	______:	______:	______:	______:	

You put a X in the position you consider nearest to your opinion.

N.B.

Make each item a separate and independent judgement.

Please make your judgements on the basis of how these shapes appear <u>to you</u>.

Work at a fairly high speed. Do not worry or puzzle over individual items. It is your first impressions, the immediate "feelings" about the items that are wanted.

ing page). While S was reading the instructions E placed a copy of the 6 chosen polygons at the top of a separate semantic differential sheet (see Appendix 3). The order in which the polygons were rated was previously determined by randomising the presentation order over preference. When S understood the instructions he was given the rating sheets one at a time to rate each of the 6 polygons. When S had completed this E asked whether he generally preferred symmetrical or asymmetrical shapes. E recorded the preference.

VI.2.5. Scoring Techniques

Polygon preference

The scores used for polygon preference were the Point total scores as in Study I. The procedure for deriving these scores is described in III.3.

Semantic differential scales

The semantic differential scale scores were obtained by numbering each scale 1 to 7 from left to right.

Asymmetry-symmetry

The asymmetry-symmetry preference judgements were placed in three categories: asymmetry, symmetry, and no preference

VI.3 RESULTS

VI.3.1 Statistical Analysis

As this was primarily a descriptive study the data were not all analysed with statistical tests. The semantic differential profiles of the polygons were compared by inspection of the data. A preliminary principal component analysis was made of the semantic differential ratings of the polygons. Non-parametric statistics were used to analyse preferences for complexity-simplicity and asymmetry-symmetry as the data were not suitable for analysis by parametric tests.

VI.3.2 Principal Component Analysis

A principal component analysis was made of all the semantic differential scale scores of the 10 polygons. The matrix of intercorrelations of the 16 semantic differential scales is given in Appendix 3. Table VI.1 gives the 16 factors which were extracted and their variance, and the loadings of the semantic differential scales on the 16 factors are shown in Table VI.2. Only the first three factors have eigenvalues above 1.00; they are interpreted as follows:

Factor I - Unpredictability - Complexity.

Scales with the highest loadings on this factor are familiar - strange, regular - irregular, simple - complex, clear - confused, calm - agitated, complete - incomplete.

Factor II - Aestheticism - Evaluation.

Scales with the highest loadings on this factor are beautiful - ugly, artistic - unartistic, pleasant - unpleasant, interesting - boring, meaningful - meaningless.

Factor III - Potency.

Scales with the highest loadings on this factor are strong - weak and

TABLE VI.1

Results of the principal component analysis

COMPONENT NUMBER	EIGENVALUE OR COMPONENT VARIANCE	ACCUMULATED VALUE AS % OF TOTAL VARIANCE
1	5.4192495	33.87
2	4.0919357	59.44
3	1.2167135	67.05
4	0.8560367	72.40
5	0.6437266	76.42
6	0.5632343	79.94
7	0.5058126	83.10
8	0.4251404	85.76
9	0.4038955	88.29
10	0.3601167	90.54
11	0.3341780	92.63
12	0.3093664	94.56
13	0.2594179	96.18
14	0.2242550	97.58
15	0.2162926	98.93
16	0.1706223	100.00

TAL VARIANCE 16.0000000
ACE 16.0000000

TABLE VI.2

Factor loadings of the semantic differential adjectives.

The loadings on the 16 factors are given on the following three pages.

	NO 1	NO 2	NO 3	NO 4	NO 5	NO 6
VARIANCE	5.41925	4.09194	1.21671	0.85604	0.64373	0.56323
Complete-incomplete	0.33211	0.16573	0.06749	0.12757	0.01709	0.15334
Agitated-calm	-0.34872	0.01450	0.10156	0.13539	0.22566	0.07573
New-old	-0.25563	0.20631	0.11152	0.03461	-0.46816	-0.32234
Regular-irregular	0.35634	0.05081	-0.03082	0.12022	-0.05484	-0.44386
Unpleasant-pleasant	0.08105	-0.37982	0.11395	0.32565	0.28767	-0.43016
Strong-weak	0.12360	0.14561	0.67228	0.39336	-0.16176	0.31102
Interesting-boring	-0.19047	0.37658	0.17981	-0.13760	0.12962	-0.01439
Unartistic-artistic	0.09343	-0.39603	-0.06876	0.21126	-0.11309	0.12702
Meaningful-meaningless	0.03297	0.35907	0.13169	-0.12330	0.64943	-0.23479
Light-heavy	-0.16043	0.21302	-0.55691	0.33332	-0.07866	-0.06749
Confused-clear	-0.35082	-0.11884	0.11076	-0.00957	-0.12119	-0.20540
Slow-fast	0.16548	-0.24476	0.20454	-0.65364	-0.16884	-0.19225
Familiar-strange	0.35825	0.03379	-0.09232	0.03372	0.00410	0.03743
Beautiful-ugly	0.04696	0.40713	-0.19797	-0.16358	-0.21531	0.09337
Complex-simple	-0.35203	0.06637	0.16611	-0.00705	-0.18390	-0.08808
Balanced-unbalanced	0.27776	0.20837	0.11334	0.20933	-0.19173	-0.46369
SUMS OF SQUARES	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

	COMPONENT NO 7	COMPONENT NO 8	COMPONENT NO 9	COMPONENT NO 10	COMPONENT NO 11	COMPONENT NO 12
VARIANCE	0.50581	0.42515	0.40390	0.36012	0.33418	0.30937
Complete-incomplete	0.15625	0.09158	0.16398	0.14889	0.71657	0.12018
Agitated-calm	0.17938	-0.62175	-0.08403	-0.12212	0.27762	0.08386
New-old	0.63503	0.08918	-0.28004	0.05686	0.00174	0.16098
Regular-irregular	-0.02624	0.19307	-0.13942	0.14770	0.21255	-0.26268
Unpleasant-pleasant	0.04036	-0.11384	-0.09867	0.04486	-0.14550	0.02579
Strong-weak	0.07367	0.03353	0.21409	-0.04038	-0.29911	-0.20170
Interesting-boring	-0.00495	-0.02129	-0.04370	0.16220	-0.00833	-0.27782
Unartistic-artistic	0.22524	0.24059	-0.00688	-0.65018	0.10147	0.01622
Meaningful-meaningless	0.21864	0.27453	0.10482	-0.39208	-0.03984	0.01250
Light-heavy	0.20540	-0.08252	0.59323	-0.00047	-0.11023	-0.27570
Confused-clear	-0.25237	0.27431	-0.01618	-0.06629	0.13405	-0.47141
Slow-fast	0.23922	-0.23746	0.44674	-0.09698	-0.02170	-0.12593
Familiar-strange	0.11009	-0.42463	-0.36363	-0.17362	0.03068	-0.57962
Beautiful-ugly	-0.15963	-0.01333	-0.26063	-0.40860	-0.16066	0.08105
Complex-simple	-0.33316	-0.04712	0.12311	-0.30013	0.42106	-0.06151
Balanced-unbalanced	-0.34950	-0.30147	0.18056	-0.17458	-0.08398	0.32287
SUMS OF SQUARES	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

	COMPONENT NO 13	COMPONENT NO 14	COMPONENT NO 15	COMPONENT NO 16
VARIANCE	0.25942	0.22426	0.21629	0.17062
Complete-incomplete	0.11510	0.32403	0.29291	0.06514
Agitated-calm	0.00849	-0.45479	0.22178	0.10933
New-old	0.03456	0.10555	-0.12988	0.08595
Regular-irregular	-0.35223	-0.55338	0.08467	-0.15542
Unpleasant-pleasant	-0.21300	0.46109	0.35139	-0.18091
Strong-weak	-0.18218	-0.06080	0.08386	0.07643
Interesting-boring	0.35731	0.03366	0.09076	-0.71459
Unartistic-artistic	0.25754	-0.14731	0.00863	-0.35509
Meaningful-meaningless	-0.03212	0.01374	-0.15241	0.21558
Light-heavy	-0.06750	0.03581	0.04155	-0.01587
Confused-clear	0.37628	-0.01434	0.29067	0.42837
Slow-fast	0.07592	0.00532	0.18007	-0.03206
Familiar-strange	0.06903	0.27440	-0.26811	0.12568
Beautiful-ugly	-0.25244	0.10186	0.58643	-0.00910
Complex-simple	-0.44117	0.20888	-0.36841	-0.17010
Balanced-unbalanced	0.41624	-0.02576	-0.09372	0.02974
SQUARES	1.00000	1.00000	1.00000	1.00000

heavy - light.

VI.3.3 Semantic Differential Ratings of Polygons

For clarity in presentation of the results the semantic differential scales have bee placed in the order of their loadings on the first factor of the principal component analysis. The mean ratings of the 10 polygons on the semantic differential scales are presented graphically in Figure VI.1 (reading 1 to 7 from left to right) and as a table in Appendix 3. It can be seen that ratings of the polygons as strange, irregular, complex, confused and agitated show an almost linear increase with increasing complexity. The more complex polygons are rated as newer, more interesting and more artistic but less complete than the simple polygons. They are also rated as faster and lighter than the simple polygons except the polygon of 3 turns. The ratings of the polygons as pleasant, beautiful and meaningful are fairly similar and they do not appear to vary with the complexity of the stimuli.

The data for the most and least preferred polygons were analysed separately. The mean semantic differential scale scores of the polygons when rated as most preferred and as least preferred are shown graphically in Figure VI.2 and as tables in Appendix 3.

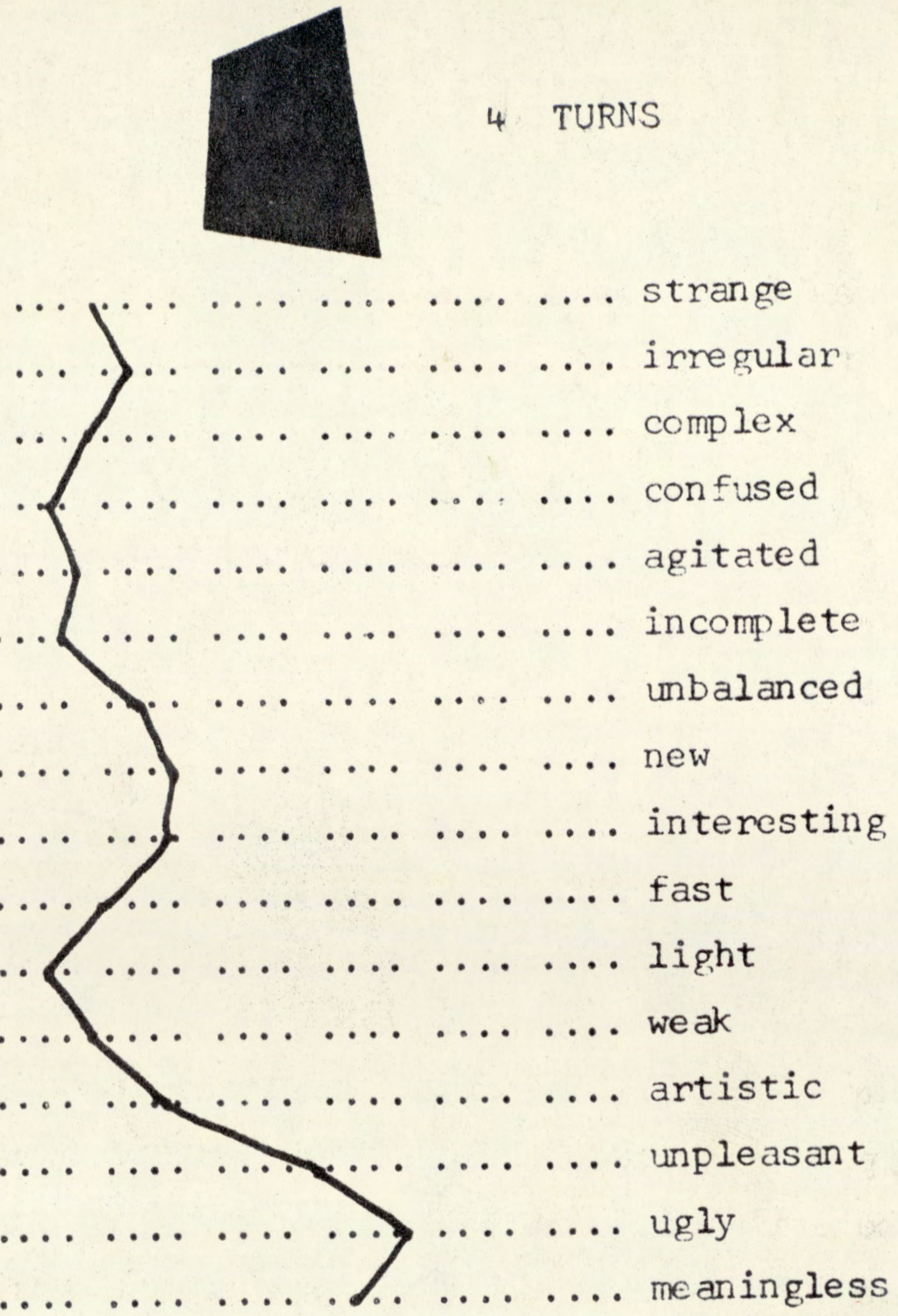
All the polygons chosen as most preferred are rated as more artistic, pleasant, beautiful and meaningful than when they are chosen as least preferred, and all but the polygon of 16 turns are rated as stronger. The Ss preferring the complex polygons rate them as more familiar, regular, clear, complete and balanced than do Ss choosing them as least preferred. The Ss preferring the simple polygons rate them as newer and more interesting than do Ss choosing them as least preferred.

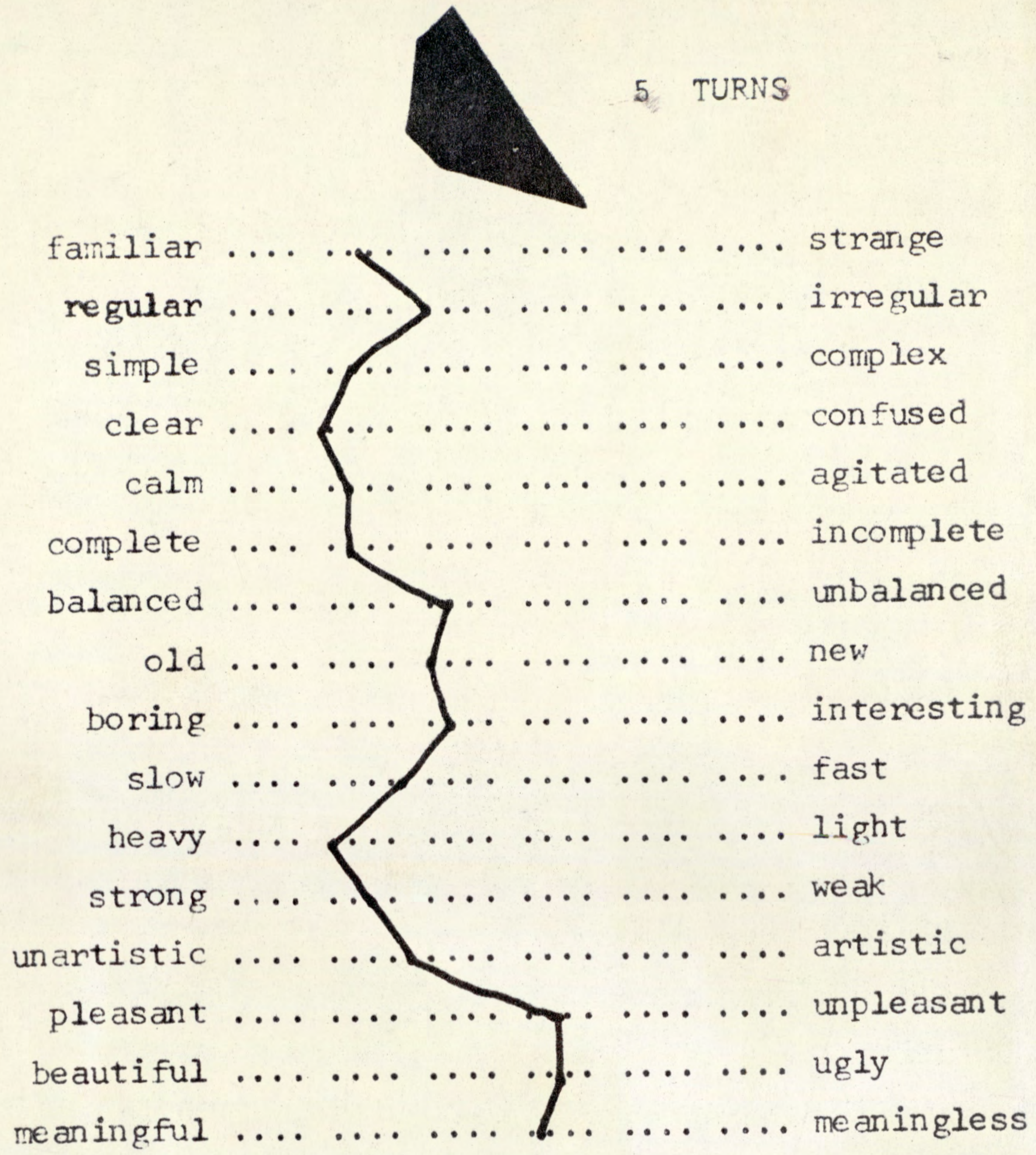
VI.3.4 Comparison of Groups Differing on Creativity and Intelligence

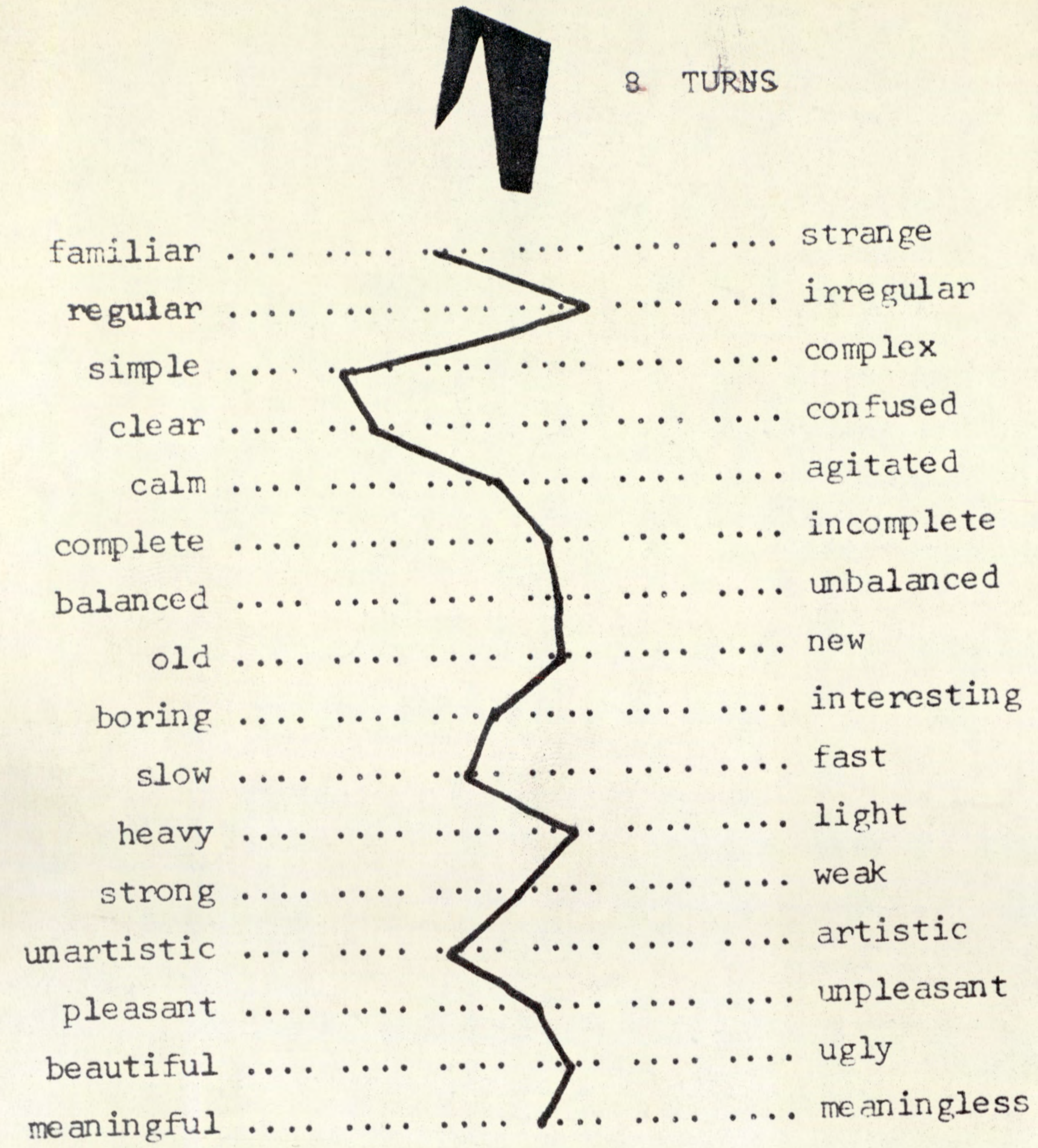
The AH5 total scores and the flexibility scores on Uses for Things from

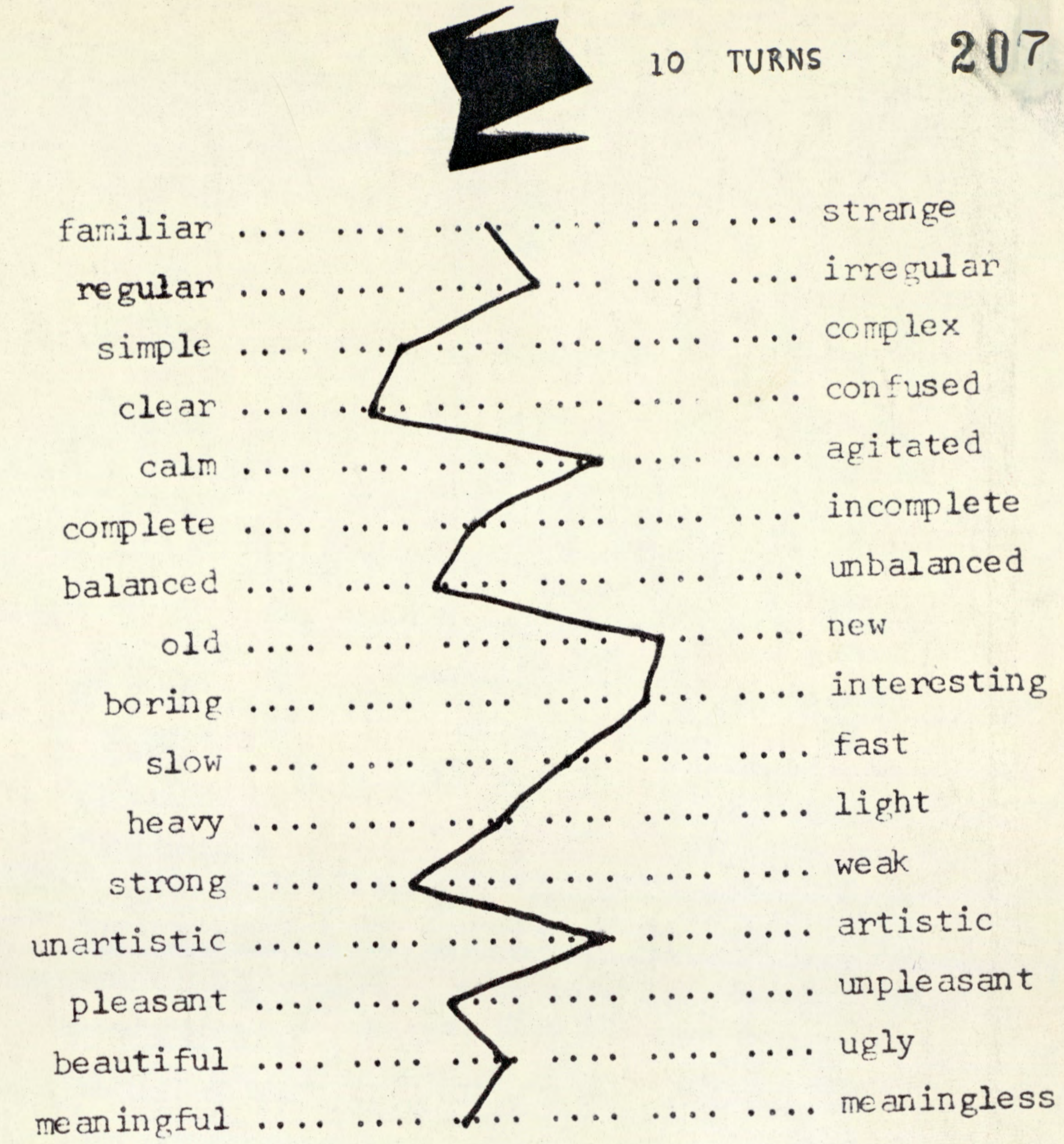
FIGURE VI.1

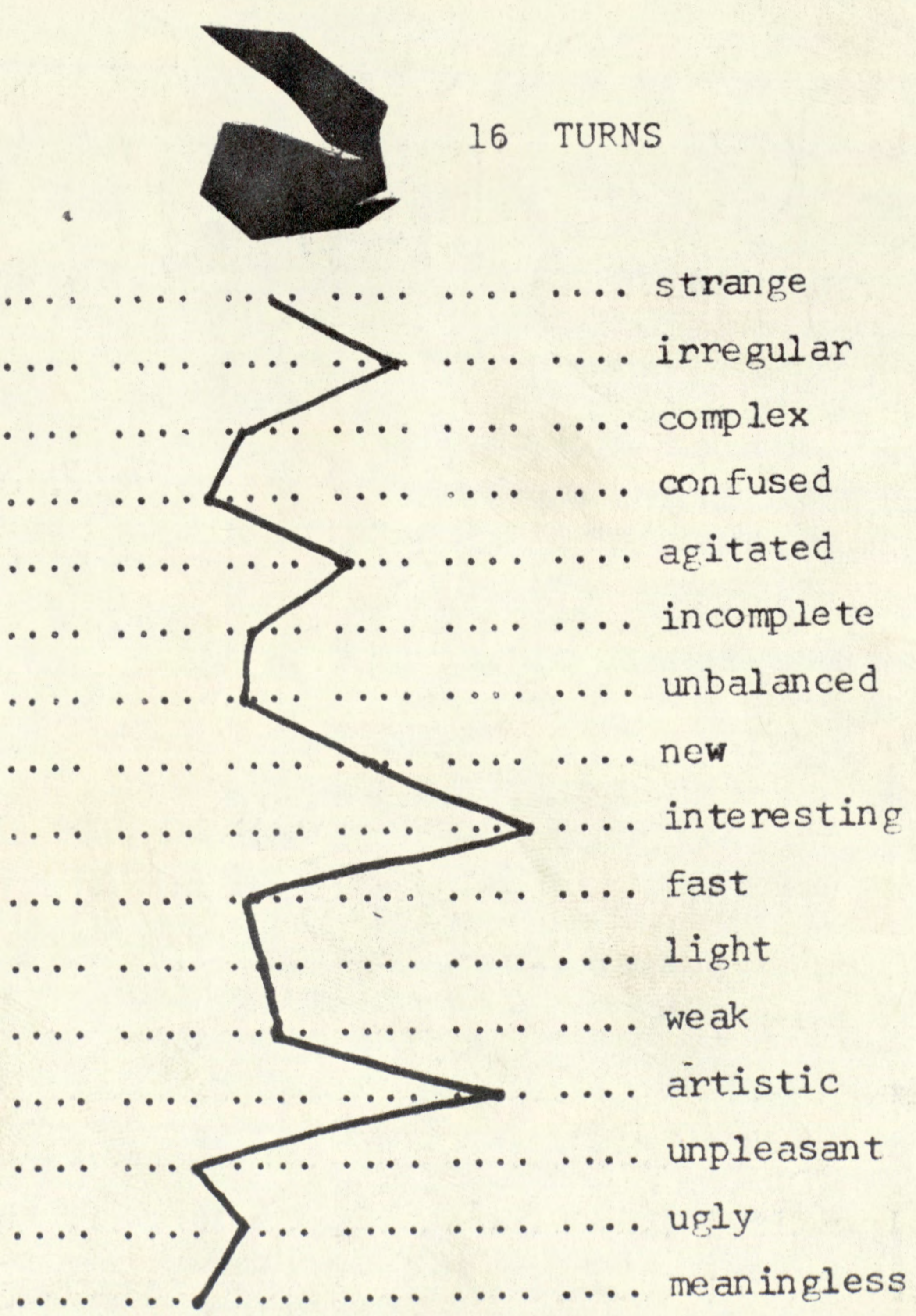
Semantic differential profiles of 10 polygons.

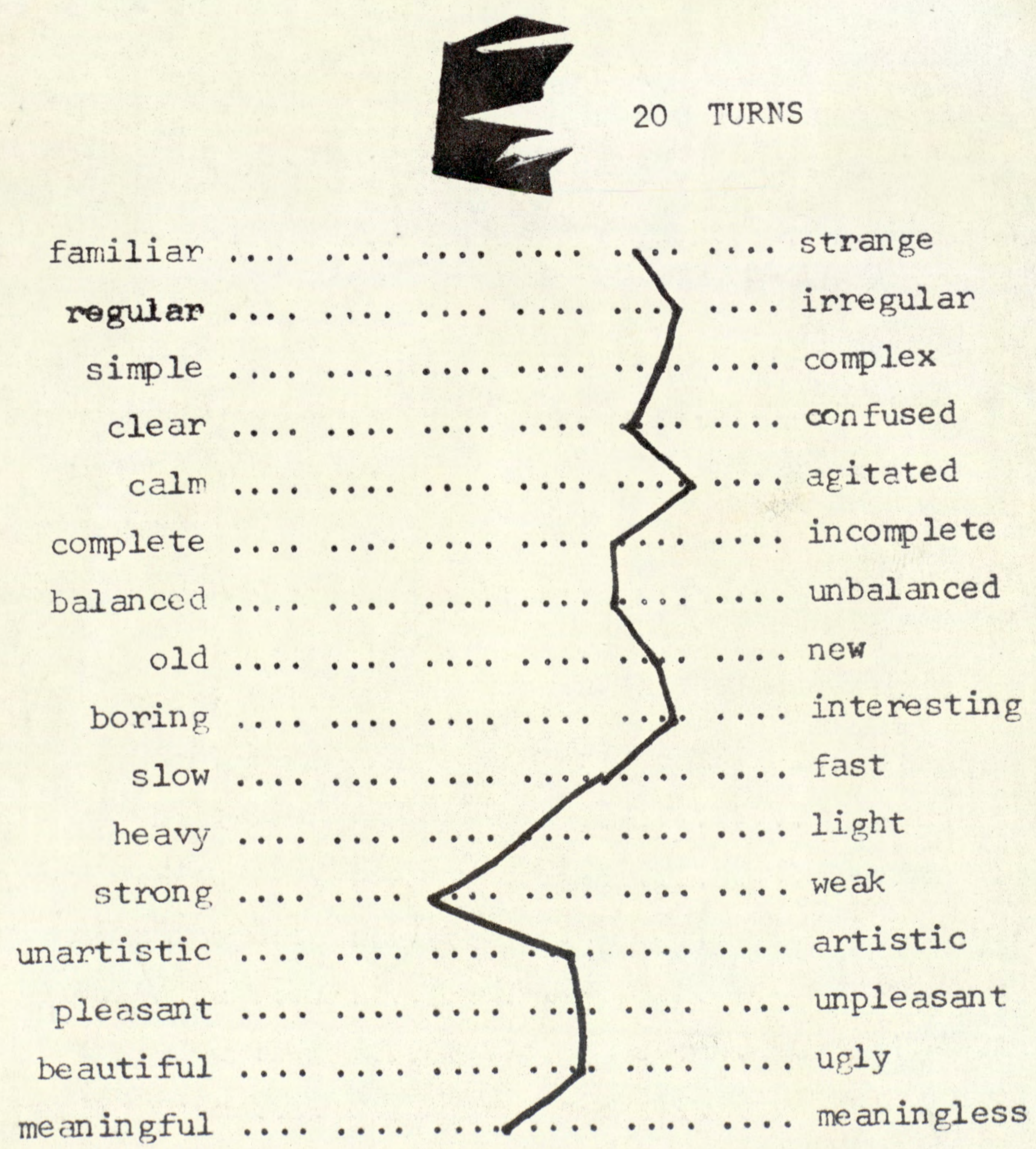

4 TURNS
strange
irregular
complex
confused
agitated
incomplete
unbalanced
new
interesting
fast
light
weak
artistic
unpleasant
ugly
meaningless

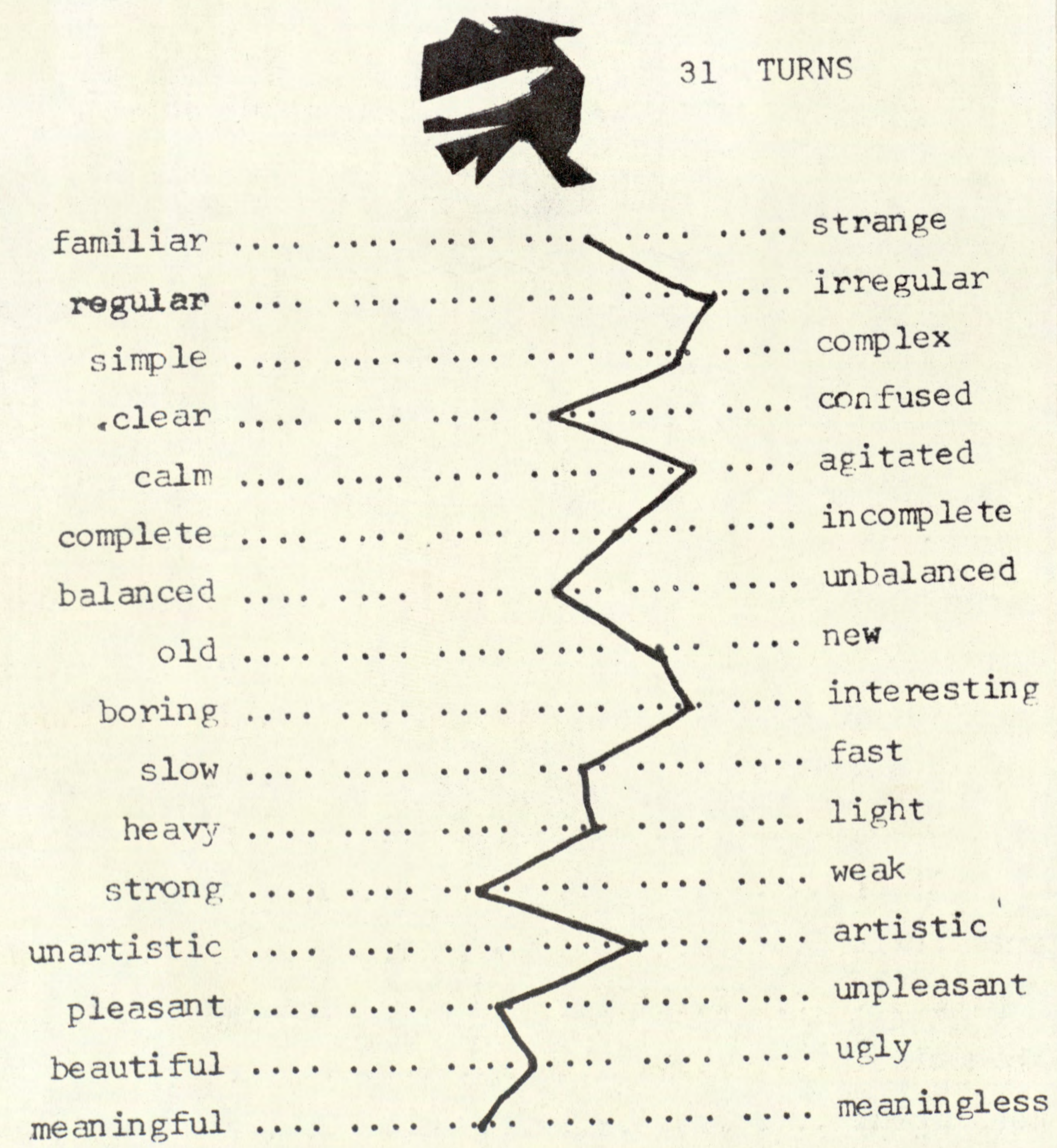

5 TURNS
familiar strange
regular irregular
simple complex
clear confused
calm agitated
complete incomplete
balanced unbalanced
old new
boring interesting
slow fast
heavy light
strong weak
unartistic artistic
pleasant unpleasant
beautiful ugly
meaningful meaningless


8 TURNS
familiar strange
regular irregular
simple complex
clear confused
calm agitated
complete incomplete
balanced unbalanced
old new
boring interesting
slow fast
heavy light
strong weak
unartistic artistic
pleasant unpleasant
beautiful ugly
meaningful meaningless


10 TURNS
familiar strange
regular irregular
simple complex
clear confused
calm agitated
complete incomplete
balanced unbalanced
old new
boring interesting
slow fast
heavy light
strong weak
unartistic artistic
pleasant unpleasant
beautiful ugly
meaningful meaningless


16 TURNS
strange
irregular
complex
confused
agitated
incomplete
unbalanced
new
interesting
fast
light
weak
artistic
unpleasant
ugly
meaningless


20 TURNS
familiar strange
regular irregular
simple complex
clear confused
calm agitated
complete incomplete
balanced unbalanced
old new
boring interesting
slow fast
heavy light
strong weak
unartistic artistic
pleasant unpleasant
beautiful ugly
meaningful meaningless


31 TURNS
familiar strange
regular irregular
simple complex
clear confused
calm agitated
complete incomplete
balanced unbalanced
old new
boring interesting
slow fast
heavy light
strong weak
unartistic artistic
pleasant unpleasant
beautiful ugly
meaningful meaningless

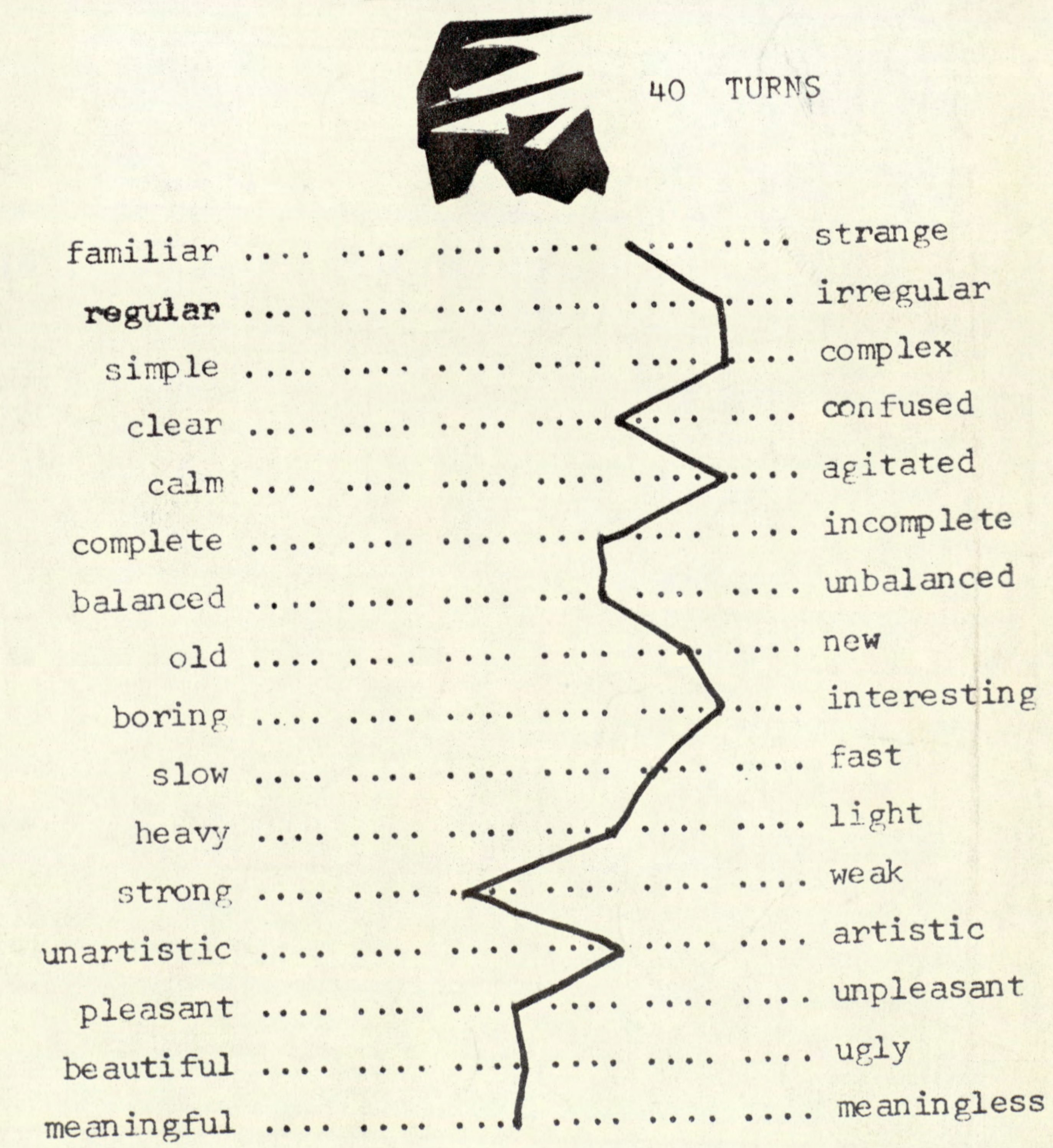
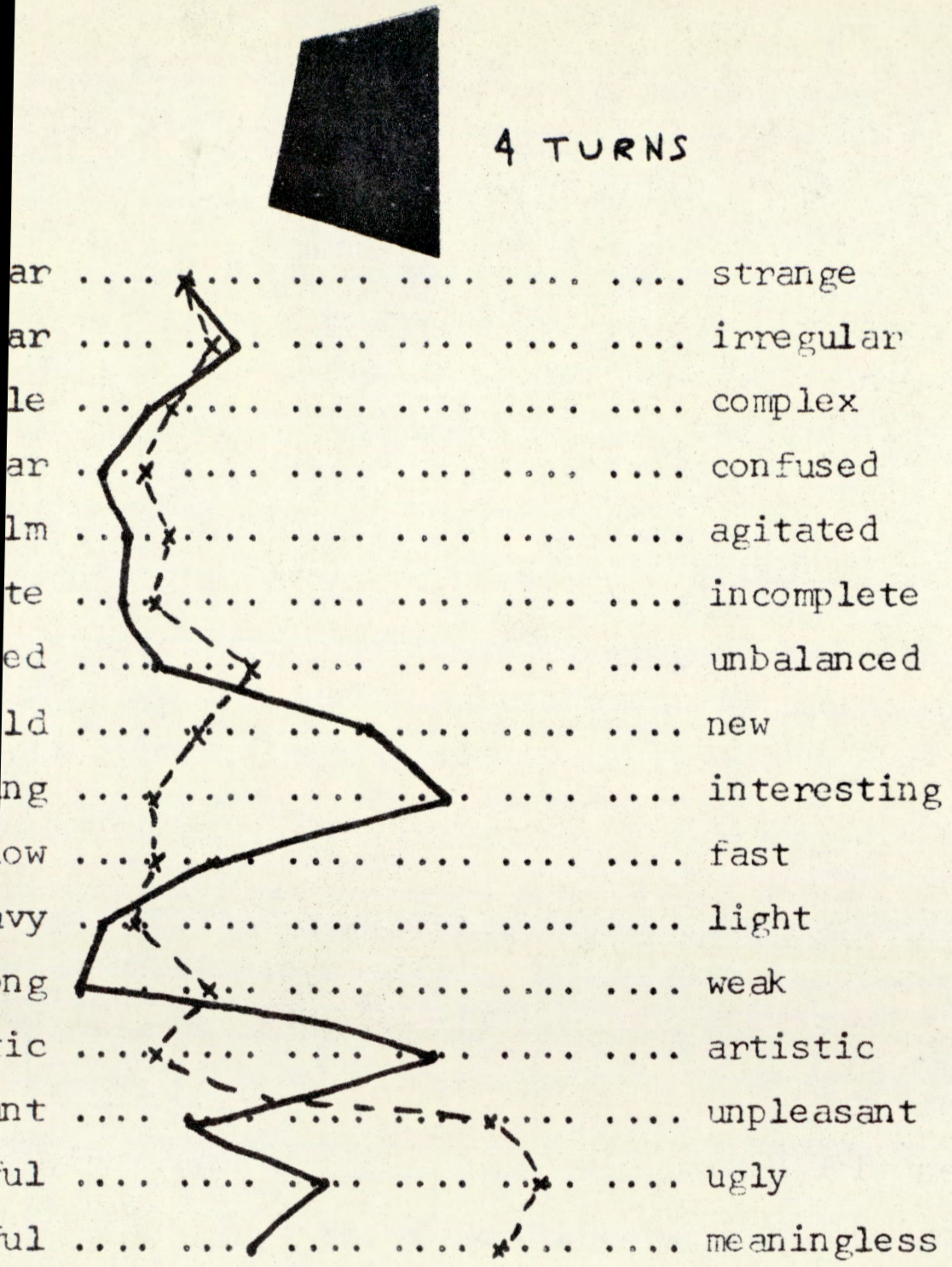
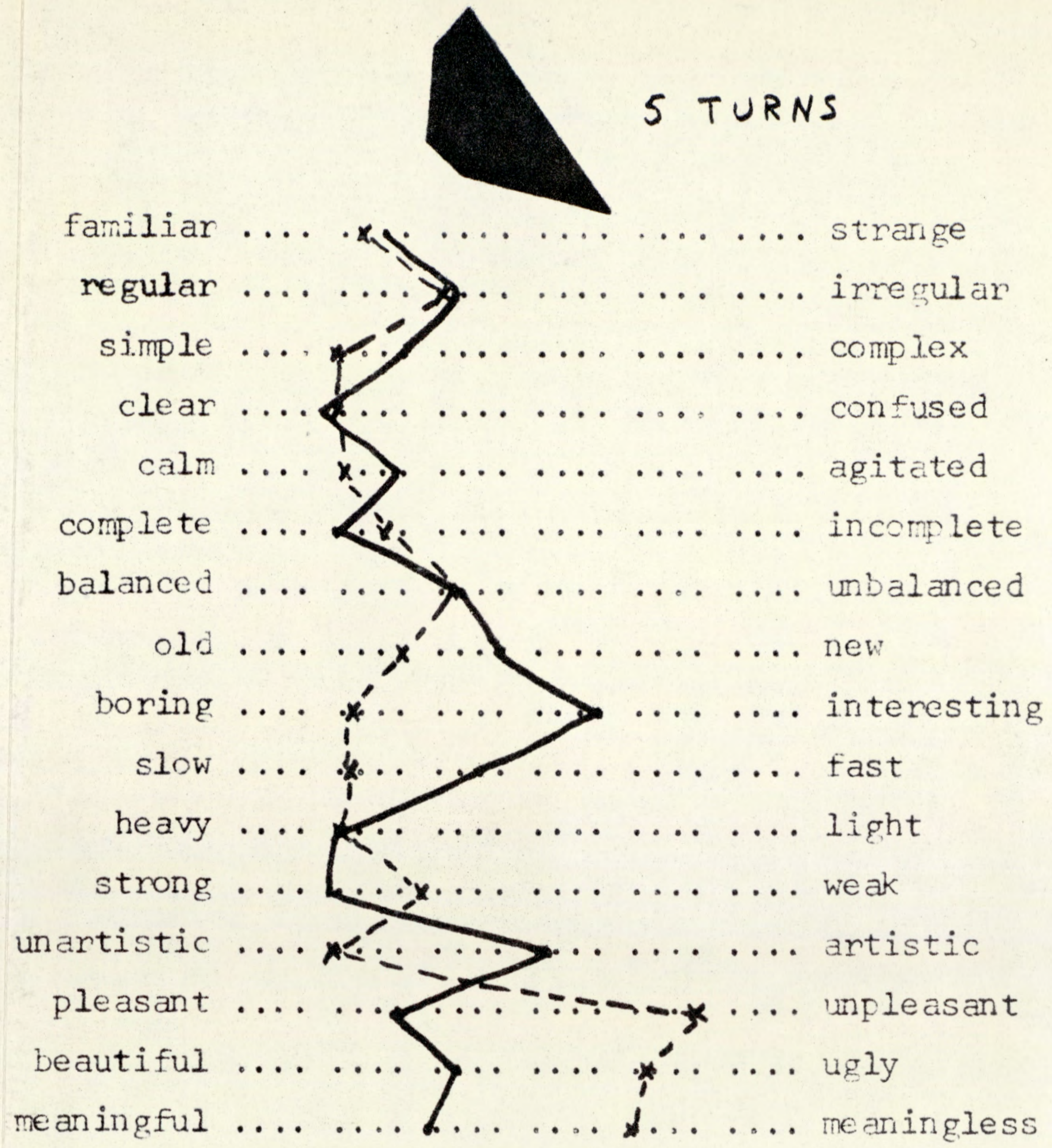
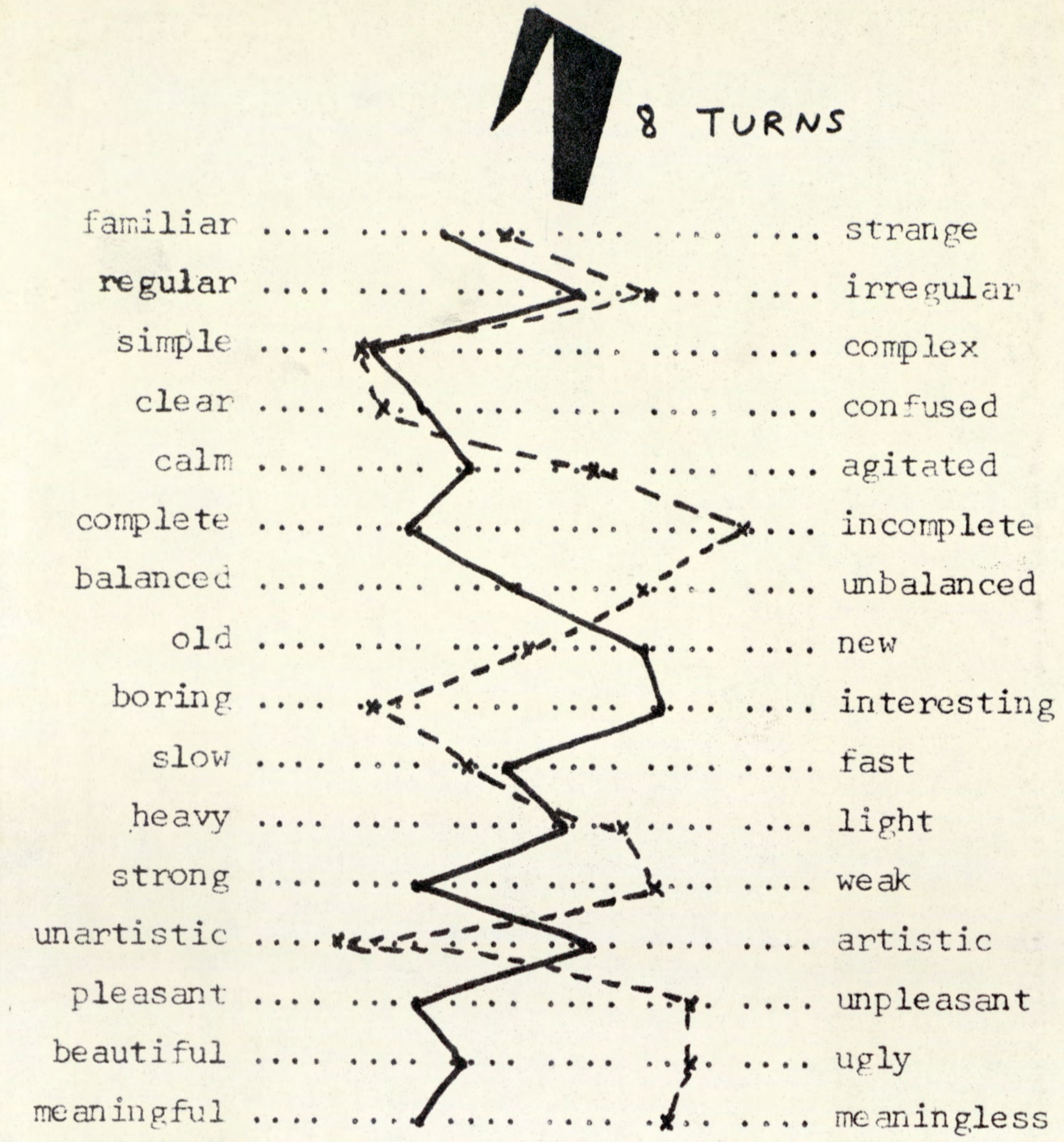

40 TURNS
familiar strange
regular irregular
simple complex
clear confused
calm agitated
complete incomplete
balanced unbalanced
old new
boring interesting
slow fast
heavy light
strong weak
unartistic artistic
pleasant unpleasant
beautiful ugly
meaningful meaningless

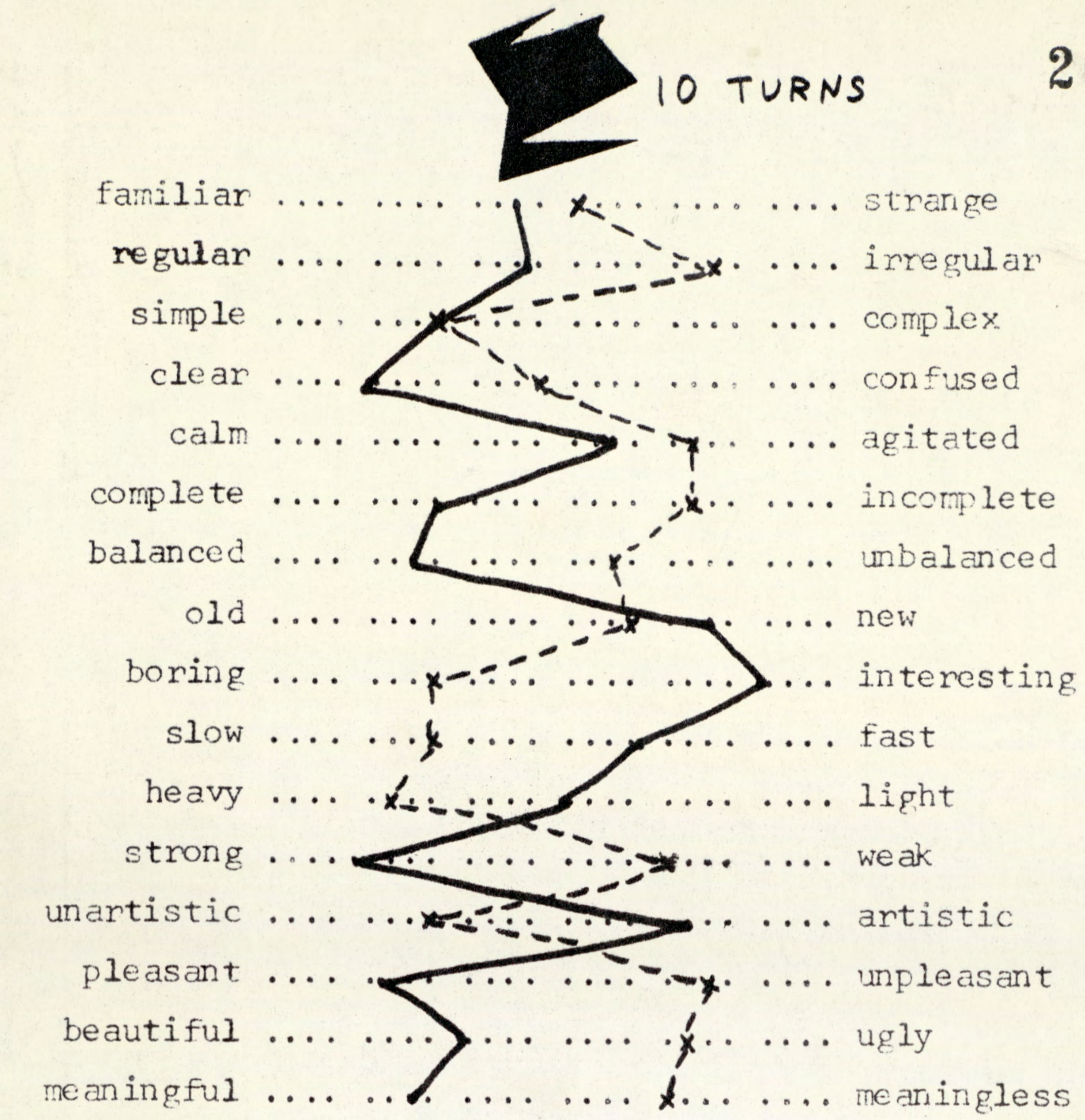
FIGURE VI.2

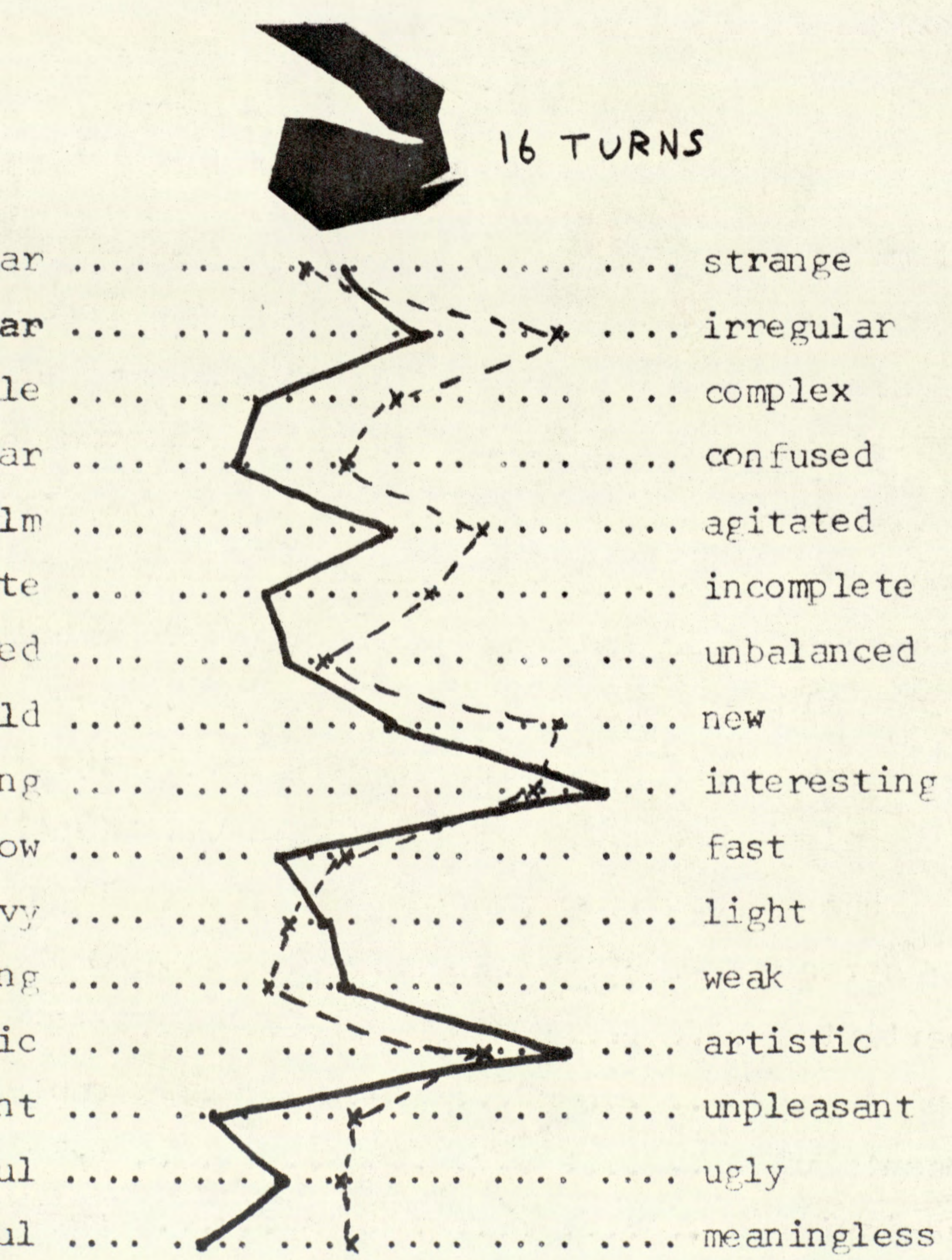
Comparisons of the semantic differential profiles of 10 polygons when chosen as most preferred and as least preferred.

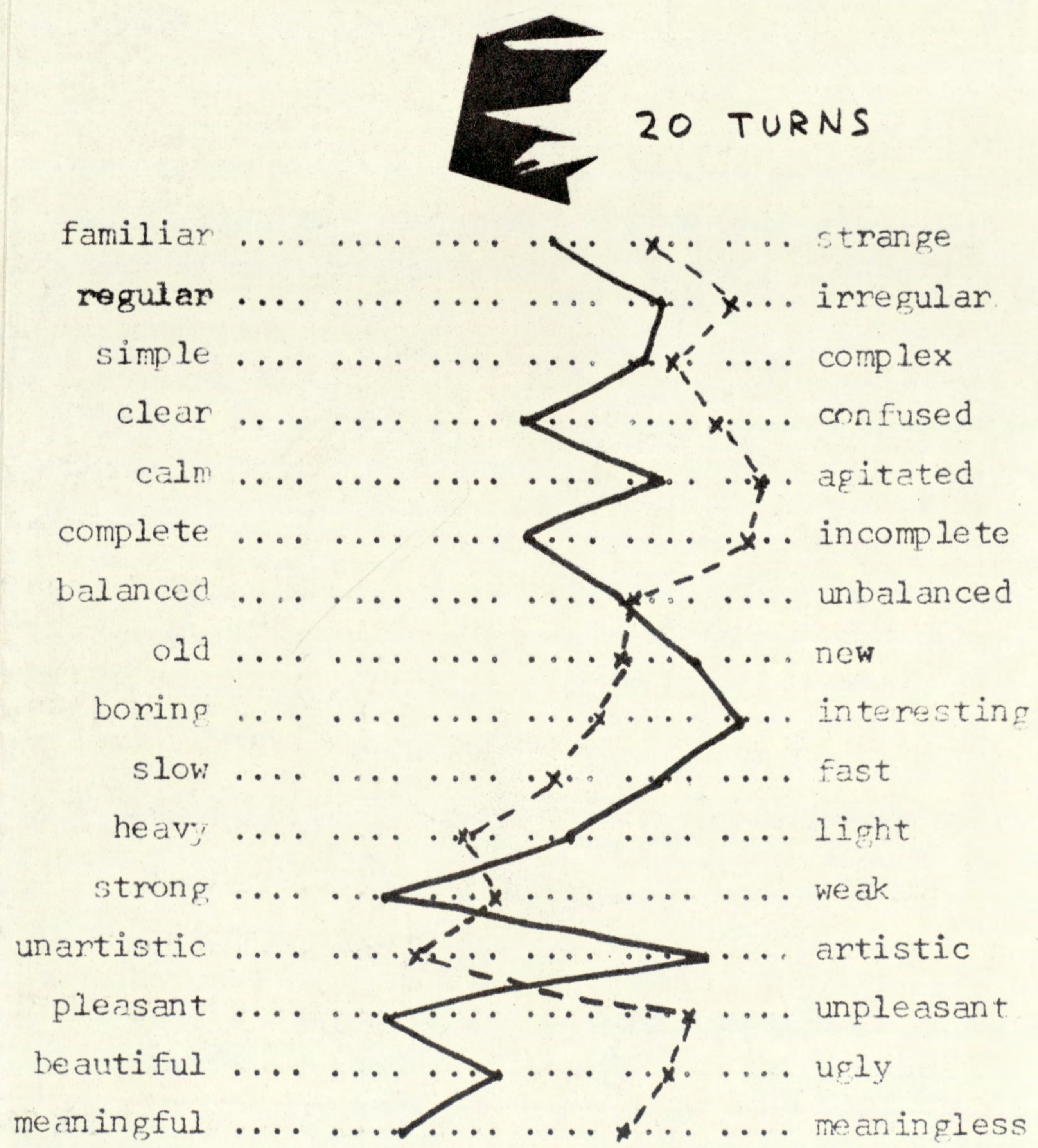

4 TURNS
strange
irregular
complex
confused
agitated
incomplete
unbalanced
new
interesting
fast
light
weak
artistic
unpleasant
ugly
meaningless

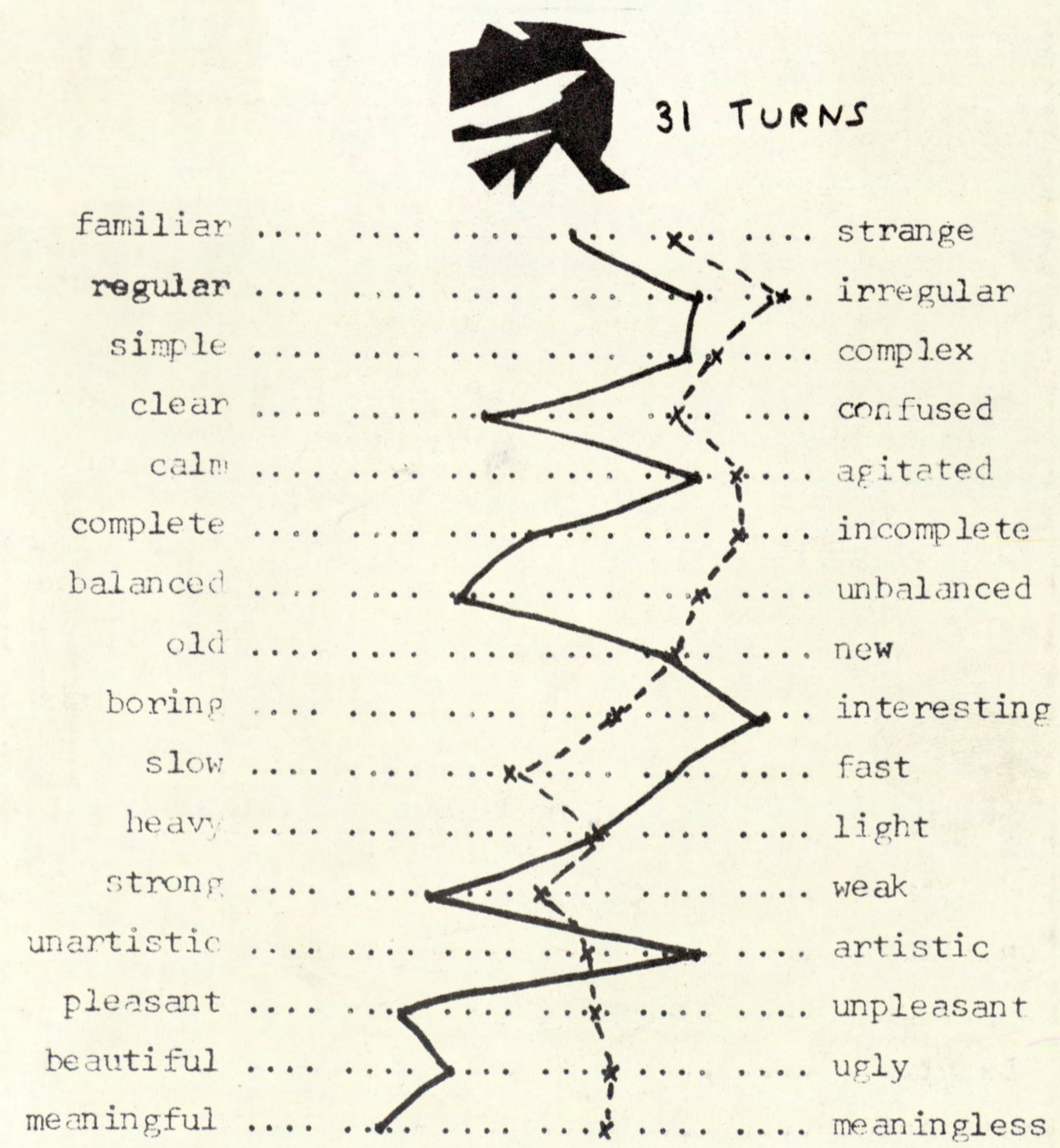

5 TURNS
familiar
regular
simple
clear
calm
complete
balanced
old
boring
slow
heavy
strong
unartistic
pleasant
beautiful
meaningful
strange
irregular
complex
confused
agitated
incomplete
unbalanced
new
interesting
fast
light
weak
artistic
unpleasant
ugly
meaningless

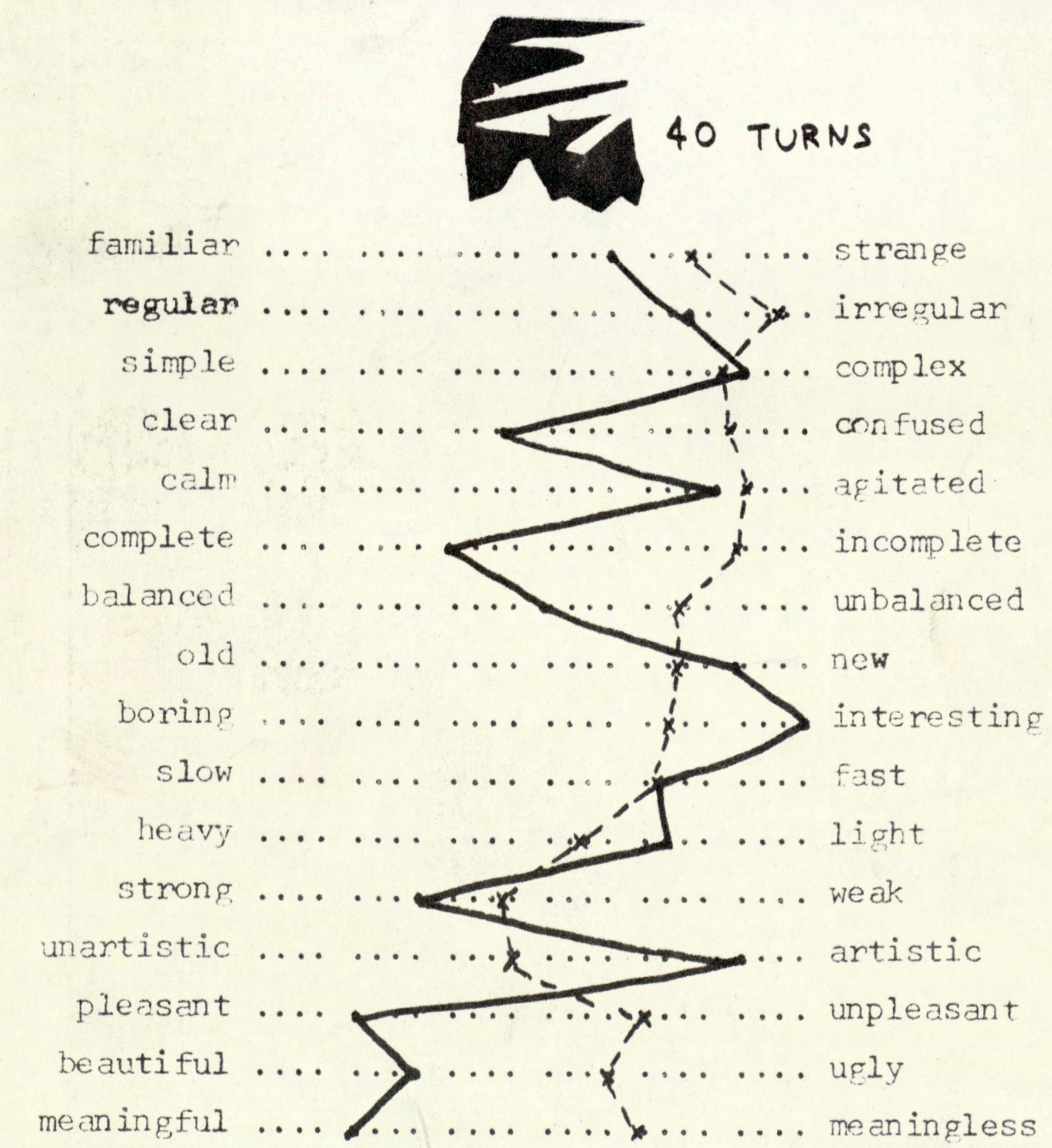

8 TURNS
familiar
regular
simple
clear
calm
complete
balanced
old
boring
slow
heavy
strong
unartistic
pleasant
beautiful
meaningful
strange
irregular
complex
confused
agitated
incomplete
unbalanced
new
interesting
fast
light
weak
artistic
unpleasant
ugly
meaningless


10 TURNS
familiar
regular
simple
clear
calm
complete
balanced
old
boring
slow
heavy
strong
unartistic
pleasant
beautiful
meaningful
strange
irregular
complex
confused
agitated
incomplete
unbalanced
new
interesting
fast
light
weak
artistic
unpleasant
ugly
meaningless


16 TURNS
strange
irregular
complex
confused
agitated
incomplete
unbalanced
new
interesting
fast
light
weak
artistic
unpleasant
ugly
meaningless


20 TURNS
familiar
regular
simple
clear
calm
complete
balanced
old
boring
slow
heavy
strong
unartistic
pleasant
beautiful
meaningful
strange
irregular
complex
confused
agitated
incomplete
unbalanced
new
interesting
fast
light
weak
artistic
unpleasant
ugly
meaningless


31 TURNS
familiar
regular
simple
clear
calm
complete
balanced
old
boring
slow
heavy
strong
unartistic
pleasant
beautiful
meaningful
strange
irregular
complex
confused
agitated
incomplete
unbalanced
new
interesting
fast
light
weak
artistic
unpleasant
ugly
meaningless


40 TURNS
familiar
regular
simple
clear
calm
complete
balanced
old
boring
slow
heavy
strong
unartistic
pleasant
beautiful
meaningful
strange
irregular
complex
confused
agitated
incomplete
unbalanced
new
interesting
fast
light
weak
artistic
unpleasant
ugly
meaningless

Study I were used to obtain four groups differing on creativity and intelligence. By dichotomizing the scores on both tests the following four groups were obtained: high creativity - high intelligence, high creativity - low intelligence, low creativity - high intelligence and low creativity - low intelligence.

The total complexity preference scores of the four groups were compared by Mann-Whitney U tests and the results are shown in Table VI.3. The high creativity - low intelligence group prefers significantly more complexity than the high creativity - high intelligence and low creativity - high intelligence groups ($p<.05$), they prefer more than the low creativity - low intelligence group but this difference does not reach significance ($p<.10$). The groups were compared on their preference for asymmetry-symmetry by a Fisher exact probability test. The results are given in Table VI.4 and show that the high creativity - low intelligence group prefers asymmetry significantly more than the low creativity - low intelligence group ($p<.05$) and nonsignificantly more than the high creativity - high intelligence group ($p<.10$).

A further comparison was made of the semantic differential ratings of the polygons given by the high creativity - low intelligence group and the low creativity - high intelligence group. Their ratings of the polygons are presented graphically in Figure VI.3 and as tables in Appendix 3. The groups do not appear to differ greatly in their semantic differential ratings of the polygons but some differences may be noted. The high creativity - low intelligence group describes the complex polygons as more complete, balanced and meaningful, and the simple shapes as older and more boring than does the low creativity - high intelligence group. The polygon of 8 turns is rated more favourably by the low creativity - high intelligence group and the polygon of 16 turns is rated more favourably by the high creativity - low intelligence group.

TABLE VI.3

Comparisons of the total scores of polygon preference for four groups differing on creativity and intelligence.

GROUPS	U	p
High creativity - low intelligence <u>v</u> High creativity - high intelligence	33.5	<.05
High creativity - low intelligence <u>v</u> Low creativity - high intelligence	34	<.05
High creativity - low intelligence <u>v</u> Low creativity - low intelligence	40.5	<.10
Low creativity - high intelligence <u>v</u> High creativity - high intelligence	67.5	
Low creativity - low intelligence <u>v</u> High creativity - high intelligence	71	
Low creativity - low intelligence <u>v</u> Low creativity - high intelligence	63.5	

Results of Mann-Whitney <u>U</u> tests (two tailed).

n = 12 in each group.

The group preferring more complexity is presented first in each pair.

TABLE VI.4

Comparisons of asymmetry-symmetry preference of four groups differing on creativity and intelligence.

GROUPS	p
High creativity - low intelligence v High creativity - high intelligence	<.10
High creativity - low intelligence v Low creativity - high intelligence	
High creativity - low intelligence v Low creativity - low intelligence	<.05
High creativity - high intelligence v Low creativity - low intelligence	
Low creativity - high intelligence v High creativity - high intelligence	
Low creativity - high intelligence v Low creativity - low intelligence	

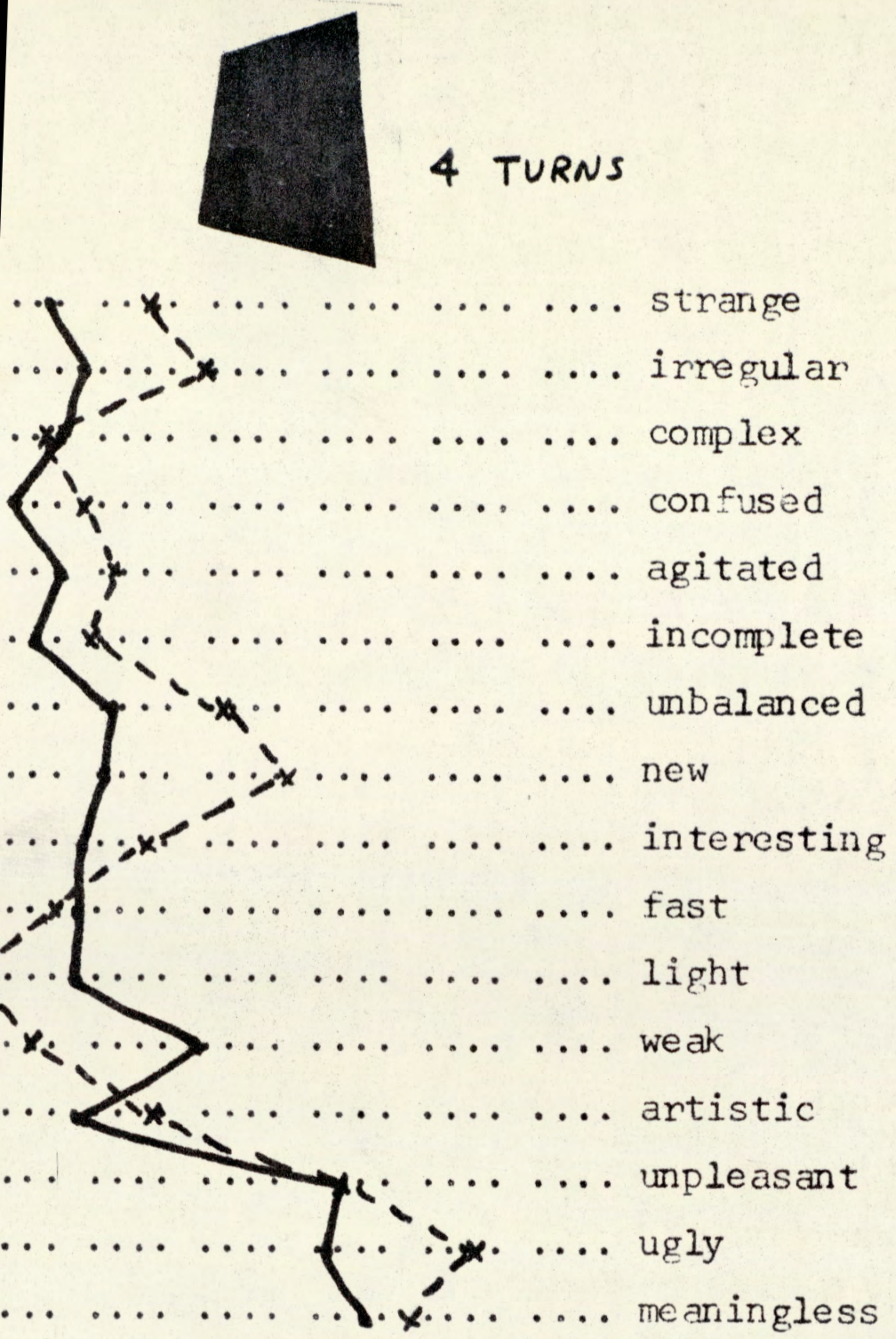
Results of Fisher exact probability tests (two tailed).

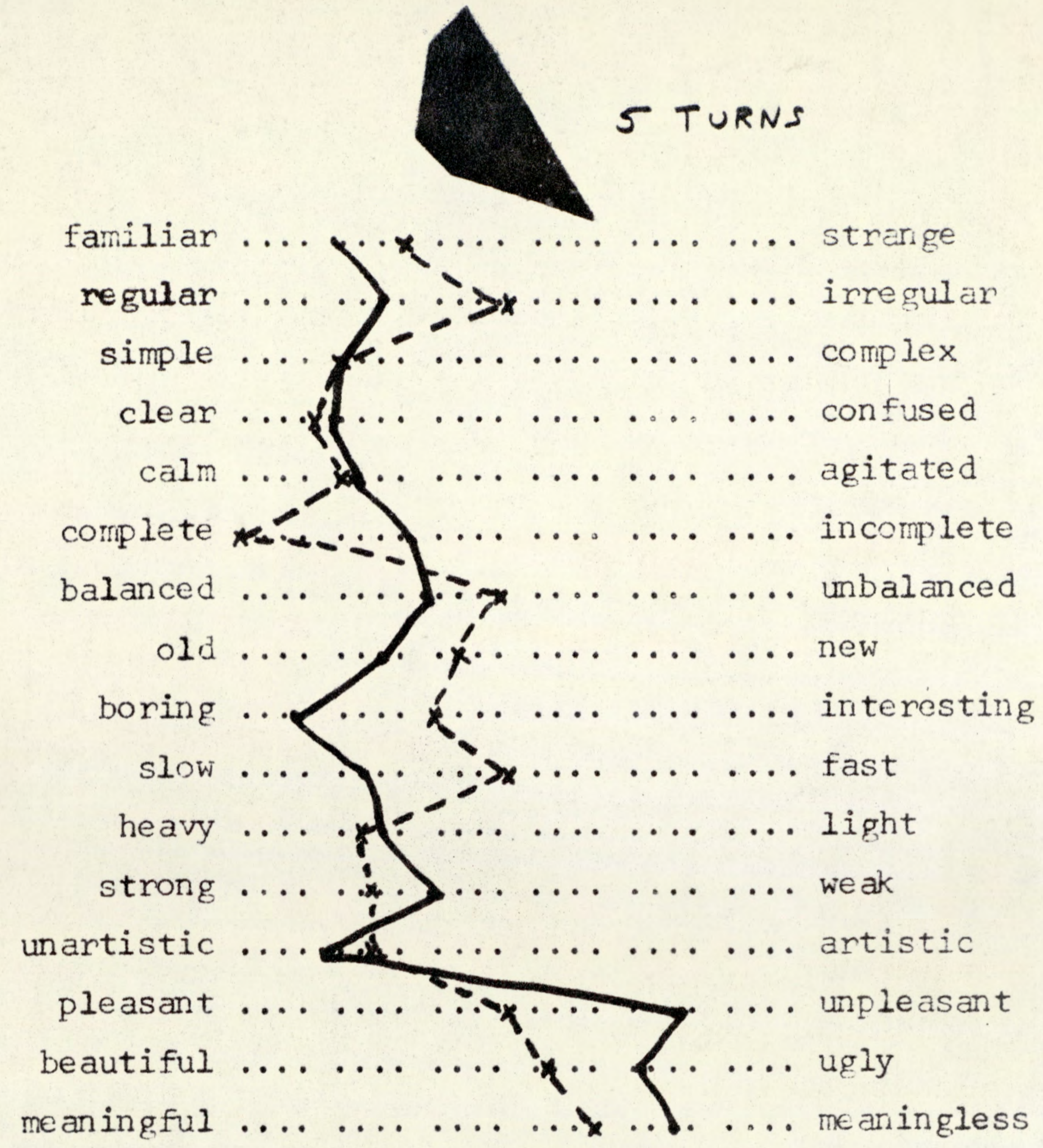
n = 12 in each group.

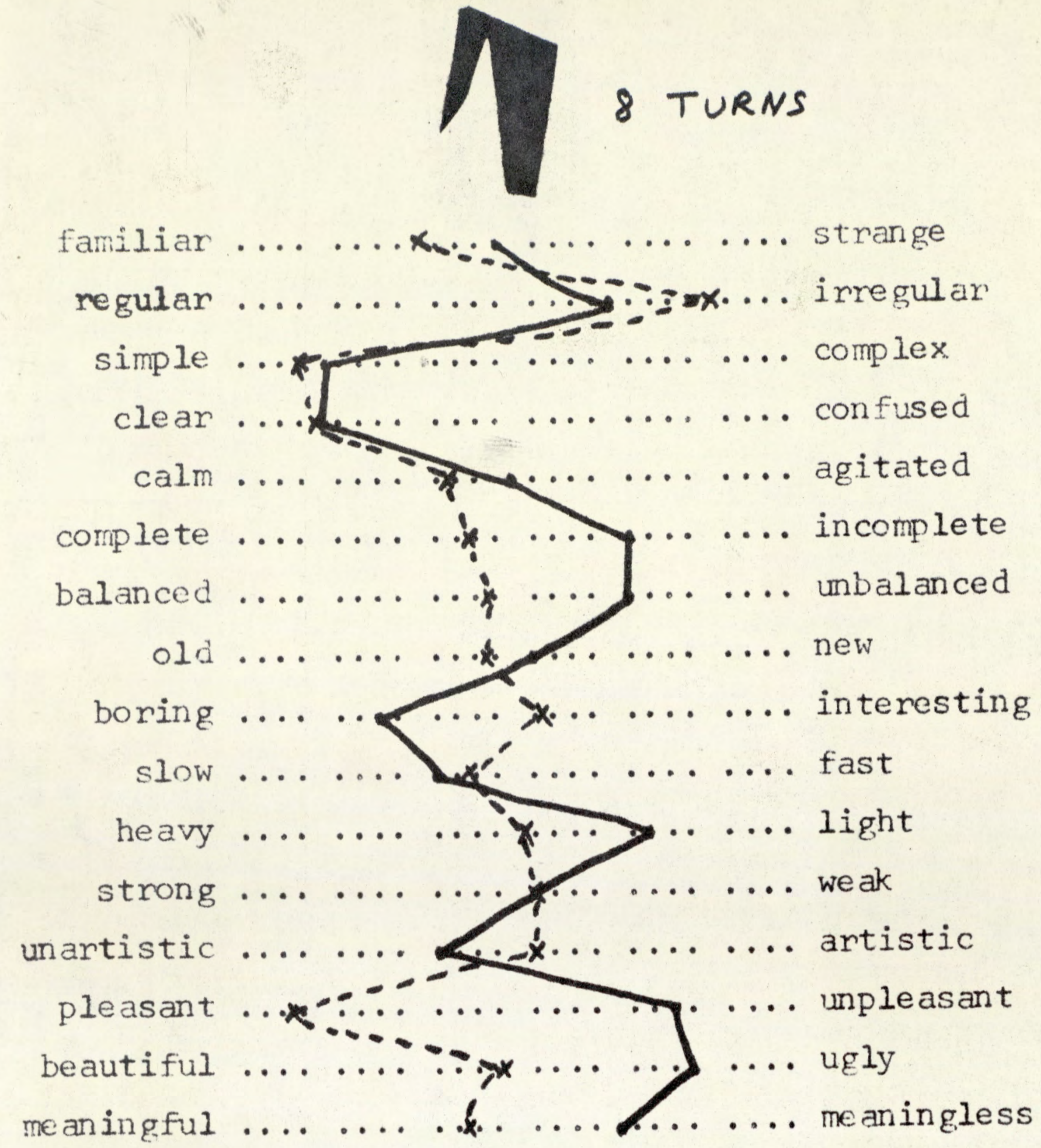
The group preferring more asymmetry is presented first in each pair.

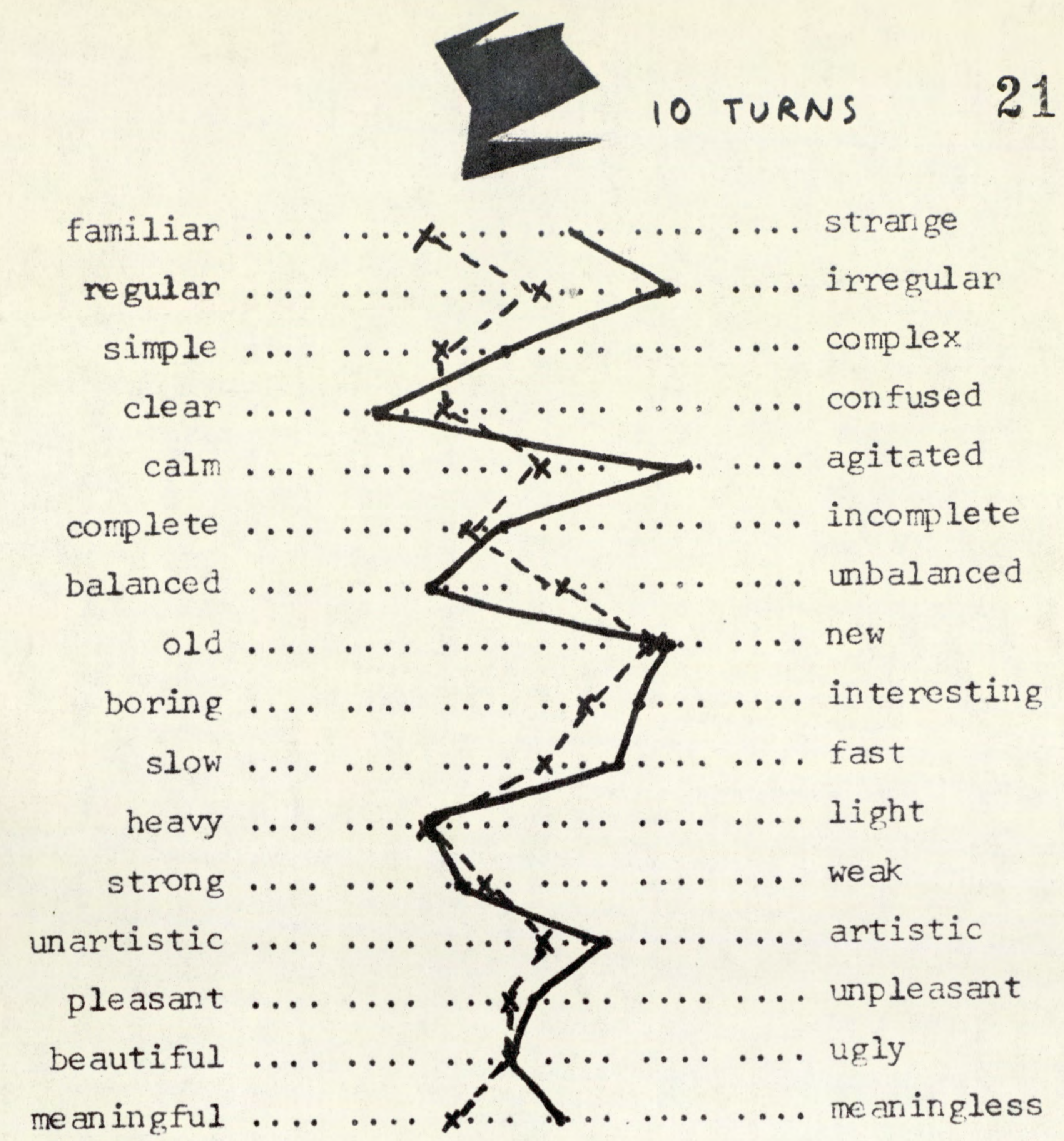
FIGURE VI.3

Comparisons of the semantic differential profiles of 10 polygons when rated by a high creativity - low intelligence group and a low creativity - high intelligence group.


4 TURNS
strange
irregular
complex
confused
agitated
incomplete
unbalanced
new
interesting
fast
light
weak
artistic
unpleasant
ugly
meaningless


5 TURNS
familiar
regular
simple
clear
calm
complete
balanced
old
boring
slow
heavy
strong
unartistic
pleasant
beautiful
meaningful
strange
irregular
complex
confused
agitated
incomplete
unbalanced
new
interesting
fast
light
weak
artistic
unpleasant
ugly
meaningless


8 TURNS
familiar
regular
simple
clear
calm
complete
balanced
old
boring
slow
heavy
strong
unartistic
pleasant
beautiful
meaningful
strange
irregular
complex
confused
agitated
incomplete
unbalanced
new
interesting
fast
light
weak
artistic
unpleasant
ugly
meaningless


10 TURNS
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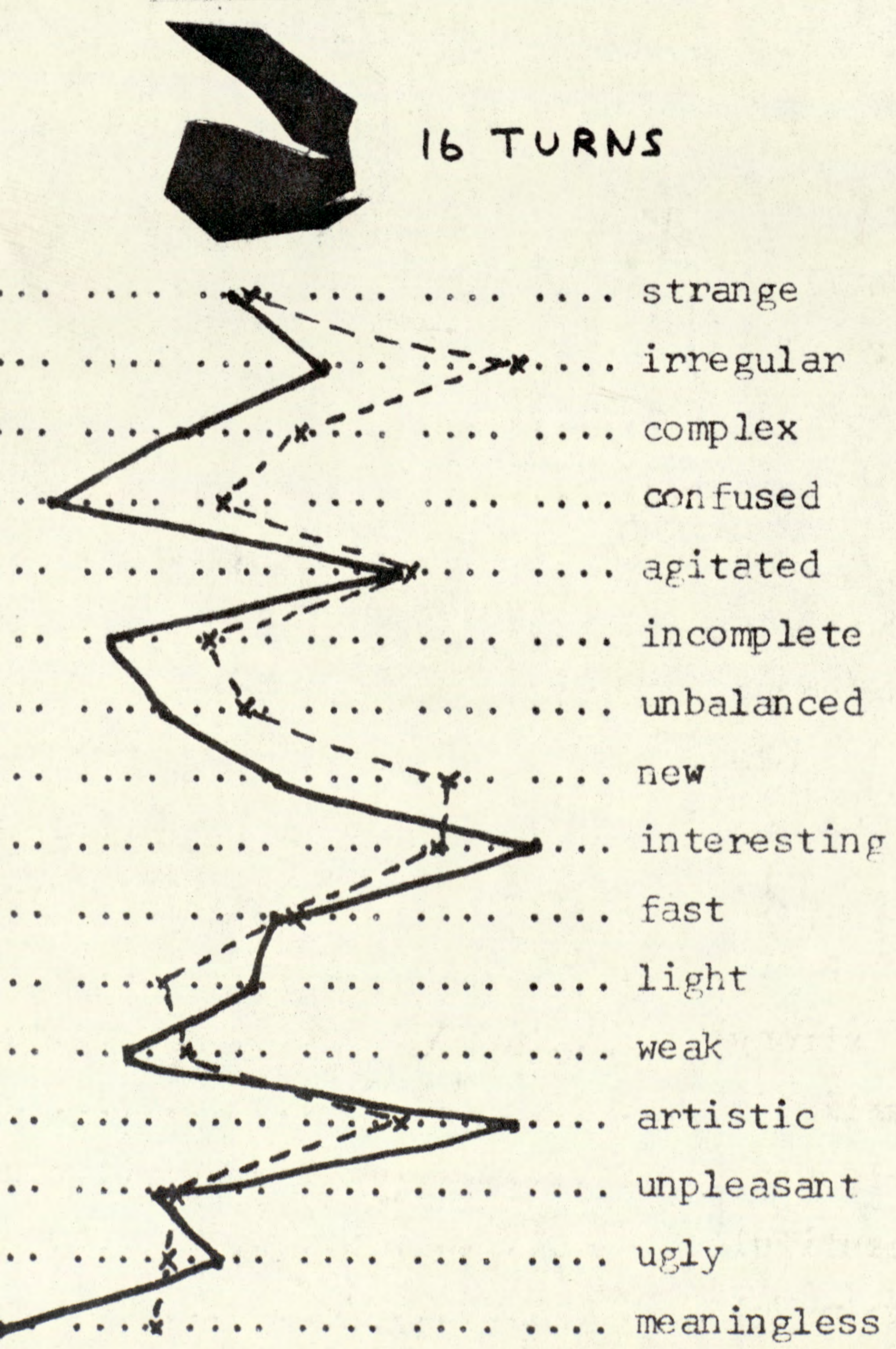
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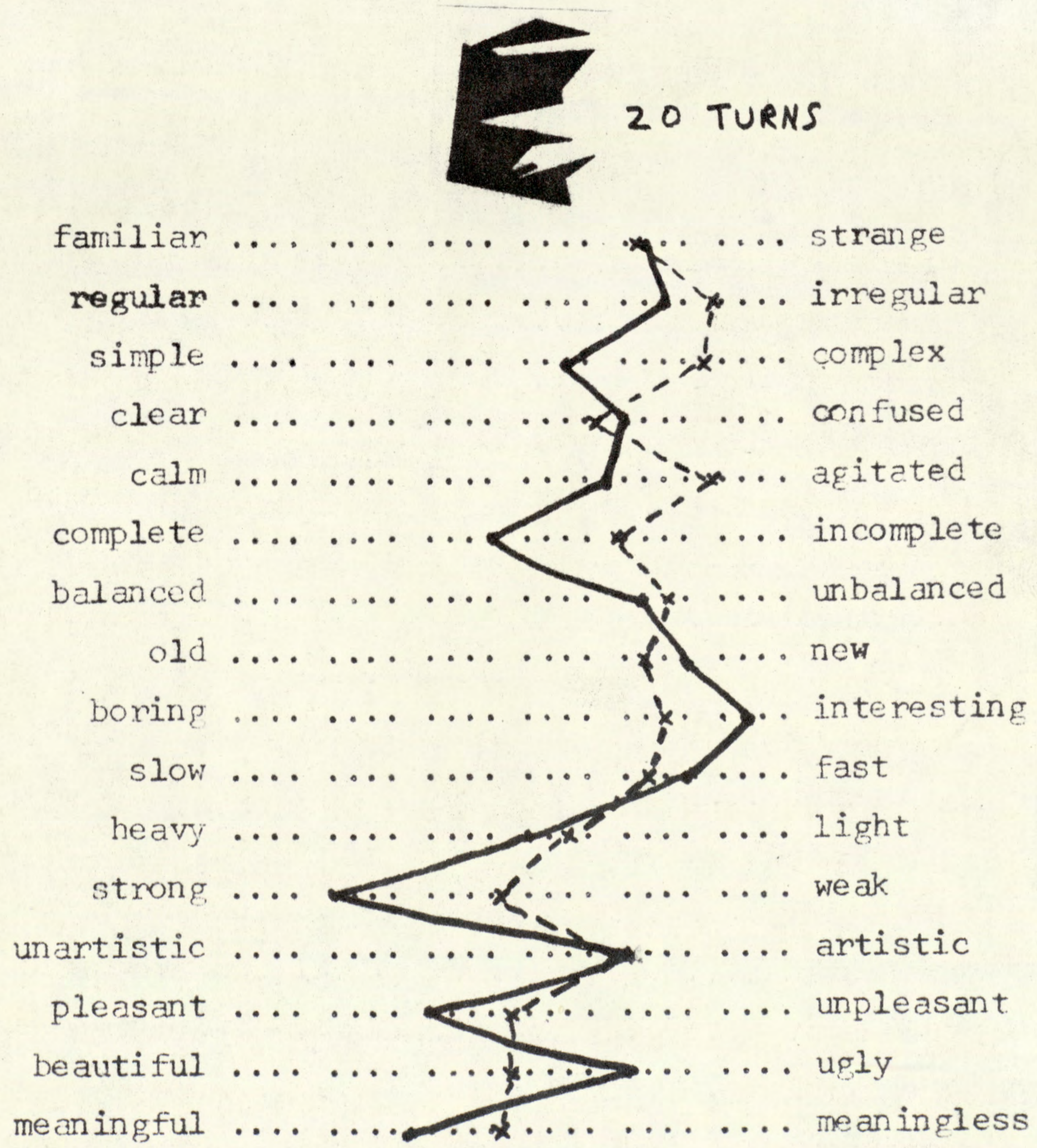
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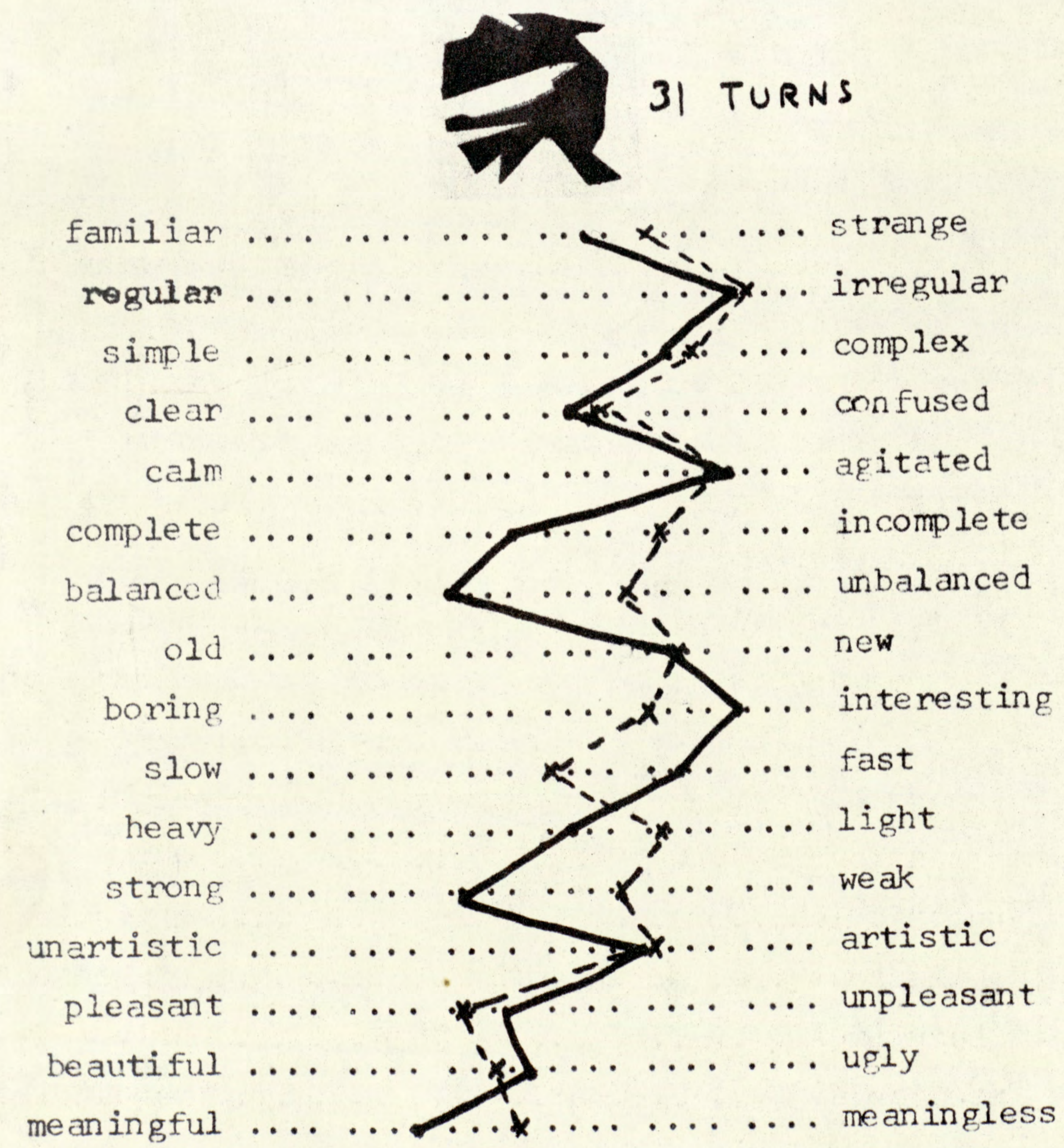
31 TURNS
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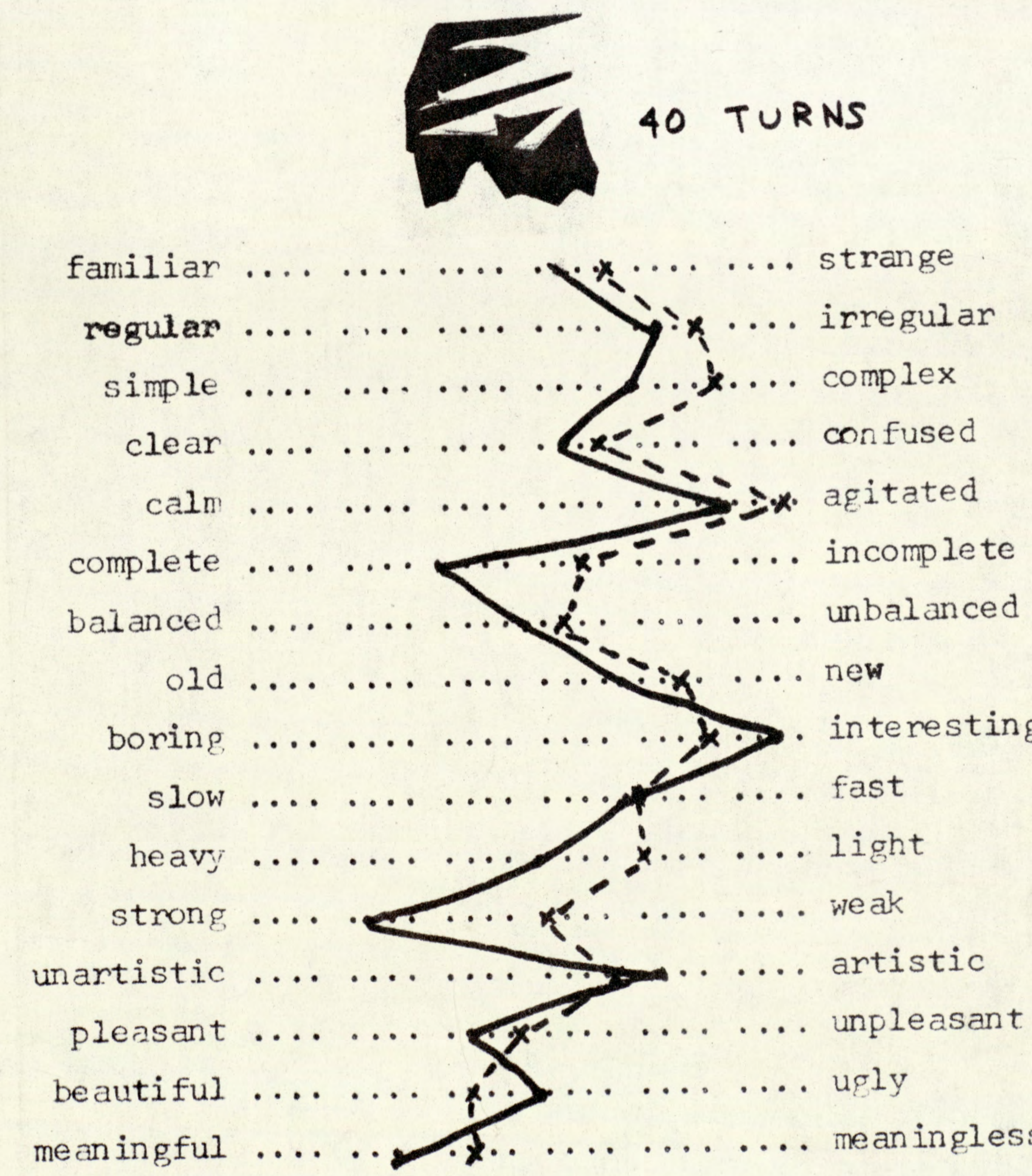
40 TURNS
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unpleasant
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meaningless

VI.3.5 Preference for Complexity-Simplicity and Asymmetry-Symmetry

An examination was made of the relationship between preference for complexity-simplicity and asymmetry-symmetry. The Ss were separated into two groups according to their preference for asymmetry or for symmetry, and into a further two groups according to their preference for complexity or for simplicity. The Contingency coefficient C was then computed. The result is given in Table VI.5

TABLE VI.5

The correlation between preference for complexity-simplicity and asymmetry-symmetry.

df	x^2	C	p
1	11.00	.47	<.01

Preference for complexity-simplicity and asymmetry-symmetry are significantly correlated ($p<.01$).

VI.4 DISCUSSION

The three factors, Unpredictability-Complexity, Aesthetic-Evaluation, and Potency which were obtained from the principal component analysis of the semantic differential ratings of the polygons are very like those obtained by Elliott and Tannenbaum (1963) (cf. VI.1.2) in a similar study using random shapes. The second and third factors correspond to the Evaluation and Potency factors obtained in semantic differential analyses of other concepts (Osgood et al., 1957). On the fourth factor extracted the scale fast-slow has a very high loading, so this might tentatively be related to the Activity dimension which is the other main factor usually found in semantic differential studies.

It appears that the complex polygons are perceived as strange, irregular, complex, confused, agitated, new, interesting, fast and light. Similar results have been obtained on ratings of random polygons for complexity (Day, 1967), novelty (Eisenman, 1968e) and interestingness (Eisenman, 1966a), but Eisenman (1968d) reported that complex polygons were rated as slow. A possible reason for this difference in rating might be that Eisenman compared symmetrical and asymmetrical polygons, and as symmetrical polygons are rated as fast this might have influenced the ratings of the complex asymmetrical polygons.

The ratings of the scales which load on the evaluative dimension do not tend to differ with the complexity or simplicity of the stimuli. In previous studies complex polygons were reported to be rated less favourably than simple polygons (Eisenman, 1968d). The comparatively higher ratings in this investigation may relate to the Ss' overall greater preference for complexity.

The largest differences between the ratings of polygons chosen as most preferred and as least preferred are on the scales of the Aesthetic-Evaluative dimension. This is in accordance with previous results (Eisenman and Rappaport, 1967) and was anticipated from previous introspective reports of Ss. The polygons are all rated as more meaningful when chosen as most preferred; this result lends support to the postulation of Munsinger and Kessen (1964) (cf. II.4) that preference may be related to ability to code the stimuli in terms of meaningfulness.

The method of analysis used in this study, which takes into account bias towards creativity and intelligence, rather than examining creativity on its own, shows creativity to be more significantly related to complexity preference than in Study I. The high creativity - low intelligence group prefers more complexity than the other groups, and tends to show a higher preference for asymmetry. The lack of highly significant differences between the groups in asymmetry-symmetry preference is probably due partly to the way in which this preference was measured.

From the comparison of the high creativity - low intelligence and the low creativity - high intelligence groups on the semantic differential ratings of polygons, it appears that the high creativity - low intelligence group perceives the simple shapes as older and more boring and the complex shapes as more complete, balanced and meaningful. This is probably related to the significantly higher preference for complexity shown by the high creativity - low intelligence group. These results taken together give modest support to the propositions of Barron (1963b) and MacKinnon (1962) that creative individuals are disposed to admit complexity and disorder in their perceptions to gain richness of experience (cf. II.3.9).

The significant correlation between preference for complexity and asymmetry indicates that Ss who prefer complex shapes state that they prefer asymmetrical shapes, and Ss who prefer simple shapes state that they prefer symmetrical shapes. However the correlation coefficient is .43 so this does not provide sufficient reason to equate the complexity-simplicity and asymmetry-symmetry dimensions.

VI.5 SUGGESTIONS FOR FURTHER RESEARCH

In further investigations of semantic differential ratings of shapes it might be feasible to reduce the number of rating scales used and at the same time increase the number of stimuli. It would then be possible to factor analyse the data for the semantic differential scales and for the shapes; and this analysis would probably aid in the understanding of preference judgements. A comparison of polygon ratings by different groups such as males and females, psychologists, engineers and artists might reveal subtle differences in preference and indicate the criteria used for preference. It appears that the semantic differential may be usefully employed to learn more about the stimulus figures and their meaning to the Ss judging them.

A P P E N D I C E S

APPENDIX 1

This appendix contains examples or descriptions of the following materials which were referred to in Chapter III :

Uses for Things,

HFT,

OPI scale descriptions,

Preparation of polygons and verbal sequences,

Response sheets for polygon preference,

Response sheets for verbal preference,

Scoring sheets for polygon preference,

Scoring sheets for verbal preference.

Name ....

Dept ....

USES FOR THINGS

Listed below are 5 objects. Your task is to write down as many different uses as you can for each object. Several examples are given in each case. Be sure to write down some uses for each object. Write down anything that comes to mind, no matter how strange it may seem.

1. BRICKS: Build houses, door stop,
2. PENCILS: Write, bookmark,
3. PAPER CLIPS: Clip paper together, make necklace,
4. TOOTHPICKS: Clean teeth, test cake,
5. SHEET OF PAPER: Write on, make aeroplane,

BRICKS	PENCILS

PAPER CLIPS	TOOTHPICKS	SHEET OF PAPER

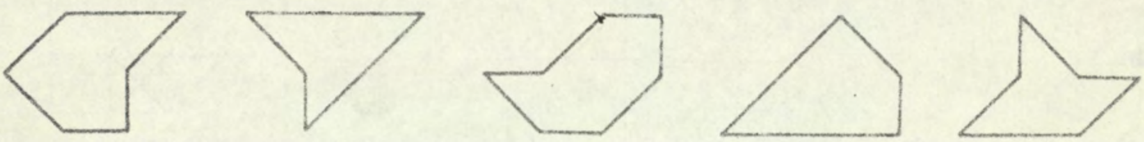
Name: ______________________________

HIDDEN FIGURES TEST — Cf-1

This is a test of your ability to tell which one of five simple figures can be found in a more complex pattern. At the top of each page in this test are five simple figures lettered A, B, C, D, and E. Beneath each row of figures is a page of patterns. Each pattern has a row of letters beneath it. Indicate your answer by putting an X through the letter of the figure which you find in the pattern.

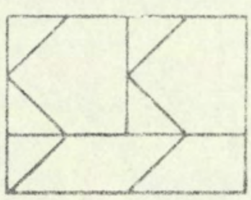
<u>NOTE</u>: There is only one of these figures in each pattern, and this figure will always be right side up and exactly the same size as one of the five lettered figures.

Now try these 2 examples.



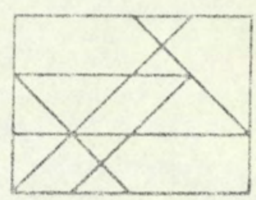
A B C D E

I



A B C D E

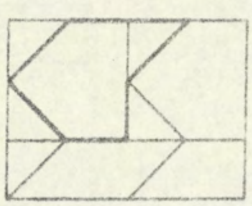
II



A B C D E

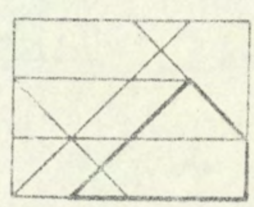
The figures below show how the figures are included in the problems. Figure A is in the first problem and figure D in the second.

I



~~A~~ B C D E

II



A B C ~~D~~ E

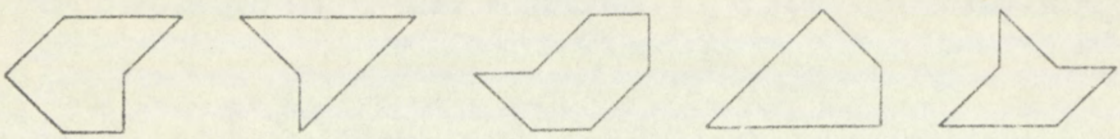
Your score on this test will be the number marked correctly minus a fraction of the number marked incorrectly. Therefore, it will <u>not</u> be to your advantage to guess unless you are able to eliminate one or more of the answer choices as wrong.

You will have <u>10 minutes</u> for each of the two parts of this test. Each part has 2 pages. When you have finished Part 1, STOP. Please do not go on to Part 2 until you are asked to do so.

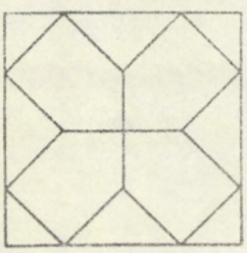
DO NOT TURN THIS PAGE UNTIL ASKED TO DO SO.

Developed under NIMH Contract M-4186

Part 1 (10 minutes)



A B C D E

1. 

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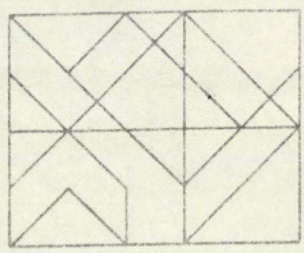
2. 

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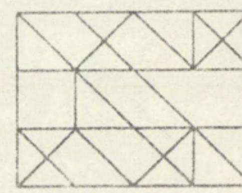
3. 

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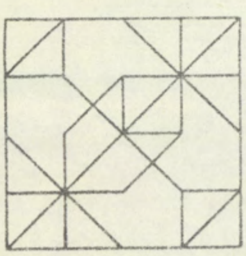
4. 

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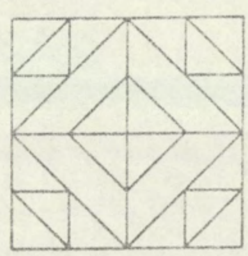
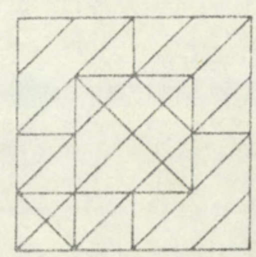
5. 

A B C D E

6. 

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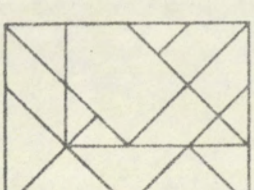
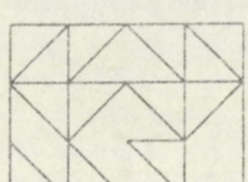
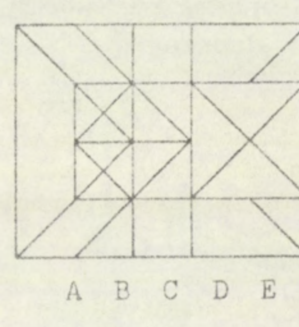
7. 

A B C D E

8. 

A B C D E

9. 

A B C D E

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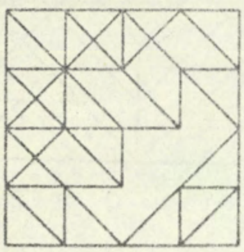
224a

Part 1 (continued)

A B C D E

10. 

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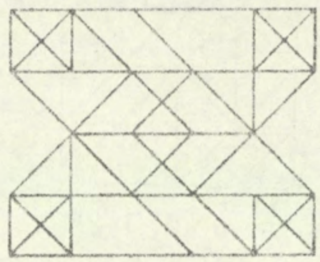
11. 

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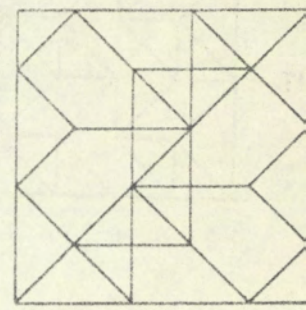
12. 

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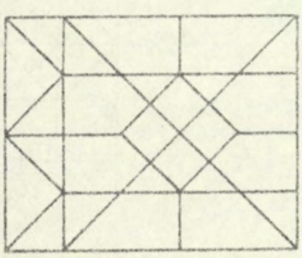
13. 

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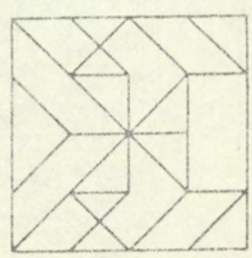
14. 

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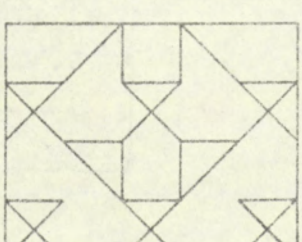
15. 

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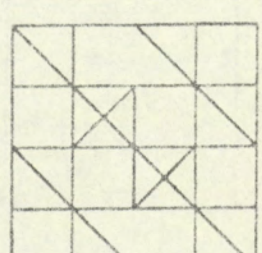
16. 

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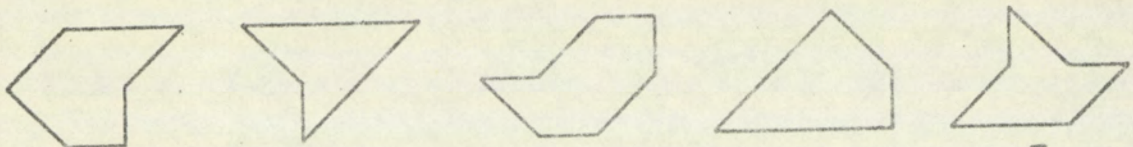

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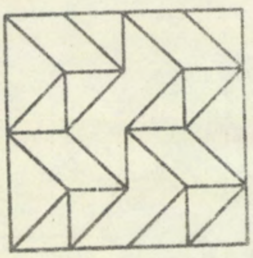

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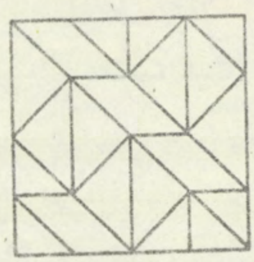

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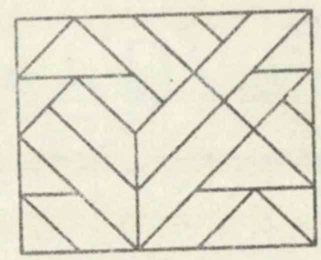

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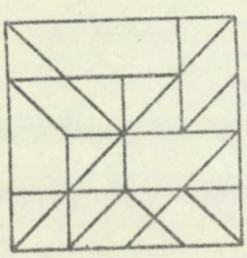

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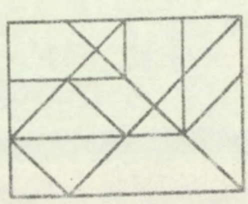

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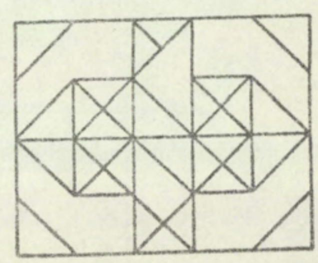

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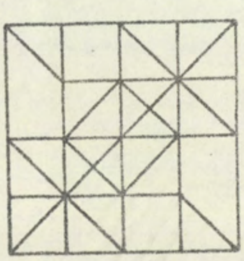

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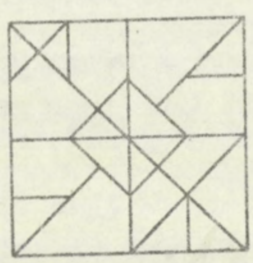

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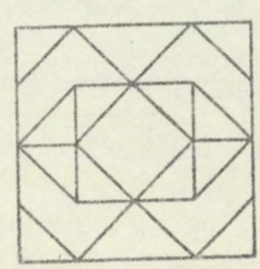

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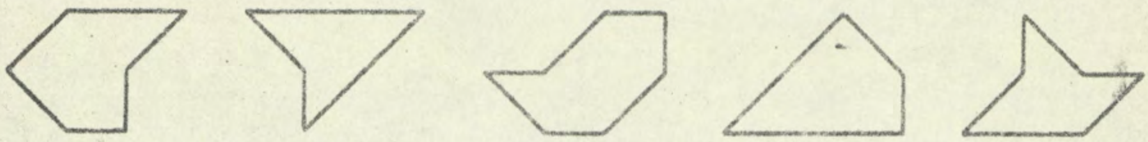

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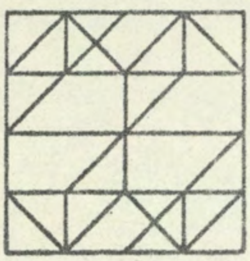

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A B C D E

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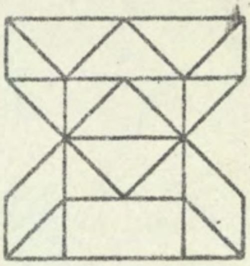

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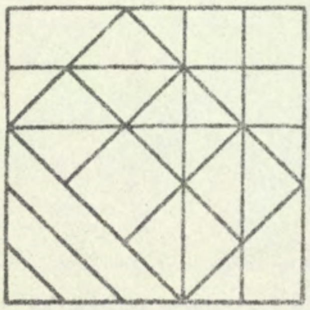

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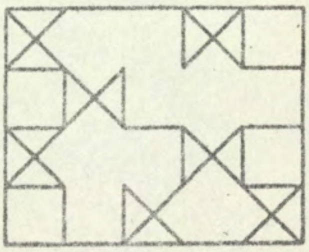

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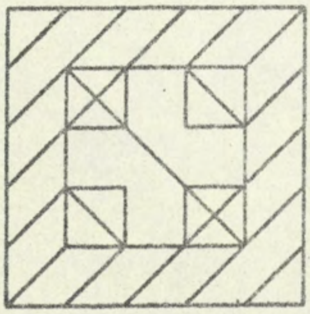

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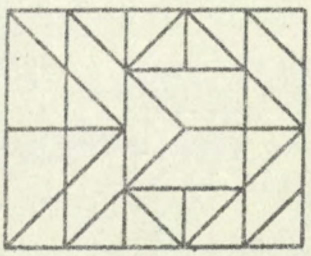

A B C D E

DO NOT GO BACK TO PART 1, AND
DO NOT GO ON TO ANY OTHER TEST UNTIL ASKED TO DO SO.

STOP.

OMNIBUS PERSONALITY INVENTORY (FORM F) ---- BRIEF SCALE DESCRIPTIONS

Thinking Introversion (TI): Persons scoring high on this measure are characterized by a liking for reflective thought and academic activities. They express interests in a broad range of ideas and in a variety of areas, such as literature, art and philosophy. Their thinking is less dominated by objective conditions and generally accepted ideas than that of thinking extroverts (low scorers). Most extroverts show a preference for overt action and tend to evaluate ideas on the basis of their practical, immediate application.

Theoretical Orientation (TO): This scale measures an interest in, or orientation to, a more restricted range of ideas than is true of TI. High scorers are interested in science and in some scientific activities, including a preference for using the scientific method in thinking. They are generally logical, analytical, and critical in their approach to problems.

Estheticism (Es): High scorers endorse statements indicating diverse interests in, as well as an appreciation of, artistic matters and activities. The focus of their interests tends to extend beyond painting, sculpture and music and includes interests in literature and dramatics.

Complexity (Co): This measure reflects an experimental orientation rather than a fixed way of viewing and organizing phenomena. High scorers are tolerant of ambiguities and uncertainties; they are generally fond of novel situations and ideas. Most high scorers very much prefer to deal with diversity and complexity, as opposed to simplicity and structure, and are disposed to seek out and enjoy unusual ambiguous events and experiences.

Autonomy (Au): The characteristic measured is composed of non-authoritarian attitudes and a need for independence. High scorers are sufficiently independent of authority, as traditionally imposed through social institutions, that they oppose infringements on the rights of individuals. They are tolerant of viewpoints other than their own, and they are nonjudgmental, realistic, and intellectually liberal.

Religious Orientation (RO): High scorers are skeptical of conventional religious beliefs and practices and tend to reject most of them, especially those that are orthodox or fundamentalistic in nature. Persons scoring near or above the mean are manifesting a liberal view of religious beliefs, and low scorers tend to be conservative in general and rejecting of other viewpoints. (The direction of scoring on this scale, with strong religious commitment indicated by low scores, was determined in part by the correlation between these items and the first four scales which together measure a general intellectual disposition.)

Social Extroversion (SE): This measure reflects a preferred style of relating to people in a social context. High scorers, displaying a strong interest in being with people seek social activities and gain satisfaction from them. The social introvert (low scorers) tends to withdraw from social contacts and responsibilities.

Impulse Expression (IE): This scale assesses a general readiness to express impulses and to seek gratification either in conscious thought or in overt action. High scorers have an active imagination, value sensual reactions, and their thinking and behavior has pervasive overtones of feelings and fantasies.

Personal Integration (PI): The high scorer admits to few attitudes and behaviors that characterize anxious, disturbed or socially alienated persons. Low scorers on the other hand, may intentionally avoid others and often express hostility and aggressions. They also indicate feelings of loneliness, rejection, and isolation.

Anxiety Level (AL): High scorers deny that they have feelings or symptoms of anxiety and do not admit to being nervous or worried. Low scorers are generally tense and high-strung and often experience some difficulty adjusting in their social environment.

Altruism (Am): The high scorer is an affiliative person and trusting in his relations with others. He exhibits concern for the feelings and welfare of people he meets. Low scorers tend to be much less concerned about the welfare of others and often view people from an impersonal, distant perspective.

Practical Outlook (PO): The high scorer on this measure is interested in practical, applied activities and tends to value material possessions and concrete accomplishments. The criterion most often used to evaluate ideas and things is one of immediate utility. Authoritarianism, conservatism and nonintellectual interests are very frequent personality components of persons scoring above the average.

Masculinity-Femininity (MF): This scale assesses some of the differences in attitudes and interests between college men and women. High scorers (masculine) deny interests in esthetic matters and they admit to few adjustment problems, feelings of anxiety, or personal inadequacies. They also tend to be somewhat less socially inclined than low scorers and more interested in scientific matters. Low scorers (feminine), besides stronger esthetic and social inclinations, also admit to greater sensitivity and emotionality.

Response Bias (RB): This measure represents an approach to assessing the students test-taking attitude. High scorers are responding to this measure in a manner similar to a group of students who were explicitly asked to make a good impression by their responses to these items. Low scorers, on the contrary, may be trying to make a bad impression.

Preparation of polygons and verbal sequences

Polygons

The 90 polygons from Munsinger and Kessen (1964) were enlarged and then pasted in pairs on sheets of white paper 6" x 8"; each sheet contained a number from 1 to 45 in the upper left hand corner. The 45 sheets of paper containing the pairs of stimuli and their corresponding numbers were then photographed with a high contrast film to produce positive 2" x 2" slides of pairs of black polygons on a white background.

Verbal Sequences

The sequences of letters and words were typed with an IBM Executive typewriter in pairs on sheets of white paper 6" x 8"; each sheet contained a number from 1 to 45 in the upper left hand corner. The sheets of paper were then photographed with a high contrast film to produce negative 2" x 2" slides of white letters on a black background.

RESPONSE SHEET

Name ....

Department ....

SHAPE PREFERENCE

I will show you a series of figures two at a time. I want you to indicate which of the two shapes you like better. You circle the L if you prefer the left figure and the R if you prefer the figure on the right.

The slides are numbered in the upper left-hand corner, and there will be a blank slide every 10 pairs to help you keep track of the numbers.

1. L - R	11. L - R	21. L - R	31. L - R	41. L - R
2. L - R	12. L - R	22. L - R	32. L - R	42. L - R
3. L - R	13. L - R	23. L - R	33. L - R	43. L - R
4. L - R	14. L - R	24. L - R	34. L - R	44. L - R
5. L - R	15. L - R	25. L - R	35. L - R	45. L - R
6. L - R	16. L - R	26. L - R	36. L - R	
7. L - R	17. L - R	27. L - R	37. L - R	
8. L - R	18. L - R	28. L - R	38. L - R	
9. L - R	19. L - R	29. L - R	39. L - R	
10. L - R	20. L - R	30. L - R	40. L - R	

RESPONSE SHEET

Name ....

Department ....

VERBAL PREFERENCE

I will show you sequences of letters two at a time. I want you to indicate which of the two sequences of letters you like better. You circle the L if you prefer the sequence of letters on the left and the R if you prefer the sequence on the right.

The slides are numbered in the upper left-hand corner, and there will be a blank slide every 10 pairs, to help you keep track of the numbers.

1. L - R	11. L - R	21. L - R	31. L - R	41. L - R
2. L - R	12. L - R	22. L - R	32. L - R	42. L - R
3. L - R	13. L - R	23. L - R	33. L - R	43. L - R
4. L - R	14. L - R	24. L - R	34. L - R	44. L - R
5. L - R	15. L - R	25. L - R	35. L - R	45. L - R
6. L - R	16. L - R	26. L - R	36. L - R	
7. L - R	17. L - R	27. L - R	37. L - R	
8. L - R	18. L - R	28. L - R	38. L - R	
9. L - R	19. L - R	29. L - R	39. L - R	
10. L - R	20. L - R	30. L - R	40. L - R	

1. 1 -- 2	11. 2 -- 4	21. 2 -- 6	31. 2 -- 8	41. 2 -- 10
2. 10 -- 4	12. 10 -- 6	22. 10 -- 8	32. 10 -- 1	42. 6 -- 7
3. 9 -- 5	13. 9 -- 7	23. 9 -- 1	33. 6 -- 5	43. 5 -- 8
4. 8 -- 6	14. 8 -- 1	24. 5 -- 4	34. 7 -- 4	44. 4 -- 9
5. 7 -- 1	15. 4 -- 3	25. 6 -- 3	35. 8 -- 3	45. 3 -- 10
6. 3 -- 2	16. 5 -- 2	26. 7 -- 2	36. 9 -- 2	
7. 5 -- 10	17. 7 -- 10	27. 9 -- 10	37. 1 -- 6	
8. 6 -- 9	18. 8 -- 9	28. 1 -- 5	38. 5 -- 7	
9. 7 -- 8	19. 1 -- 4	29. 4 -- 6	39. 4 -- 8	
10. 1 -- 3	20. 3 -- 5	30. 3 -- 7	40. 3 -- 9	

/	1	2	3	4	5	6	7	8	9	10
1		1	10	13	28	37	5	14	23	32
2			6	11	16	21	26	31	36	41
3				15	20	25	30	35	40	45
4					24	29	34	39	44	2
5						33	38	43	3	7
6							42	4	8	12
7								9	13	17
8									18	22
9										27
10										
C =										
ρ =										
R =										

1. 1 -- 2	11. 2 -- 4	21. 2 -- 6	31. 2 -- 8	41. 2 -- 10
2. 10 -- 4	12. 10 -- 6	22. 10 -- 8	32. 10 -- 1	42. 6 -- 7
3. 9 -- 5	13. 9 -- 7	23. 9 -- 1	33. 6 -- 5	43. 5 -- 8
4. 8 -- 6	14. 8 -- 1	24. 5 -- 4	34. 7 -- 4	44. 4 -- 9
5. 7 -- 1	15. 4 -- 3	25. 6 -- 3	35. 8 -- 3	45. 3 -- 10
6. 3 -- 2	16. 5 -- 2	26. 7 -- 2	36. 9 -- 2	
7. 5 -- 10	17. 7 -- 10	27. 9 -- 10	37. 1 -- 6	
8. 6 -- 9	18. 8 -- 9	28. 1 -- 5	38. 5 -- 7	
9. 7 -- 8	19. 1 -- 4	29. 4 -- 6	39. 4 -- 8	
10. 1 -- 3	20. 3 -- 5	30. 3 -- 7	40. 3 -- 9	

/	1	2	3	4	5	6	7	8	9	10
1		1	10	13	28	37	5	14	23	32
2			6	11	16	21	26	31	36	41
3				15	20	25	30	35	40	45
4					24	29	34	39	44	2
5						33	38	43	3	7
6							42	4	8	12
7								9	13	17
8									18	22
9										27
10										
C =										
ρ =										
R =										

APPENDIX 2

This appendix contains tables of intercorrelations among parts and part-whole correlations on the following tests used in Study I :

HFT,

Uses for Things, (a) flexibility

(b) fluency

Polygon preference,

Verbal preference.

Intercorrelations of HFT Scores

	1	2	3
1. Part I		48	84
2. Part II			88
3. Total			

Intercorrelations of the items on Uses for Things for a) flexibility and b) fluency.

a) Flexibility

	1	2	3	4	5	6
1. Brick		73	75	61	67	88
2. Pencil			73	73	63	89
3. Paper clip				76	61	89
4. Toothpick					59	85
5. Paper						82
6. Total						

b) Fluency

	1	2	3	4	5	6
1. Brick		66	67	61	57	82
2. Pencil			84	80	56	85
3. Paper clip				76	52	81
4. Toothpick					55	79
5. Paper						76
6. Total						

Decimals have been omitted

N = 75

Intercorrelations of the polygon preference scores

	1	2	3	4	5	6	7	8	9	10	11	12
1. 3 turns		73	56	56	-02	-47	-65	-65	-74	-67	-82	-88
2. 4 turns			70	51	02	-39	-63	-55	-84	-75	-87	-90
3. 5 turns				40	-08	-28	-70	-40	-71	-74	-78	-79
4. 8 turns					17	-33	-42	-42	-66	-62	-70	-68
5. 10 turns						06	00	-13	-13	-26	-15	-12
6. 13 turns							15	37	26	11	28	36
7. 16 turns								33	61	60	70	73
8. 20 turns									40	33	51	58
9. 31 turns										79	91	91
10. 40 turns											93	89
11. Point Total												98
12. Weighted Total												

Decimals have been omitted.

N = 75

Intercorrelations of the verbal preference scores

	1	2	3	4	5	6	7	8	9	10	11
1. Redundant letters		38	31	-35	-36	-18	-23	-17	-22	-01	-26
2. Redundant words			14	02	-19	-09	-41	-31	-58	-28	-66
3. Prose				36	17	05	-11	-45	-25	-42	-55
4. Fourth-order phrases					54	50	-07	-40	-55	-59	-54
5. Second-order phrases						43	07	-32	-35	-50	-30
6. First-order phrases							03	-42	-29	-54	-31
7. Random words								05	18	-11	25
8. Third-order words									46	52	69
9. Second-order words										51	81
10. Random letters											78
11. Weighted Total											

Decimals have been omitted

N = 75

APPENDIX 3

This appendix contains a semantic differential rating sheet and tables of results from Study II. It presents the intercorrelations of the semantic differential adjectives, and the scale scores of the 10 polygons on the semantic differential. The scale scores are given separately for the following groups of Ss:

All Ss (N = 48),

Ss choosing the polygons most preferred,

Ss choosing the polygons least preferred,

The high creativity - low intelligence group,

The low creativity - high intelligence group.

complete :_____:_____:_____:_____:_____:_____:_____: incomplete

agitated :_____:_____:_____:_____:_____:_____:_____: calm

new :_____:_____:_____:_____:_____:_____:_____: old

regular :_____:_____:_____:_____:_____:_____:_____: irregular

unpleasant :_____:_____:_____:_____:_____:_____:_____: pleasant

strong :_____:_____:_____:_____:_____:_____:_____: weak

interesting :_____:_____:_____:_____:_____:_____:_____: boring

unartistic :_____:_____:_____:_____:_____:_____:_____: artistic

meaningful :_____:_____:_____:_____:_____:_____:_____: meaningless

light :_____:_____:_____:_____:_____:_____:_____: heavy

confused :_____:_____:_____:_____:_____:_____:_____: clear

slow :_____:_____:_____:_____:_____:_____:_____: fast

familiar :_____:_____:_____:_____:_____:_____:_____: strange

beautiful :_____:_____:_____:_____:_____:_____:_____: ugly

complex :_____:_____:_____:_____:_____:_____:_____: simple

balanced :_____:_____:_____:_____:_____:_____:_____: unbalanced

Intercorrelations of the adjectives on the semantic differential.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. complete-incomplete		-56	-29	65	38	38	-08	06	28	14	69	-09	-62	28	-55	59
2. agitated-calm			46	-67	-19	-14	39	19	00	-27	-57	33	59	-12	64	-47
3. new-old				-37	17	03	55	40	19	-35	-38	34	44	25	51	-17
4. regular-irregular					15	22	-30	-09	14	22	62	-21	-67	15	-62	61
5. pleasant-unpleasant						17	47	53	44	-24	34	19	-19	71	-05	32
6. strong-weak							17	13	22	24	24	04	-19	11	-09	38
7. interesting-boring								73	56	-34	-22	44	30	50	45	02
8. artistic-unartistic									54	-32	02	36	14	57	28	19
9. meaningful-meaningless										-17	23	25	-07	50	01	29
10. heavy-light											13	51	-23	-34	-25	06
11. clear-confused												-17	-69	28	-67	55
12. fast-slow													25	33	31	-03
13. strange-familiar														-18	67	-52
14. beautiful-ugly															02	37
15. complex-simple																-37
16. balanced-unbalanced																

Decimal points have been omitted

Semantic differential scale scores of 10 polygons

Adjectives	Number of turns on polygon									
	3	4	5	8	10	13	16	20	31	40
familiar - strange	1.6	2.1	2.5	3.3	3.7	4.6	3.6	5.4	4.8	5.2
regular - irregular	2.1	2.4	3.2	4.8	4.2	4.9	4.7	5.8	6.1	6.1
simple - complex	1.6	2.0	2.4	2.3	2.8	3.6	3.3	5.6	5.7	6.1
clear - confused	1.3	1.7	2.1	2.6	2.5	3.6	3.0	5.3	4.4	5.0
calm - agitated	2.3	1.9	2.4	3.9	4.8	4.3	4.3	5.9	5.8	6.1
complete - incomplete	1.5	1.8	2.4	4.4	3.5	3.9	3.4	5.1	5.0	4.8
balanced - unbalanced	4.8	2.5	3.4	4.5	3.1	3.9	3.3	5.1	4.4	4.8
old - new	3.6	2.8	3.2	4.5	5.4	4.6	4.5	5.5	5.4	5.7
boring - interesting	3.8	2.7	3.4	3.8	5.2	5.2	5.9	5.7	5.7	6.0
slow - fast	5.2	2.1	2.9	3.5	4.4	3.5	3.3	5.0	4.6	5.3
heavy - light	5.1	1.6	2.2	4.6	3.7	2.8	3.4	4.1	4.7	4.9
strong - weak	3.4	2.0	2.6	4.0	2.8	2.6	3.5	3.2	3.5	3.3
unartistic - artistic	3.0	2.7	3.0	3.3	4.7	4.3	5.6	4.6	5.1	4.9
pleasant - unpleasant	3.1	4.1	4.5	4.2	3.2	3.6	2.8	4.7	3.7	3.8
beautiful - ugly	3.4	4.9	4.5	4.5	3.7	4.2	3.2	4.7	4.0	3.9
meaningful - meaningless	3.4	4.4	4.3	4.2	3.3	4.2	2.8	3.9	3.5	3.8

Semantic differential scale scores of 10 polygons
when chosen as most preferred

Adjectives	Number of turns on polygon									
	3	4	5	8	10	13	16	20	31	40
familiar - strange	1.5	2.1	2.6	3.0	3.6	4.2	3.7	5.4	4.4	4.8
regular - irregular	2.1	2.6	3.3	4.4	3.7	4.2	4.4	5.5	5.7	5.6
simple - complex	2.0	1.8	2.8	2.3	2.8	3.4	2.9	5.3	5.6	6.2
clear - confused	1.1	1.4	2.0	2.8	2.1	2.7	2.7	4.1	3.5	3.7
calm - agitated	2.0	1.6	2.7	3.3	4.6	4.1	4.1	5.5	5.7	5.9
complete - incomplete	1.2	1.6	2.1	2.7	2.8	2.6	3.0	4.1	4.0	3.1
balanced - unbalanced	1.6	1.9	3.4	3.8	2.6	3.2	3.2	5.1	3.3	4.1
old - new	4.3	3.9	3.8	5.1	5.6	4.3	4.1	5.9	5.4	6.1
boring - interesting	5.3	4.6	4.8	5.3	6.1	5.5	6.1	6.3	6.4	6.8
slow - fast	5.8	2.5	3.6	3.7	4.9	3.4	3.1	5.5	5.4	5.3
heavy - light	5.4	1.4	2.2	4.3	4.1	2.9	3.5	4.6	4.7	5.4
strong - weak	2.1	1.2	2.1	2.8	2.0	2.2	3.7	2.7	3.0	2.8
unartistic - artistic	5.7	4.5	4.3	4.6	5.4	4.8	5.8	6.0	5.7	6.2
pleasant - unpleasant	1.5	2.2	2.8	2.8	2.3	2.6	2.5	2.7	2.7	2.2
beautiful - ugly	2.1	3.5	3.4	3.3	3.1	3.8	3.1	3.9	3.2	2.8
meaningful - meaningless	2.0	2.8	3.1	2.9	2.6	3.2	2.4	2.9	2.5	2.2

Semantic differential scale scores of 10 polygons
when chosen as least preferred

Adjectives	Number of turns on polygon									
	3	4	5	8	10	13	16	20	31	40
familiar - strange	1.8	2.1	2.4	3.6	4.2	4.9	3.3	5.4	5.4	5.6
regular - irregular	2.1	2.4	3.2	5.1	5.6	5.6	5.7	6.2	6.5	6.5
simple - complex	1.3	2.0	2.1	2.2	2.8	3.8	4.2	5.6	5.9	6.0
clear - confused	1.4	1.8	2.1	2.4	3.8	4.4	3.7	6.0	5.5	6.0
calm - agitated	2.6	2.0	2.2	4.6	5.4	4.6	5.0	6.5	6.1	6.2
complete - incomplete	1.8	1.9	2.6	6.1	5.4	5.1	4.5	6.4	6.1	6.1
balanced - unbalanced	3.3	2.8	3.3	5.1	4.6	4.6	3.5	5.2	5.7	5.5
old - new	2.9	2.3	2.8	3.9	4.8	4.9	5.7	5.1	5.5	5.5
boring - interesting	2.4	1.9	2.3	2.3	2.8	4.9	5.5	4.9	4.9	5.4
slow - fast	4.7	1.9	2.3	3.3	2.8	3.6	3.7	4.4	3.8	5.3
heavy - light	4.9	1.7	2.2	4.9	2.4	2.7	3.2	3.5	4.7	4.5
strong - weak	4.4	2.4	3.0	5.2	5.2	3.0	3.0	3.8	4.1	3.7
unartistic - artistic	2.6	1.9	2.1	2.0	2.8	3.9	5.0	3.0	4.6	3.8
pleasant - unpleasant	4.5	5.0	5.8	5.6	5.6	4.6	3.8	5.8	4.7	5.2
beautiful - ugly	4.4	5.5	5.3	5.6	5.4	4.6	3.7	5.6	4.9	4.8
meaningful - meaningless	4.8	5.1	5.1	5.4	5.2	5.2	3.8	5.1	4.8	5.1

Semantic differential scale scores of 10 polygons rated by the high creativity - low intelligence group

Adjectives	Number of turns on polygon									
	3	4	5	8	10	13	16	20	31	40
familiar - strange	1.6	1.7	2.1	3.8	4.5	5.6	3.5	5.4	4.6	4.4
regular - irregular	1.9	2.0	2.6	5.0	5.5	4.6	4.3	5.6	6.1	5.4
simple - complex	2.0	1.8	2.2	2.0	3.8	4.0	3.0	4.8	5.4	5.1
clear - confused	1.6	1.4	2.1	2.0	2.5	3.4	1.9	5.2	4.4	4.4
calm - agitated	2.3	1.8	2.3	4.0	5.7	5.0	5.0	5.0	6.0	6.0
complete - incomplete	1.7	1.6	2.9	5.2	3.8	3.6	2.4	3.8	3.8	3.1
balanced - unbalanced	2.8	2.3	3.0	5.2	3.0	6.0	2.9	5.4	3.2	4.0
old - new	2.9	2.2	2.6	4.2	5.5	4.2	3.9	5.8	5.4	5.0
boring - interesting	2.9	2.0	1.7	2.6	5.2	4.6	6.2	6.4	6.1	6.6
slow - fast	4.6	2.0	2.4	3.2	5.0	2.4	3.9	5.8	5.5	5.0
heavy - light	4.3	2.0	2.6	5.4	3.0	2.2	3.7	4.2	4.4	4.1
strong - weak	3.8	3.1	3.1	4.2	3.3	2.8	2.6	2.2	3.3	2.3
unartistic - artistic	2.9	2.0	2.0	3.2	4.8	3.8	6.0	5.2	5.1	5.4
pleasant - unpleasant	4.6	4.4	5.7	5.6	4.0	5.0	2.9	3.2	3.7	3.4
beautiful - ugly	4.3	4.3	5.3	5.8	3.8	5.0	3.4	5.2	4.0	4.1
meaningful - meaningless	4.4	4.6	5.6	5.0	4.3	4.2	1.5	2.0	2.8	2.6

Semantic differential scale scores of 10 polygons
rated by the low creativity - high intelligence group

Adjectives	Number of turns on polygon									
	3	4	5	8	10	13	16	20	31	40
familiar - strange	1.8	2.6	2.8	3.0	3.0	4.6	3.6	5.3	5.2	4.9
regular - irregular	2.0	3.1	3.9	6.0	4.2	5.6	6.0	6.1	6.2	5.8
simple - complex	2.4	1.7	2.2	1.8	3.2	4.0	4.1	6.0	5.7	6.0
clear - confused	1.0	2.0	1.9	2.0	3.2	3.8	3.4	4.9	4.7	4.8
calm - agitated	2.6	2.3	2.2	3.3	4.2	5.2	5.0	6.1	5.8	6.7
complete - incomplete	1.4	2.1	1.1	3.5	3.4	4.8	3.3	5.1	5.3	4.6
balanced - unbalanced	2.6	3.3	3.8	3.7	4.4	4.6	3.6	5.6	5.0	4.4
old - new	5.4	3.9	3.4	3.7	5.4	5.2	5.4	5.4	5.5	5.6
boring - interesting	4.8	2.6	3.1	4.3	4.6	5.6	5.3	5.6	5.2	5.9
slow - fast	6.0	1.8	3.9	3.5	4.2	3.6	4.0	5.4	4.2	5.1
heavy - light	5.0	1.0	2.4	4.1	3.0	2.8	2.9	4.6	5.3	5.2
strong - weak	3.4	1.6	2.5	4.2	3.6	3.6	3.1	3.9	4.9	4.2
unartistic - artistic	5.2	2.7	2.5	4.2	4.2	4.4	5.0	5.0	5.2	4.9
pleasant - unpleasant	2.8	4.4	3.9	1.7	3.8	3.8	3.0	4.0	3.3	3.9
beautiful - ugly	2.2	5.6	4.3	3.9	3.8	4.2	3.0	4.0	3.6	3.4
meaningful - meaningless	3.2	5.0	4.8	3.5	3.2	4.2	2.9	3.9	3.9	3.4

BIBLIOGRAPHY

ADEVAI, G., SILVERMAN, A.J., & McGOUGH, W.E. (1968) MMPI findings in field-dependent and field-independent subjects. Percept. mot. Skills, 26, 3-8.

BARRON, F. (1952) Personality Style and Perceptual Choice. J. Pers., 20, 385-401.

BARRON, F. (1953a) Some personality correlates of independence of judgement. J. Pers., 21, 287-297.

BARRON, F. (1953b) Complexity - simplicity as a personality dimension. J. abnorm. soc. Psychol., 68, 163-172.

BARRON, F. (1955) The disposition toward originality. J. abnorm. soc. Psychol., 51, 478-485.

BARRON, F. (1957) Originality in Relation to Personality and Intellect. J. Pers., 25, 730-742.

BARRON, F. (1963a) Creativity and Psychological Health. Princeton, N.J. : Van Nostrand.

BARRON, F. (1963b) The needs for order and disorder as motives in creative activity. In C.W. Taylor & F.Barron (Eds.), Scientific Creativity. New York : Wiley.

BARRON, F. (1965) Creativity. In New Directions in Psychology No. 2. New York : Holt, Rinehart & Winston.

BARRON, F., & WELSH, G.S. (1952) Artistic perception as a possible factor in personality style : its measurement by a figure preference test. J. Psychol., 33, 199-203.

BERLYNE, D.E. (1963) Complexity and incongruity variables as determinants of exploratory choice and evaluative ratings. Canad. J. Psychol., 17, 274-290.

BERLYNE, D.E. (1969) Measure of aesthetic preference. In J. Hogg (Ed.), Psychology and the visual arts. London : Penguin.

BERLYNE, D.E., & PECKHAM, S. (1966) The semantic differential and the other mea sures of reaction to visual complexity. Canad. J. Psychol., 20, 125-135.

BIERI, J. (1960) Parental identification, acceptance of authority and with-sex differences in cognitive behaviour. J. abnorm. soc. Psychol., 60, 76-79.

BIERI, J. (1961) Complexity - simplicity as a personality variable in cognitive and preferential behaviour. In D.W. Fiske & S.R. Maddi (Eds.) Functions of Varied Experience. Homewood, Ill. : Dorsey Press.

BIERI, J., BRADBURN, W.M., & GALINSKY, M.D. (1958) Sex differences in perceptual behaviour. J. Pers., 26, 1-12.

BIERI, J. & MESSERLY, S. (1957) Differences in Perceptual and Cognitive Behaviour as a function of Experience Type. J. consult. Psychol., 21, (3), 217-221.

BLOOMBERG, M. (1967) A n inquiry into the relationship between field independence-dependence and creativity. J. Psychol., 67, 127-140.

BOZZI, P., & FLORES D'ARCAIS, G.B.(1967) Experimental study on intermodal relationships among expressive qualities. Archivo di Psicologia, Neurologia & Psichia tria. 28, (5), 377-420. (A bstract)

BUTCHER, H.J. (1968) Human Intelligence : Its Nature and Assessment. London : Methuen.

CASHDAN, S., & WELSH, G.S. (1966) Personality correlates of creative potential in talented high school students. J. Pers., 34, 445-455.

CATTELL, R.B. (1963) The Personality and Motivation of the Researcher from Measurements of Contemporaries and from Biography, in C.W.Taylor & F.Barron (Eds.), Scientific Creativity. New York : Wiley.

CATTELL, R.B. (1969) Is field independence an expression of the general personality source trait of independence, U.I.19?. Percept. mot. Skills, 28, 865-866.

CATTELL, R.B., & HUNDLEBY, J.H. (1968) Conceptual and experimental requirements in relating independence (U.I.19) and field independence in L- and Q- data media: a comment on Dr. Ohnmacht's research. Percept. mot. Skills, 27, 733-734.

CHILD, I.L. (1962) Personal preferences as an expression of aesthetic sensitivity. J. Pers., 30, 496-512.

CHILD, I.L. (1964) Observations on the meaning of some measures of aesthetic sensitivity. J.Psychol., 57, 49-64.

CHILD, I.L. (1965) Personality correlates of aesthetic judgement in college students. J. Pers., 33, 476-511.

CHRISTENSEN, P.R., GUILFORD, J.P., & WILSON, R.C. (1957) Relations of Creative Responses to working time and instructions. J. exp. Psychol, 53, (2), 82-88.

CROSS, P., CATTELL, R.B., & BUTCHER, H.J. (1967) The personality pattern of creative artists. Brit. J. Psychol, 37, 292-299.

DANA, R.H. & GOOCHER, B. (1959) Embedded-Figures and Personality. Percept. mot. Skills, 9, 99-102.

DATTA, L. (1964) Remote Associates Test as a predictor of Creativity in Engineers. J. appl. Psychol., 48, (3), 183.

DAVIS, R.C. (1936) An evaluation and test of Birkhoff's aesthetic measure and formula. J. gen. Psychol., 15, 231-240.

DAY, H. (1966) Looking time as a function of stimulus variables and individual differences. Percept. mot. Skills, 22, 423-428.

DAY, H. (1967) Evaluations of subjective complexity, pleasingness and interestingness for a series of random polygons varying in complexity. Percept. & Psychophysics, 2, 147-148.

DAY, H. (1968) The importance of symmetry and complexity in the evaluation of complexity, interest and pleasingness. Psychon. Sci., 10, (10), 339-340.

DEMBER, W.N., & EARL, R.W. (1957) Analysis of exploratory, manipulatory and curiosity behaviours. Psychol. Rev., 64, 91-96.

DORFMAN, D.D., & McKENNA, H. (1966) Pattern preferences as a function of pattern uncertainty. Canad. J. Psychol. /Rev. Canad. Psychol., 20,(2), 143-153.

DREVDAHL, J.E. (1956) Factors of Importance for Creativity. J. clin. Psychol., 12, 21-26.

EASTERBY, R.S. (1970) The perception of S ymbols for Machine Displays. Ergonomics, 13, (1), 149-158.

EDWARDS, A.L. (1958) Statistical Analysis (Revised ed.). New York : Holt, Rinehart & Winston.

EISENMAN, R. (1965a) Birth order, aesthetic preference, and volunteering for an electric shock experiment. Psychon. Sci ., 3, 151-152.

EISENMAN, R. (1956b) Aesthetic preference of schizophrenics. Percept. mot. Skills, 20, 601-604.

EISENMAN, R. (1966a) Pleasing and interesting visual complexity: support for Berlyne. Percept. mot. Skills, 23, 1167-1170.

EISENMAN, R. (1966b) The association value of random shapes revisited. Psychon. Sci., 6, 397-398.

EISENMAN, R. (1967a) Complexity - Simplicity: I. Preference for symmetry and rejection of complexity. Psychon. Sci., 8, (4), 169-170.

EISENMAN, R. (1967b) Birth order and sex differences in aesthetic preference for complexity - simplicity. J. Gen. Psychol., 77, 121-126.

EISENMAN, R. (1967c) Complexity - Simplicity: II. Birth order and sex Differences. Psychon. Sci., 8, (4), 171-172.

EISENMAN, R. (1968a) Personality and demography in complexity - simplicity. J. consult. clin. Psychol., 32, (2), 140-143.

EISENMAN, R. (1968b) Birth order, Insolence, Socialization, Intelligence, and Complexity -Simplicity Preferences. J. Gen. Psychol., 78, 61-64.

EISENMAN, R. (1968c) Complexity - simplicity preferences, involvement and attitude change. J. Creat. Behav., 2 (2), 128-132.

EISENMAN, R. (1968d) Semantic differential ratings of polygons varying in complexity - simplicity and symmetry - asymmetry. Percept. mot. Skill, 26, 1243-1248.

EISENMAN, R. (1968e) Novelty ratings of simple and complex shapes. J. Gen. Psychol., 78, 61-64.

EISENMAN, R. (1969) Creativity, Awareness, and Liking. J. consult. clin. Psychol., 33, (2), 157-160.

EISENMAN, R., & COFFEE, S. (1964) Aesthetic preferences of art students and mathematics students. J. Psych., 58, 375-378.

EISENMAN, R. & GELLENS, H.K. (1968) Preference for complexity - simplicity and symmetry - asymmetry. Percept. mot. Skills, 26, 888-890.

EISENMAN, R., HANNON, J.H., & BERNARD, J.L. (1966) Perceived creativity, set, and preference for simple or complex shapes. Percept. mot. Skills, 22, 111-114.

EISENMAN, R., & RAPPAPORT, J. (1967) Complexity preference and semantic differential ratings of complexity-simplicity and symmetry-asymmetry. Psychon. Sci., 7, (4), 147-148.

EISENMAN, R. & ROBINSON, N. (1967) Complexity-simplicity, creativity, intelligence, and other correlates. J. Psychol., 67, 331-334.

ELLIOTT, L.L. & TANNENBAUM, P.H. (1963) Factor-structure of semantic differential responses to visual forms and prediction of factor-scores from structural characteristics of the stimulus-shapes. Amer. J. Psychol., 76, 589-597.

ELLIOTT, R. (1961) Interrelationships among measures of field dependence, ability, and personality traits. J. abnorm. soc. Psychol., 63, 27-36.

EVANS, F.J. (1967) Field dependence and the Maudsley Personality Inventory. Percept. mot. Skills, 24, 526.

EYSENCK, H.J. (1940) The general factor in aesthetic judgments. Brit. J. Psychol., 31, 94-102.

EYSENCK, H.J. (1941a) "Type"- factors in aesthetic judgments. Brit. J. Psychol., 31, 262-270.

EYSENCK, H.J. (1941b) The empirical determination of an aesthetic formula. Psychol. Rev., 48, 83-92.

EYSENCK, H.J. (1941c) Personality factors and preference judgments. Nature, 148, 346.

EYSENCK, H.J. (1942) The experimental study of the "Good Gestalt" - A new approach. Psychol.Rev., 49, 344-364.

EYSENCK, H.J. (1968) An experimental study of aesthetic preference for polygonal figures. J. gen. Psychol., 79, 3-17.

EYSENCK, H.J. & CASTLE, M. (1970) Training in art as a factor in the determination of preference judgements for polygons. Brit. J. Psychol., 61, (1), 65-81.

FIEBERT, M. (1967) Sex differences in cognitive style. Percept. mot. Skills, 24, 1277-1278.

FISKE, D.W. & MADDI, S.R. (1961) A Conceptual Framework. In D.W. Fiske & S.R. Maddi (Eds.), Functions of Varied Experience. Homewood, Ill. : Dorsey Press.

FREEMAN, J., BUTCHER, H.J. & CHRISTIE, T. (Nov. 1968) Creativity - a selective review of research. Society for Research into Higher Education Monographs.

FRENCH, J.W., EKSTROM, R.B., & PRICE, L.A.(1963) (Revised ed.) Kit of reference tests for cognitive factors. Princeton N.J. : E.T.S.

GETZELS, J.W., & JACKSON, P.W. (1960) Occupational Choice and Cognitive Functioning : Career aspirations of highly intelligent and of highly creative adolescents. J. abnorm. soc. Psychol., 61, 119-123.

GETZELS, J.W., & JACKSON, P.W. (1961) Family environment and cognitive style : a study of the sources of highly intelligent and of highly creative adolescents. Amer. Sociol. Rev., 26, (3), 351-359.

GETZELS, J.W., & JACKSON, P.W. (1962) Creativity and Intelligence : Explorations with gifted children. New York : Wiley.

GOLANN, S.E. (1962) The Creativity Motive. J. Psychol., 30, 588-600.

GOLANN, S.E. (1963) Psychological Study of Creativity. Psychol. Bull., 60, (6), 548-565.

GOODENOUGH, D.R., & KARP, S.A. (1961) Field dependence and intellectual functioning. J. abnorm. soc. Psychol., 63, (2), 241-246.

GORDON, O., BRAYER, R., & TIKOFSKY, R. (1961) Personality variables and the perception of embedded figures. Percept. mot. Skills, 12, 195-202.

GRUEN, A. (1955) The relation of dancing experience and personality to perception. Psychol. Monogr., 69, (Whole No. 399)

GRUEN, A. (1957) A critique and re-evaluation of Witkin's perception and perception-personality work. J. gen. Psychol., 56, 73-93.

GUILFORD, J.P. (1950) Creativity. Amer. Psychologist, 5, 444-454.

GUILFORD, J.P. (1956) The structure of intellect. Psychol. Bull., 53, 267-293.

GUILFORD, J.P. (1957) Creative abilities in the arts. Psychol. Rev., 64, 110-118.

GUILFORD, J.P. (1959) Three faces of intellect. Amer. Psychologist, 14, 469-479.

GUILFORD, J.P. (1966) Intelligence : 1965 Model. Amer. Psychologist, 21, 20-26.

GUILFORD, J.P. (1967) The Nature of Human Intelligence. New York : McGraw - Hill.

HARONIAN, F., & SUGARMAN, A.A. (1967) Fixed and mobile field independence: Review of studies relevant to Werner's dimension. Psychol. Reps., 21, 41-57.

HARSH, C.M., BEEBE - CENTER, J.G., & BEEBE - CENTER, R. (1939) Further evidence regarding preferential judgement of polygonal forms. J. Psychol., 7, 343-350.

HASAN, P., & BUTCHER, H.J. (1966) Creativity and Intelligence : a partial replication with Scottish children of Getzels and Jackson's study. Brit. J. Psychol., 57, 129-135.

HECKHAUSEN, H. (1964) Complexity in perception : phenomenal criteria and information theoretic calculus - a note on D.E. Berlyne's "Complexity effects". Canad. J. Psychol. / Rev. Canad. Psychol., 18, (2), 168-173.

HEIM, A.W. (1956) Manual for the Group Test of High Grade Intelligence A.H.5. London : National Foundation for Educational Research.

HONIGFELD, G., & SPIGEL, I.M. (1960) Achievement motivation and field in - dependence. J. consult. Psychol., 24, 550-551.

HOUSTON, J.P., & MEDNICK, S.A. (1963) Creativity and the need for novelty. J. abnorm. soc. Psychol., 66, 137-141.

HUDSON, L. (1966) Contrary Imaginations. London : Methuen.

JACKSON, D.N. (1956) A short form of Witkin's Embedded-Figures Test. J. abnorm. soc. Psychol., 53, 254-255.

JACKSON, D.N. (1957) Intellectual ability and mode of perception. J. consult. Psychol., 21, 458.

JACKSON, D.N., MESSICK, S., & MYERS, C.T. (1964) Evaluation of group and individual forms of embedded-figures measures of field-independence. Educ. Psychol. Measmt., 24, (2), 177-192.

JOHNSON, D.T., NEVILLE, C.W., & WORKMAN, S.N. (1969) Field independence and the Sixteen Personality Factor Questionaire. Percept. mot. Skills, 28, 670.

KARP, S.A. (1963) Field dependence and overcoming embeddedness. J. consult. Psychol., 27, (4), 294-302.

KOFFKA, K. (1922) Perception : An Introduction to Gestalt - Theorie. In M.D. Vernon, (Ed.) (1966) Experiments in visual perception. London : Penguin.

LEAGUE, B.J., & JACKSON, D.N. (1961) Activity and passivity as correlates of field independence. Percept. mot. Skills, 12, 291-298.

LINDLEY, D.V., & MILLER, J.C.P. (1962) Cambridge Elementary Statistical Tables. Cambridge : University Press.

LINTON, H.B. (1955) Dependence on external influence : Correlates in perception, attitudes and judgement. J. abnorm. soc. Psychol., 51, 502-507.

LITTLEJOHN, M.T. (1967) Creativity and masculinity-femininity in ninth graders. Percept. mot. Skills, 25, 737-743.

MacKINNON, D.W. (1962) The nature and nurture of creative talent. Amer. Psychologist, 17, 484-495.

McWHINNIE, H.J. (1966) Effects of a learning experience on preference for complexity and asymmetry. Percept. mot. Skills, 23, 119-122.

McWHINNIE, H.J. (1967) Some relationships between creativity and perception in sixth-grade children. Percept. mot. Skills,25,979-980.

MACKLER, B., & SCHONTZ, F.C. (1965) Creativity : Theoretical and Methodological Considerations. Psychol. Record, 15, 217- 238.

MADDI, S.R. (1961) Variation Seeking in Man. In D.W. Fiske and S.R Maddi (Eds.), Functions of Varied Experience. Homewood Ill. : Dorsey Press.

MARLOWE, D. (1958) Some psychological correlates of field independence. J. consult. Psychol., 22, 334.

MEDNICK, S.A. (1962) The associative basis of the creative process. Psychol. Rev., 69, 220-232.

MESSICK, S., & FRITZY, F.J. (1963) Dimensions of analytic attitude in cognition and personality. J. Pers., 31, 346-370.

MILLER, G.A. , & SELFRIDGE, J.A. (1950) Verbal context and the recall of meaningful material. Amer. J. Psychol., 63, 176-185.

MOYLES, E.W., TUDDENHAM, R.D., & BLOCK, J. (1965) Simplicity / complexity or symmetry / asymmetry? A re-analysis of the Barron-Welsh Art scales. Percept. mot. Skills, 20, 685-690.

MUNSINGER, H. (1966) Multivariate Analysis of Preference for Variability. J. exp. Psychol., 71, (6), 889-895.

MUNSINGER, H., & KESSEN, W. (1964) Uncertainty, Structure, and Preference. Psychol. Monogr., 78, (9), (Whole No. 586).

MUNSINGER, H., & KESSEN, W. (1965) Stimulus-Variability and two meanings of meaningfulness. Amer. J. Psychol., 68, 683-685.

MUNSINGER, H., & KESSEN, W. (1966a) Preference and Recall of stimulus Variability. J. exp. Psychol., 72, (2), 311-312.

MUNSINGER, H., & KESSEN, W. (1966b) Stimulus Variability and Cognitive Change. Psychol. Rev., 73, (2), 164-178.

MUNSINGER, H., KESSEN, W., & KESSEN, M.L. (1964) Age and Uncertainty. Developmental Variation in Preference for Variability. J. exp. Psychol., 25, 375-382.

NASH, J. (1970) Developmental Psychology : A psychobiological approach. Englewood Cliffs, N.J. : Prentice-Hall.

OHNMACHT, F.W. (1968) Note on the validity of the Sixteen Personality Factor Questionaire measure of field independence. Percept. mot. Skills, 27, 564.

OSGOOD, C.E., SUCI, G.J., & TANNENBAUM, P.H. (1957) The measurement of meaning. Urbana : Univ. of Illinois Press.

PARLOFF, M.B., & DATTA, L. (1968) Personality characteristics which differentiate male adolescents and adults. J. Pers., 36, 528-552.

PEMBERTON, C.L. (1952a) The closure factors related to other cognitive processes. Psychometrika, 17, 267-288.

PEMBERTON, C.L. (1952b) The closure factors related to temperament. J. Pers., 21, 159-175.

POSTMAN, L. (1955) Witkin, H.A., Lewis, H.B., Hertzman, M., Machover, K., Meissner, P.B., & Wapner, S. Personality through perception. Book review. Psychol. Bull., 52, 79-83.

PYRON, B. (1966) Rejection of avant-garde art and the need for simple order. J. Psychol., 63, 159-178.

ROSEN, J.C. (1955) The Barron-Welsh Art Scale as a predictor of originality and level of ability among artists. J. appl. Psychol., 39, (5), 366-367.

ROSS, R.T. (1934) Optimum orders for the presentation of pairs in the method of paired comparisons. J. educ. Psychol., 25, 375-382.

RUMP, B.E. (1968) Relative preference as a function of the number of elements in absract designs. Aust. J. Psychol., 20, (1), 39-48.

SCHAEFER, C.E. (1968) The Barron-Welsh art scale as a predictor of adolescent creativity. Percept. mot. Skills, 27, 1099-1102.

SCHECHTER, N., SCHMEIDLER, G.R., & STAAL, M. (1965) Dream reports and Creative Tendencies in Students of the Arts, Sciences, and Engineering. J. consult. Psychol., 29, (5), 415-421.

SCHMEIDLER, G.R. (1965) Visual Imagery correlated to a measure of Creativity. J. consult. Psychol., 29, (1), 78-80.

SIEGEL, S. (1956) Non-parametric Statistics. New York : McGraw-Hill.

SNYDER, B. (1967) Creative students in science and engineering. Universities Quarterly, 21, (2), 205-218.

SPOTTS, J.V., & MACKLER, B. (1967) Relationships of field-dependent and field-independent cognitive styles to creative test performance. Percept. mot. Skills, 24, 239-268.

TAYLOR, R.E., & EISENMAN, R. (1964) Perception and production of complexity by creative art students. J. Psychol., 57, 239-242.

TORRANCE, E.P. (1965) Scientific Views of Creativity and Factors Affecting its Growth. Daedalus, 663-681.

VANDERPLAS, J.M., & GARVIN, E.A. (1959) The association value of random shapes. J. exp. Psychol., 57, 147-154.

VITZ, C.P. (1964) Preference for rates of information presented by sequences of tones. J. exp. Psychol., 68, (7), 176-183.

VITZ, C.P. (1966a) Affect as a function of stimulus variation. J. exp. Psychol., 71, (1), 74-79.

VITZ, C.P. (1966b) Preference for Different Amounts of Visual Complexity. Behav. Sci., 11, 105-114.

WALLACH, M.A., & KOGAN, N. (1965) Modes of Thinking in Young Children. New York : Rinehart & Winston.

WERTHEIM, J., & MEDNICK, S.A. (1958) The achievement motive and field independence. J. consult. Psychol., 22, 38.

WITKIN, H.A. (1950) Individual differences in ease of perception of embedded figures. J. Pers., 19, 1-15.

WITKIN, H.A. (1965) Psychological differentiation and forms of pathology. J. abnorm. Psychol., 70, 317-336.

WITKIN, H.A., DYK, R.B., FATERSON, H.F., GOODENOUGH, D.R., & KARP, S.A. (1962) Psychological Differentiation. New York : Wiley.

WITKIN, H.A., LEWIS, H.B., HERTZMAN, M., MACHOVER, K., MEISSNER, P.B., & WAPNER, S. (1954) Personality through perception. New York : Harper.

YOUNG, H.H. (1959) A test of Witkin's field dependence hypothesis. J. abnorm. soc. Psychol., 59, 188-192.