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THE MEASUREMENT OF MEANING IN PERSONALITY RESEARCH

by

Robert Johnston Craig Harper

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PREFACE

The first study reported in this investigation was presented as a paper at the 1961 Annual Meeting of the American Psychological Association in New York. An abstract of the paper appeared in the American Psychologist of July, 1961, under the title, "Mediated Generalization in Attitude Change". The reason for the difference between this title and that given in the body of this work is that it is shorter.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PART I

CHAPTER I

INTRODUCTION

It is a simple truism that the validity and significance of psychological questions are largely determined by the theoretical bias of the observer. Occasionally, however, there arise issues that survive misperception and misunderstanding to challenge the logical structure and comprehensiveness of all conceptual frames of reference. Floyd Allport surely had these thoughts in mind when he characterized the subject of this dissertation in these eloquent terms:

> Meaning, a concept born under the malediction of introspectionists, bandied about by philosophers, overformalized by configurationists, disguised by behaviorists who could not afford to disown it, has long been a neglected stepchild in psychology. Or perhaps it is like Cinderella, a ragged waif compelled by those who are ignorant of its identity to carry the burden of their theories without recognition until such time as it can be touched by an understanding that will reveal its true nature and illuminate the systems it has been compelled to serve.
>
> (1, p.575)

Although Allport's comments are directed principally to general psychologists, they have considerable relevance for theorists working in the field of personality. Those psychologists who favour the idiographic approach have tended to lean heavily on the construct of meaning without attempting to define precisely what they mean by this term. In a sense, this lack of specification is understandable since it is their very insistence on the complexity of such constructs as meaning that has led these psychologists to reject or doubt the value of highly formalized systems in this field. Advocates of the nomothetic

position have taken the opposite view, preferring to avoid the use of variables that do not lend themselves to dimensional analysis within the rubric of a quantitative frame of reference. However, as Allport implies, one cannot dismiss meaning by theoretical sanction and then re-introduce it in a disguised form. It is a well-known fact that the responses given to items on personality questionnaires are partially determined by their particular wording. Eysenck (18, p. 291) provides a number of good examples of this in "objective" tests of prejudice. He does not, however, get to the root of the problem which is quite simply that until we have a satisfactory account of the nature of meaning we will be left guessing as to the precise relationship between a stimulus and the response it evokes, no matter whether the stimulus is as unstructured as an ink-blot, or as "structured" as a written question.

If it were possible to define meaning in such a way that it could be quantified with minimum loss of information on its idiosyncratic aspects, the idiographically inclined might be saved the embarrassment of being accused of pure subjectivism, while the quantitatively oriented theorist might be a little more willing to recognize the essential uniqueness of the individual.

The most promising means of effecting this compromise would appear to involve some kind of multivariate analysis. As Cattell has observed:

> The clinician is generally a multivariate experimenter, who abstracts laws and concepts from obeerving ("globally" or by "gestalts" as he might say) simultaneous changes in a large number of uncontrolled variables... but without the benefit of precise instrumental measurements or explicit correlational procedures.
>
> (7, p.261)

Assuming that the clinician would agree with Cattell's contention, we would nevertheless expect him to demand that the parameters of meaning

bear a fairly clear affinity with his own subjective impressions. Furthermore, he would certainly require that the number of parameters and the units of measurement be such as to permit maximum discriminations among meanings within and between individuals.

No personality theorist has so far addressed himself to this problem. Quite recently, however, Charles Osgood, a neo-Behaviourists, proposed (52, 53) a general model of behaviour in which meaning is treated as the most important aspect of learning. Osgood's approach should be of considerable interest to personality theorists since he is primarily concerned with meaning in language - or to be more precise - with the circumstances that determine how a word, which is initially of a purely arbitrary nature, becomes a sign of something else. This problem is faced by every theorist who employs language as a mediator for the reflection and identification of other psychological variables. As such, it is a problem that is written into every method from the case-history to factor-analysis.

In collaboration with George Suci and Percy Tannenbaum, Osgood (54) has also published an account of the Semantic Differential, an instrument that purports to measure the connotative meaning of words. This instrument consists of a variable number of bi-polar adjectival scales that are assumed to be representative of the major dimensions along which meaningful judgments can vary. These psychologists maintain, among other things, that the Semantic Differential permits not only quantitative comparisons between groups, but by virtue of its flexibility, offers a maximum degree of freedom for recording highly personal meanings. Unlike the great majority of quantitative approaches to personality assessment, it is not a standardized test.

Two rationales are offered for the Semantic Differential. The

first rationale comprises a purely operational definition of meaning that is expressed in terms of the numerical values assigned to the sequence of verbal quantifiers that index direction and intensity of ratings on the adjectival scales. The second rationale assumes an isomorphic relationship between the characteristics of meaning as defined within Osgood's neo-Behaviouristic model and the direction and intensity of ratings on the Semantic Differential.

This dissertation represents an attempt to test the validity of the second of the two rationales, and to determine the possible value of the Semantic Differential as a research tool in comparative studies of different clinical groups. To permit a comprehensible statement of the hypotheses, it will be necessary to outline the historical background against which Osgood's approach to meaning and its measurement are set. Since there is already a voluminous leterature on the subject of meaning, the preliminary discussion will be limited to a consideration of two questions. The first concerns what psychologists have had to say about the circumstances that determine the acquisition of word-meaning. The second question concerns previous attempts to index word-meaning. This discussion will be followed by a presentation of Osgood's theory and a description of the Semantic Differential. This will conclude Part I of the dissertation. Part II will comprise reports of the three studies that form the core of the work. In Part III an attempt will be made to draw the various findings together within the context of a general concluding discussion.

CHAPTER II

EARLY THEORIES OF WORD-MEANING

We may begin with the self-evident fact that words are quite different from the objects or situations that are signified by them. The word "fire", for example, in no way resembles the physical characteristics of flames and smoke. However, if someone were to shout "Fire!" in a crowded theatre, it would be relatively easy to predict the general reaction. It would be surprising if instead of attempting to escape, the patrons started to fumble for change and look expectantly for the ice-cream vendors. It seems reasonable to conclude therefore, that there are associations between words and their objects and that these associations are learned. The question of meaning concerns the nature of these associations and the circumstances that determine their establishment.

An examination of the history of psychology reveals a marked reluctance on the part of the early scientific theorists to accept meaning as a real problem. These men were preoccupied with describing mental activities as they actually exist, and since meaning seemed to point away from experience or behaviour to remote and vague ideas or acts, the analysis of this concept seemed a rather fruitless enterprise. Nevertheless, since the psychologists of the day were still being strongly influenced by their philosophical predecessors (particularly the British Associationists), accounts of meaning were more or less de rigueur.

Titchener and Meaning

Titchener (79, p.26ff) distinctly excludes meaning from the subject

matter of psychology on the grounds that, as a science, psychology should deal only with facts and not with their values, meanings and uses. Meaning, he argues, is of a highly personal and subjective character since one experience may have many meanings; several experiences may have a common meaning; meaning may be stripped from any mental process by introspection; and finally, an entirely meaningless process may acquire meaning.

From this point of view, only one question could be asked about meaning, namely, what attributes of mental processes have the effect of endowing them with meaning? Titchener answers as follows:

> Meaning is always context; one mental process is the meaning of another mental process if it is that other's context. And context in this sense, is simply the mental process which accrues to the given process through the situation in which the organism finds itself.
>
> (78 p.367)

Mental processes, then, have no intrinsic meaning. They may acquire extrinsic meaning through their association with other mental processes. Titchener invokes the classical laws of association (similarity, contrast, frequency and contiquity) to explain how contextual meaning is established.

This theory, as it stands, has nothing in common with the behavioristic tradition that developed in opposition to all forms of mentalism. When, however, we examine Titchener's views on the origin of meaning, we find a position that is remarkably similar to neo-Behaviouristic thinking. For Titchener, meaning is initially a form of kinaesthetic sensation:

> ... the organism faces the situation by some bodily attitude, and the characteristic sensations which the attitude involves give meaning to the process that stands at the conscious focus, are psychologically the meaning of that process.
>
> (77, p.176)

In dealing with meaning in language, Titchener asserts (59,p.177) that words are at first motor attitudes, gestures and kinaesthetic contexts, together with the auditory stimulus characteristics that are peculiar to speech. This total context is later expanded by the acquisition of reading skills so that eventually the meaning of a word may involve verbal images and their visual-kinaesthetic and auditory-kinaesthetic concomitants. He then suggests that under certain circumstances, word-meanings may not require conscious representation in the form of ideas or images. Instead, meaning may be carried in purely "physiological" terms. Titchener offers book-skimming and skilled musical performances as examples of this phenomenon. He does not explain meaning without awareness, and is apparently content with stressing that its existence underlines rather than detracts from the significance of conscious meaning.

In the light of his reluctance to discuss meaning, it is not surprising to note that Titchener has nothing to say on the matter of indexing this process. Indeed he believes that the success of the introspective method depends on the elimination of meaning from the reports of both the subject and the observer.

Watson and Meaning

Like Titchener, Watson is inclined to dismiss meaning as a useless concept:

> Exhaust the conception of action, i.e. experimentally determine all of the organized responses a given object can call forth in a given individual, and you have exhausted all possible meanings of that object for that individual.
>
> (85, p.365)

He specifically rejects Titchener's notion of meaning as context and maintains (85, p.364) that to explain the meaning of one image or

idea in terms of other associated ideas is to explain nothing. He recognizes however that in excluding mental processes, meaningful and otherwise, he is obliged to point out their equivalent in behaviour. Since his alternative proposal re-introduces meaning in a somewhat disguised form, a close examination is warranted.

For Watson, thought-processes are no more than the faint reinstatements of motor activities - particularly in the larynx (83, p.174). The development of language is therefore crucial in the establishment of the so-called highest forms of cognitive activity. Through conditioning, motor responses to an object are learned by the young child. He is then presented with stimuli that elicit responses of naming both the object and the conditioned response. Each object then becomes a stimulus that is capable of releasing either the non-language habits or the language habits (84, p.329ff). The penultimate stage is reached when objects evoke naming responses only, and language development is complete when subsequent parts of a series of verbal responses can be initiated by the introduction of appropriate stimuli at any antecedent point in the series.

Watson does not specifically refer to meaning within the context of this discussion, but in a later work we find the following:

> Meanings are implicit (speech) responses originally elicited by referents and then, through conditioning, by words.
>
> (85, p.97)

That this statement is rather more theoretically constructive than the "sum-total" definition quoted earlier is borne out in a still later work in which Watson describes how the meaning of "steep" is acquired. He suggests (86, p.102) that "hill" objects are conditioned to explicit

and implicit responses of saying "steep". These responses produce stimuli that are in turn conditioned to further verbal and motor responses of saying and then executing hill-climbing movements. The significance of this illustration is that it implies that the meaning of the linguistic sign "hill" is not simply the sum of the responses that are elicited by it, but an ordered sequence of responses. Within this sequence there are implicit speech responses whose primary function is to produce stimuli that mediate consequent behaviour. If Watson had reserved the term "meaning" for such responses and then gone on to develop the anticipatory function of meaning thus defined, there would have been no need to introduce the term "neo-Behaviourism" into the vocabulary of psychology. As will be seen presently, the only difference between Behaviourism and neo-Behaviourism is that the latter school places a much greater emphasis on mediating events between stimuli and responses than does the former. An examination of Watson's general theory of behaviour reveals that mediating events are invoked in the dire emergency of having to account for the highly variable nature of instrumental sequences over time. Having committed himself to a study of only the observables in behavior, he is clearly on thin ice in respect to response-produced stimuli. Furthermore, in failing to specify the nature of the unconditioned stimuli with which response-produced stimuli must be paired in the conditioning process, Watson leaves himself open to the very criticisms he advances against the Structuralists.

Watson's theory of word-meaning was accepted more or less *in toto* by his fellow-Behaviourists, but a number of refinements and extensions are worthy of note. Dashiell (10) utilized the concept of inhibition to explain the non-appearance of meaning-responses where they might have been expected. Weiss (87, pp. 318-319) and Gray (26, pp. 65-72) provided

a behaviouristic interpretation of concept-formation. These psychologists suggested that word concepts are developed by conditioning a given verbal response to a variety of physically dissimilar but functionally equivalent objects or names of objects.

Watson's failure to distinguish between meaning as response and meaning as mediating response has important implications for the indexing of this variable. On the basis of his first definition, the experimenter would apparently limit himself to the recording of all responses elicited by a given word. The unprofitable nature of such an enterprise would become immediately apparent when he finds that the same verbal stimulus elicits synonyms and antonyms in addition to mutually antagonistic muscle groups. If, however, he limited himself to mediating responses, his task would become a little more meaningful, as it were, but only at the price of running into severe methodological and theoretical difficulties. This is in fact what happened.

Before the Behaviourists could demonstrate that meaning is an implicit speech response, they first had to show that all mental activities could be reduced to muscle-activity of one kind or another. There appeared a spate of experiments designed to show that tongue, laryngeal movements and other small muscle-groups are always present during thinking. The initial experiments employed various devices for measuring mechanical changes in muscle-tissues and were quite unsuccessful. The first positive evidence came with the development of techniques for recording changes in muscle potential. Both Jacobson (38) and Max (46, 47) reported rough correlations between cognitive activity such as problem solving or imagining the raising of a limb, and bursts of muscle potential. It was clear, however, that this evidence did not constitute grounds for rejecting a centralist conception of thinking. An incidental finding of the Max

investigations might have created the suspicion that thinking possibly involves both peripheral and central processes. Max reported correlations ranging from -0.22 to -0.92 between scores on a number of intelligence tests and average microvoltages from muscle contractions occurring during problem-solving. The consistency of this trend indicates that the more intelligent the subject, the less overt are his symbolic processes.

No evidence was adduced to suggest that there was a measurable similarity between tongue-movement patterns and overt speech, and perhaps because of this, experimental interest in a peripheralist approach to human thinking petered out. The logical step would have been to shelve the theoretical controversy and pursue the lines of enquiry opened by Max. This would have called for a programme of developmental and comparative studies designed to examine the possible changes in overt muscular responses as a function of time, task-complexity and intelligence level. Such a programme might well have shed light not only on the nature of thinking but on the development of meaning.

Thorndike and Meaning

The view that all learning could be explained on the basis of a simple conditioning model was attacked by E. L. Thorndike. He argues (72, pp.401-412) that conditioned response learning is characterized by features that are not found in "ordinary" learning. In particular, he noted that the establishment of conditioned responses demands highly artificial laboratory controls and that the emphasis is placed on stimulus substitution rather than on response modifiability.

In a summary of various theories concerning the origin of language, Thorndike refers to the kind of model proposed by Watson as follows:

> The ding-dong theory assumed a mystical power of certain things to evoke certain sounds from men. Since each sound was associated with the experience

> of the thing, it came to mean it... All the evidence is against the existence of such a power.
>
> (74, pp. 84-85)

Thorndike uncovered the major weakness of Watson's theory, namely that for every vocalization made by the individual there must be a corresponding unconditioned stimulus. If Watson had been faced with this issue, he would have had to agree that a simple conditioning theory of behaviour is inadequate.

Thorndike's own theory of word-meaning was not presented as one complete statement and it is therefore necessary to tease out his views from a number of his writings. He argues (74, p. 97ff) that in the course of random vocalizations, the young child has the good fortune to make a sound that is recognizably like some accepted word in the language-culture. When this happens, he is rewarded by his mother or some other person, and the probability of the sound's subsequent occurrence is gradually increased. Such sounds then become available for association with objects, persons, or other words through the principle of "associative shift". (73, p.404). According to this principle the stimulus that is likely to evoke a particular vocalization is linked with some other stimulus which, in the course of time will acquire the capacity to elicit the vocalization without the contiguous presence of the original stimulus. The meaning of a word is the connection between the word and a real experience or verbal statement thereof. It is not, as Watson suggested, the response elicited by the word. To illustrate this distinction, Thorndike (73, p.371-375) draws on word association experiments in which a given stimulus word such as "cold" may evoke such responses as "like ice", "snow", "frozen" on the one hand, and "air", "cream" and"shoulder" on the other. The first of these two groups of associations, Thorndike argues, reflect

"meaning-connections" while the second group are merely habitual sequences in speech or writing.

The notion of selective reinforcement constitutes an important difference between Thorndike and Watson. The latter adopted a classical conditioning model in which no provision is made for the establishment of responses for which there are no readily identifiable stimuli (e.g. vocalizations in early infancy). In effect, such a model is restricted to a statement of the conditions under which a well-established response may be elicited by a formerly neutral stimulus. In Thorndike's scheme the organism is merely presumed to be capable of emitting the desired response which - when and if it appears - is then strengthened by reward in primary reinforcement.[1]

At first sight, the principle of associative shift seems to be identical to classical conditioning. Thorndike however, made no less than twelve distinctions between these two forms of learning (73, p.402ff). The following four are worthy of note: (1) in associative shifting, time relations are relatively unimportant in that the neutral stimulus may be presented before, after or in simultaneous contiguity with the operational stimulus; (2) unlike classical conditioning, associative shifting normally requires that the neutral stimulus be introduced gradually with the presentation of the operational stimulus; (3) in ordinary associative shifting, the role of reward is crucial whereas it is incidental to the establishment of conditioned responses; and (4) in associative shifting, the new connection, once acquired is strengthened by repetition and reward. Conditioned responses, on the other hand, may

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[1]The distinction between the Watson and Thorndike models is essentially analagous to that made by Skinner (48, pp.18-19, 238) between Type S (classical) and Type R (operant) conditioning.

be extinguished at least temporarily by massed practice.

Thorndike does not commit himself to a description of the precise nature of meaning-connections and contents himself with the flat assertion that such connections or "associative tendencies" exist (73, p.373). Hilgard (32, p.18) maintains that Thorndike thinks of connections as direct impulses to action and that he excludes ideas and consciousness from his theory. However, when one asks the question as to what is connected in meaning-connections, a mentalistic associationism is invoked by Thorndike. Since this point is crucial it will be necessary to quote him directly:

> If a word is seen or heard ...these connections constitutive of meaning are likely to operate. If one or more of them do operate, the person will think of some thing, quality, act, event or relation which has frequently and fitly gone with the word or of some verbal expression which gives it meaning.
>
> (73, p.373)

This suggests that connections are formed not only between stimuli and responses but also between stimuli and some mediation process. This interpretation is supported by Thorndike's own notions concerning the consequences of such associations. The occurrence of meaning-connections might lead to a response such as writing the name of the thing, quality, act, event or relation. Alternatively, such connections may "proceed further to some associated idea and its name" (73, p.373).

The principle of associative shifting is used by Thorndike to strengthen the distinction between meaning - connections and habitual sequences. The former consist of stimuli which are functionally interchangeable in producing the same response or class of responses. Thus the connection between the visual object, "bread" and the written word "bread" is meaningful because both stimuli are associated with eating.

Habitual sequences do not have this property. "Brown-bread" for example, is a sequence that is composed of two words each of which is separately associated with discriminably different responses or response-classes.

In summary then, Thorndike contends that the origin of the child's language lies in the selective reinforcement of spontaneous vocalizations. Words acquire their meaning through associations with objects or other words under the conditions of associative shifting. The test of similarity in meanings lies in whether or not words evoke common responses or response-classes.

The greatest difficulty with this theory is that it raises more questions than it answers. Thorndike's general theory of learning involves the concept of a single-stage or direct connection between stimulus and response situations. Such a connection, strictly speaking, is a response-tendency. In his theory of meaning, however, connections are not direct but involve the mediating properties of ideas, thoughts, or representations. The "associative-tendency" or meaning-connection is established between the initiating stimulus and the idea. Between the latter and the terminal response there is still another connection which is the response-tendency proper. The obvious question concerns the precise nature of the mediating process. Thorndike provides no answer. Although the principle of associative shift helps us to understand the conditions which give meaning-connections their distinctive character, there is clearly no suggestion that the mediating process is the (common) response elicited by two stimuli.

The Transition to neo-Behaviourism - Hull

Although Clark L. Hull did not advance a theory of word-meaning he laid the groundwork for the neo-Behaviouristic conception of meaning

advanced by Osgood. In one of his earlier papers, Hull states:

> A reflective consideration of the habit mechanisms involved in anticipatory defence reactions reveals a phenomenon of the greatest significance. This is the existence of acts whose sole function is to serve as stimuli for other acts. We shall accordingly call them pure stimulus acts.
>
> (34, p.515)

Hull went on to argue that behaviour sequences involving the production of pure stimulus acts had the greatest significance for survival since the organism was thereby enabled to react to "the not-here and the not-now" (34, p.524). He concluded that the concept of the pure stimulus act probably constituted the organic basis of symbolism.

The development of pure stimulus acts may be observed during conditioning experiments. Hull noted that as the trials progress, reactions originally elicited at one point in the behaviour sequence appear to move forward in that sequence in an anticipatory fashion. His explanation was that any stimulus that persists throughout the sequence will become conditioned to all reactions in the sequence. However, since associations formed between the stimulus and reactions occurring near the terminal point of reinforcement are strengthened more rapidly, the occurrence of the same stimulus earlier in the sequence will tend to elicit these later reactions in an antedating fashion. Hull stressed the point that these reactions are not only conditioned to "artificial" stimuli such as a continuous buzzer sound but also to drive stimuli arising from tissue needs.

The significance of antedating reactions does not lie so much in the fact that they are reactions as in the fact that the stimuli produced by their occurrence may mediate a variety of responses. In a classical

conditioning experiment, there would be an obvious affinity between mediating and terminal responses, but in instrumental or avoidance conditioning, the pure stimulus act may mediate a conditioned response that need bear no resemblance to the unconditioned response.

The concept of the pure stimulus act is not unlike Watson's notion of the response-produced stimulus. Watson however thought of the response-produced stimulus as the link between two or more different conditioned reflexes. Hull's pure stimulus act is developed within a single conditioned reflex. This difference is illustrated in Figure 1. In Hull's paradigm, the pure stimulus act antedates the conditional response.

$CS_1 \longrightarrow$ Pure Stimulus Act $\longrightarrow CR_1$

$CS_1 \longrightarrow CR_1 \dashrightarrow$ (Response-produced S $\dashrightarrow$ CR_2
(U.C.S. or $CS_2 \longrightarrow$

FIGURE 1.

THE CONDITIONING PARADIGMS OF WATSON AND HULL

The response-produced stimulus in Watson's model is produced by the conditioned response, and then becomes available as a conditioned stimulus for CR_2 by being made contiguous with an unconditioned stimulus or a second conditioned stimulus.

Evidence for the pure stimulus act comes from studies by Culler (9), Marcuse and Moore (45), Moore and Marcuse (51), and Liddell (44, p.189) which demonstrated that certain components of the total unconditioned response occur earlier than others in the course of conditioning. The authors arrive at the common conclusion that the difference between the

unconditioned and conditioned responses in all forms of conditioning is attributable to the stimulation produced by the antedating reactions. These studies also indicate that the antedating reactions are largely of an autonomic nature but may include "light-weight" voluntary muscle contractions.

Hull did not develop fully the notion that pure stimulus acts might constitute the origin of symbolic behaviour. It is, however, central to Osgood's theory of meaning to which we may now address ourselves.

CHAPTER III

OSGOOD'S THEORY OF MEANING

Although Osgood deals exclusively with the nature of meaning in The Measurement of Meaning (54), published in 1957, his ideas are best understood in the context of a general theory of behaviour outlined by him in two earlier works (52, 53).

He begins (52, p.75) by criticising the various types of S-S and S-R theories for their failure to account for important behavioural phenomena. While granting that the S-S model deals fairly adequately with relations among sensory input events and between these and central processes, Osgood maintains that the question of what happens between the central processes and overt behaviour is scarcely touched. S-R theories can at best explain simple relations between stimulus and response variables, but have little or nothing to say about sensory integrations (perceptions) or response integrations (motor-skills). Finally, neither the S-S nor the S-R models have contributed much to our understanding of symbolic processes.

The model Osgood (52, p.76) proposes is one which envisages two stages and three levels of organization. The first stage, decoding, is the total process whereby the physical energies of the environment are interpreted by the organism. The second stage, encoding, is the total process whereby the intentions of the organism are expressed. The three levels of organization are (1) Projection which relates sensory and motor events to the brain via innate neural mechanisms; (2) Integration which organizes and sequences both incoming and outgoing neural events;

and (3) Representation which is at once the terminal stage of decoding and the initiation stage of encoding operations.

The Projection level has two major characteristics. The first takes the form of an isomorphic relationship between the receptor surface of the organism and the sensory cortex. This relationship also holds between the motor cortex and the voluntary muscle system. The clearest evidence for the isomorphism comes from neurological studies that demonstrate a high degree of correspondence between direct electrical stimulation of the sensory cortex and reported sensations and between stimulation of the motor cortex and observed muscular contractions. The second characteristic of organization at this level is that it is not subject to modification through experience, i.e. the isomorphic relationships are unaffected by learning. Both characteristics enable us to depend on stimulus and response observations as faithful indices of sensory and motor signals.

From our everyday observations of behaviour, it is evident that certain patterns and sequences of stimuli have precedence over others. This also seems to hold for response patterns and sequences. Osgood suggests that sensory and motor signals must therefore be subject to structure and organization. The concept of Integration is then invoked to account for this organization. Borrowing directly from Hebb (30, p.62), Osgood advances the following quasi-neurological postulate:

> Whenever central neural correlates of projection-level signals are simultaneously active and in fibrous contact, either directly or mediately, an increased dependence of one on the other results.
>
> (52, p.79)

Here, Osgood envisages a series of neural connections between cells in the projection areas and certain more central cells. The latter may be

termed the "central neural correlates" of the former. Thus the firing of a specific group of cells in the sensory projection area will produce activity in a corresponding group of central cells. The firing of the central neural correlates of a specific group of motor cells will be followed by activation of the latter. The characteristics of projection cells preclude the possibility of any relation of dependency growing out of the simultaneous activation of different cell groups. At the integration level, however, the simultaneous activation of two central correlates may, over time, lead to an increase in the probability of one firing the other. This relationship is assumed by Osgood (52, p.80) to be a direct function of the density of fibrous contact at their synapse. Thus if there is a thicker band of fibrous contacts between central neural correlates a and b than between a and c, or alternatively, the connection between a and c is mediated by a third correlate x, the resultant tendency for correlate a to activate b should be greater than its tendency to activate c.

Osgood then uses this neurological conception to advance two psychological principles relating to sensory and motor integrations respectively:

PRINCIPLE I

> The greater the frequency with which stimulus events A and B are associated in the input of an organism, the greater will be the tendency for the central neural correlates of one, a to activate the central neural correlates of the other, b.

PRINCIPLE II

> The greater the frequency with which response events A and B are associated in the output of an organism, the greater will be the tendency for the central neural correlates of one, a, to activate the central neural correlates of the other, b.

(52, p.81)

Taken together, these principles state in effect that the patterning and ordering of events in the stimulating environment on the one hand, and

in the overt behaviour of the organism on the other, will produce equivalent or parallel organizations within the sensory and motor nervous systems respectively. Sensory and motor integrations function as classes of intervening variables, anchored directly to antecedent and subsequent variables via a simple frequency of co-occurrence function. The effect of the frequency factor on what is observed may be expressed in two subsidiary principles:

PRINCIPLE III - EVOCATION

> With high frequency of stimulus or response pairing, the firing of central correlates of one will become a sufficient condition for the excitation of the correlates of the other.

PRINCIPLE IV - PREDICTION

> With lower frequency of stimulus or response pairing, the central correlates of one will become merely a condition for "tuning up" the correlates of the other.

(52, p.81)

The behavioural implications of these two principles are clear: the higher the frequency with which a set of stimuli (or responses) have occurred together, the greater is the probability that the appearance of one member of the set will produce the central experience of the others in their absence. Osgood believes that these integrations permit an increase in the stability of decoding and encoding operations. For example, the perception of certain cues would increase the probability of also perceiving other cues that are in competition with other stimuli. The initiation of certain responses would, in a similar fashion, increase the probability of initiating others that happen to be in competition with other action tendencies.

So far the model is capable of integrating sensory signals into evocative and predictive relationships that reflect the redundancies of the events to which the organism has been exposed. It is also capable of

integrating motor signals into evocative and predictive units which parallel the redundancies in its own behaviour. Thus, dependency relationships between two or more responses will develop as a function of the number of times these responses have occurred in contiguity in the past experiences of the organism. The model covers then, both S-S and R-R relationships but not S-R relations. What is required now is a construct that will account for the adaptive nature of behaviour. The higher level of organization which such a construct implies is termed by Osgood, representation (52, p.91), and since his discussion of this level constitutes his theory of meaning it will be necessary to proceed with a rather more detailed account of his views.

Osgood begins by observing that stimulus events may be related to response events at all levels of organization. Some sensory signals have innate connections with specific responses to form unconditioned reflexes. Additional signals may acquire such direct connections with motor signals to form conditioned reflexes (53, p.354).[1] At the Integrational level, associations between complex patterns of sensory and motor signals may also be innate (instinctual behaviour) or acquired e.g. sensory-motor skills that have been relegated from higher levels of cortical control. However, the most important mechanism for linking sensory and motor events operates, Osgood claims, through a two-stage mediation process:

> The essential notion here is that in the course of associating external stimuli with overt behaviour, some fractional representation of this overt behaviour becomes anticipatory, producing self-stimulation that has a symbolic function.
>
> (52, p.92)

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[1] In the reference cited it would appear that conditioned reflexes are established at the Projection level. This is a slip on Osgood's part since, by definition, activity at this level cannot be modified by experience. A higher level of organization must therefore be invoked.

Osgood admits that the postulation of mediation processes is not a theoretical innovation. The same notion finds expression in Hull's concept of the pure stimulus act (34), Tolman's "sign-significate expectation" (80), and Guthrie's "movement-produced stimulus" (28). But he claims that both Hull and Guthrie called on mediation only in dire extremities, whereas he himself considers it to be the usual form of S-R learning and crucial to a satisfactory account of cognition. In this respect, Osgood considers that the basic problem of symbolic processes concerns the circumstances in which certain stimuli become signs of something else. Before answering this question, he finds it necessary to introduce the term "significate" which is defined as "any pattern of stimulation that regularly and reliably elicits a predictable pattern of behaviour". (53, p.355). All unconditioned stimuli would then be significates; so also would previously learned relations. The basic problem may now be rephrased as follows: how is it possible for neutral, arbitrary stimulus patterns to become signs of significates? Osgood suggests the answer:

> Whenever a neutral stimulus (sign-to-be) is paired with a significate and this pairing occurs sufficiently close in time to a reinforcing state of affairs, the neutral stimulus will acquire an increment of association with some distinctive portion of the total behaviour elicited by the significate.
>
> (53, p.355)

It is assumed that certain components in the total reaction to the significate are detachable in the sense that they tend to move forward in the conditioning sequence in what might be termed an anticipatory fashion. Osgood calls these reaction components "representational mediation processes" (53, p. 356). They are representational in that, although elicited by the sign, they are part of the behaviour produced by the

significate. They are mediational because the stimuli which they produce can become associated through ordinary instrumental learning, with various overt responses appropriate to the significate. As such they constitute the meaning of the sign.

A simple illustration of Osgood's two-stage paradigm is presented in Figure 2. The significate ($\dot{S}$) is in this case an unconditioned stimulus. The feel and taste of milk in the mouth is reflexly associated

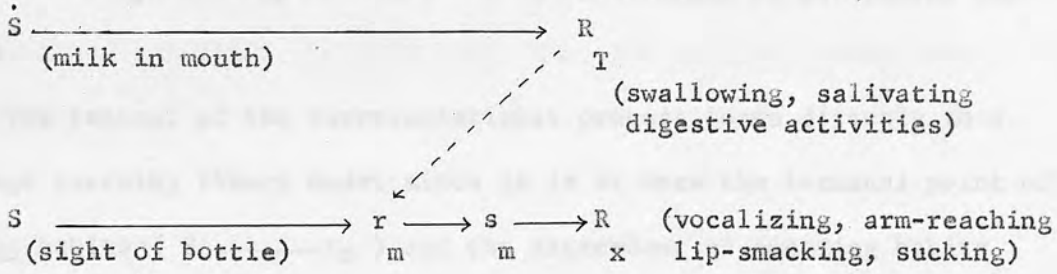

FIGURE 2

OSGOOD'S PARADIGM OF SIGN-LEARNING

with a pattern of behaviour (R_T). Initially the sight of the bottle does not initially elicit behaviour that is appropriate to S. The frequent pairing of these two discriminably different stimuli however, leads to the detachment of certain components of R_T and their consequent association with the sight of the bottle. When this latter stimulus elicits these components or representational mediational processes ($r_m \longrightarrow s_m$) it becomes a sign (S) of the significate, $\dot{S}$.

What characteristics determine which components of the total reaction to the significate will become available as $r_m \longrightarrow s_m$ processes? Osgood (52, p.93) suggests the following: (1) energy expenditure - the less the energy expended by the component, the more likely is the possibility of association with a sign; (2) interference - the less any component interferes with goal-directed behaviour, the more

likely it is to be included; (3) discrimination - the more discriminable any component is from those elicited by other signs, the more likely it is to be included. From the literature on conditioning, there is considerable evidence that certain components of the unconditioned response appear earlier in the conditioned response than other components. Such components would have $r_m \longrightarrow s_m$ status in Osgood's theory. More recently, Osgood (54, p.7) has suggested that some $r_m \longrightarrow s_m$ processes may be purely neural events (presumably as residuals or refinements of peripheral mediators).

The concept of the representational process leads directly to a two-stage learning theory model since it is at once the terminal point of decoding habits ($S \longrightarrow r_m$) and the antecedent of encoding habits ($s_m \longrightarrow R_x$). The acquisition of decoding and encoding habits can proceed independently. For example, a child may learn the danger significance of a wasp (by virtue of having been stung) well before he learns to take appropriate action. It is therefore possible to apply the conceptual machinery of single-stage S-R theory to both sides of the two-stage model (52, p.99) without, at the same time, being committed to a peripheralist point of view. Before discussing some of the important implications of such a transfer, however, it will be convenient for our purposes to examine Osgood's conception of how language-signs acquire meaning for the child. This is what Osgood terms "Linguistic decoding" (52, p.93).

Prior to the acquisition and use of language, the child learns the perceptual meaning of familiar objects in its environment (52, p.94). The sight of a ball, like the sight of the feeding bottle, is initially meaningless to the child. As a visual stimulus the ball acquires meaning only when it is paired frequently with stimuli produced by direct contact and

related to weight, resilience and so forth. These latter stimuli are assumed to produce, regularly and reliably, a total reaction comprised of grasping, bouncing, squeezing, and pleasurable autonomic reactions associated with play-behaviour. The sight of the ball as a visual sensory integration then comes to elicit fractional components of this total reaction as representational mediation processes, and as such is now a perceptual sign. It follows that this sign becomes a significate if it in turn elicits (via the acquired $r_m \longrightarrow s_m$ process) a total reaction that is regular and reliable. When the original significate and the perceptual sign are now paired with the auditory stimulus "ball" in the presence of reinforcement, the new stimulus will acquire fractional components of the total response to the perceptual sign. There will probably be a direct transfer of the representational process itself. The auditory stimulus "ball" is now a sign of the object "ball". The total sequence is illustrated in Figure 3.

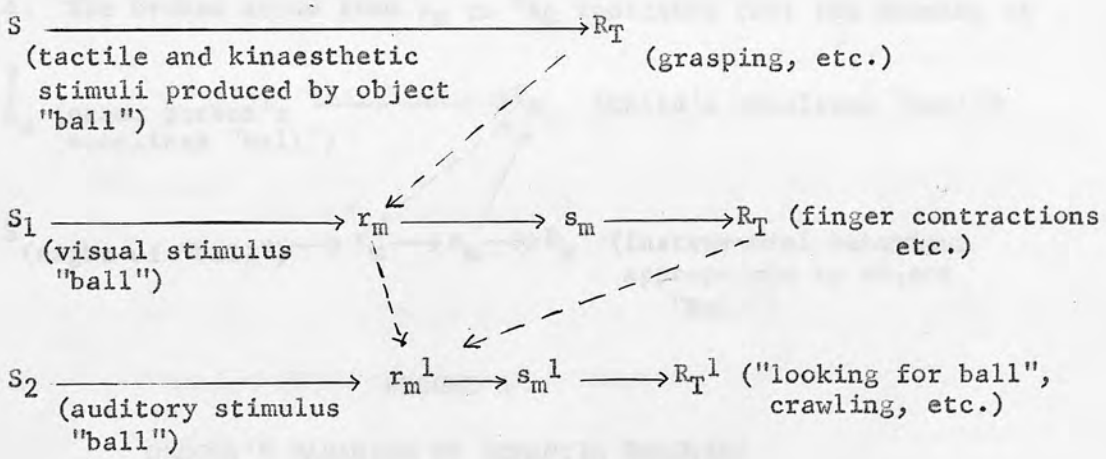

FIGURE 3

OSGOOD'S PARADIGM OF WORD-MEANING
or LINGUISTIC DECODING

The acquisition of linguistic decoding habits represents only the

first phase in the development of symbolic processes. The second phase "linguistic encoding" (52, p.95ff) is rather more complicated in nature. The origin of encoding, according to Osgood, lies in the circular reflex of babbling whereby the occurence of vocalizations becomes a sufficient condition for their repetition. Through primary stimulus generalization it becomes possible for someone other than the child himself to elicit babbling. People in the child's environment will tend to "feed back" only those sounds that approximate most closely to the spoken language. Eventually, on hearing his mother say "ball", the child will return the vocalization as an approximate imitation, but this imitative labelling has no meaning until the auditory stimulus "ball" is paired with the sight of the ball. The pairing should have two consequences: (1) the development of a single-stage association between the sight of the object and the imitative label, and (2) a two-stage mediated association between the sight of the object and the imitative label. This process is shown in Figure 4. The broken arrow from r_m to $^{V}R_C$ indicates that the meaning of

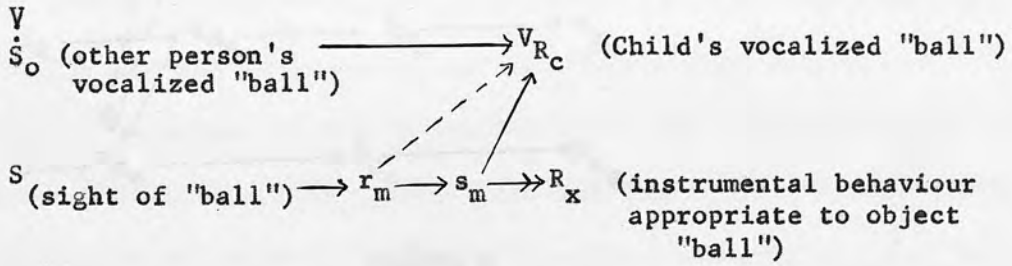

FIGURE 4

OSGOOD'S PARADIGM OF SEMANTIC ENCODING

The visual sign (S) of the ball has been transferred to the child's vocalization of "ball". The single-headed unbroken arrow from s_m to $^{V}R_c$ indicates that the self-stimulation produced by the mediating reaction elicits the

vocalization "ball". The instrumental behaviour associated with the same mediating reaction is of course still retained ($s_m \longrightarrow\!\!\!\!\rightarrow R_x$). Any condition that elicits the crucial representational process is thereby capable of mediating the correct vocalization.

According to Osgood (54 p.8) the vast majority of signs used in ordinary communication are assigns. An assign is a sign that derives its meaning through association with more primary linguistic signs. Thus by looking up an appropriate reference book, it is possible to learn the meaning of "zebra" without being physically confronted with the animal. The assign's meaning is in effect the integration of portions of the mediating reactions already associated with the more primary signs. The paradigm for this kind of learning is presented in Figure 5:

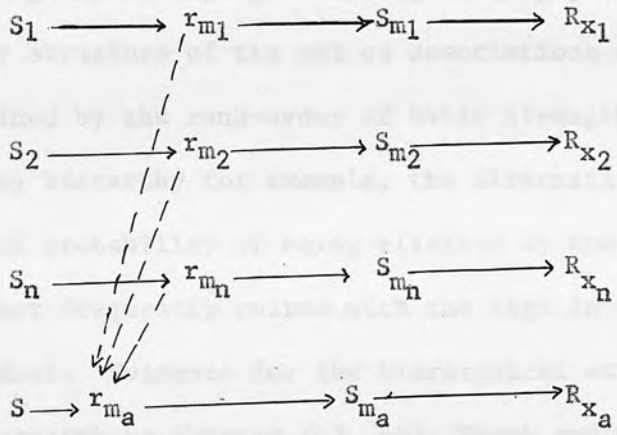

FIGURE 5

OSGOOD'S PARADIGM OF ASSIGN-LEARNING

As has been noted, Osgood maintains that it is possible to apply single-stage S-R constructs to his model. In this respect he leans heavily on Hull's concept of habit-family hierarchy (35,36) for demonstrating man's flexibility in the use of language (52, p.96ff). Hull distinguishes between two kinds of hierarchy: (1) the convergent

hierarchy which involves the association of different stimuli with a common response pattern, and (2) the divergent hierarchy, in which one stimulus situation is variably associated with a number of different responses. Osgood suggests that in his two-stage model, both decoding and encoding habits may take the form of divergent or convergent habit-family hierarchies. At the decoding stage, different sensory integrations may be associated with a common mediating reaction to form a convergent sign hierarchy. (e.g. STYLE and FASHION). Alternatively, one sensory integration may be associated with a number of different mediating reactions to produce a divergent sign hierarchy (e.g. CASE). The stimulus properties of mediating reactions permit the establishment of both convergent and divergent hierarchies at the encoding stage.

Again, following Hull, Osgood (52, p.97) suggests that the probability structure of the set of associations within a hierarchy will be determined by the rank-order of habit strength. Thus, in a divergent decoding hierarchy for example, the alternative meaning which has the greatest probability of being elicited by the sign, is that which has been most frequently paired with the sign in the past experience of the individual. Evidence for the hierarchical structure of association comes from research by Skinner (63, 64), Thumb and Marbe (75), Cason and Cason (6), Bousfield and Sedgewick (4), and Bousfield and Barclay (3). Of particular interest is a study by Foley and MacMillan (22) in which subjects were assigned to one of five groups. Two of the groups were composed of first and second-year law students respectively; two groups comprised first and second-year medical students, and finally, a control group of non-professional students. All subjects were then asked to write down their associations to each of a list of forty stimulus words, half of which were homophones interpretable in legal, medical or non-professional

senses. It was found that there was a significant relationship between professional status and the interpretations placed on the homophones. Furthermore, the consistency of such interpretations increased with amount of professional training.

Probability structures are subject to the influence of context, set, and drive. For example, if a sign has a number of alternative meanings, we can raise to near certainty the probability of a sub-dominant association by providing an appropriate context. Thus, the linguistic sign CASE presented to one subject out of context might elicit a dominant meaning derived from the past association of this sign with travel. In the context HOSPITAL, the sub-dominant meaning associated with illness would in all probability be elicited first. Again, if the individual is set for certain meanings and not others, sub-dominant associations may acquire high probability values - at least throughout the duration of the task.

Drive has a highly complex influence on associative hierarchies. Osgood (53, p.367) follows Hebb (31) in that he distinguishes between the cue-effects and the energizing effects of drive. He maintains (53,p.388) that the cue-effects of a given drive increase the availability of meaningful processes previously associated with the drive. Support for this hypothesis comes from research by Sanford (61) and Levine, Chein and Murphy (43) in which it was found that frequency of 'food' interpretations of ambiguous stimuli was influenced by the degree of hunger motivation present in the subjects. In another study, Postman and Bruner (56) asked their subjects to decode tachistoscopically-presented sentences. They found (among other things) that experimentally produced stress had the apparent effect of increasing the frequency of aggressive and escape words in the interpretations offered by subjects. For example, "tests much" was read as "treat

rough" while "sacred" was read as "screamed". This kind of behaviour is of course very similar to that elicited by projective techniques such as the Rorschach and the T.A.T.

The energizing effects of drive are believed by Osgood (53,p.370) to vary with both the amount of generalized drive present and with the task to be performed. In this matter he employs the general relation between drive and behaviour postulated by Hull (37, p.229) and elaborated by Taylor (70) and Farber and Spence (21). This is the so-called multiplicative relation according to which increases in drive strength raise the probability of alternative reactions in proportion to their initial habit strengths. This means that the relatively more probable alternatives would become even more probable, while the sub-dominant alternatives would become even less probable.

This theory has led to the general prediction that subjects learning under high irrelevant drive should perform more efficiently in tasks where the initially dominant response is correct, but should do relatively worse when sub-dominant responses must be selected or discriminated. Experiments by Beam (2), Spence, Farber and McFann (67) and Spence, Taylor and Ketchel (68) have borne out this prediction.

By way of summary, Osgood's theory states that linguistic signs acquire their meaning through association with significates - stimuli that regularly and reliably elicit a particular response pattern - and in the presence of reinforcement. Parts of the total response to the significance are transferred to the sign as representational mediating processes. These processes produce stimuli which in turn elicit responses that are appropriate to the significate. Representational mediating processes may undergo refinement to the point where they may be purely neural events. When

meaning in language is being acquired in early childhood, linguistic signs are paired initially with perceptual signs. Later, new linguistic signs may acquire their meaning through association with more primary linguistic signs. This is known as assign-learning. Signs, their meanings and the responses mediated by these meanings may form convergent and divergent hierarchies. The base probability structures of these hierarchies may be influenced by context, set and drive.

CHAPTER IV

THE SEMANTIC DIFFERENTIAL

It will be recalled that in Osgood's model, encoding involves the selective encoding of instrumental acts, R_x, by the representational mediating process, $r_m \longrightarrow s_m$. Intentional encoding can take one of two forms, non-linguistic (e.g. gestures, changes in facial expression) and linguistic. It is the latter form which Osgood (54, p.18) considers as the sounder base for the development of a quantitative index of meaning. From this line of thinking Osgood, Suci and Tannenbaum (54) constructed the Semantic Differential, an instrument designed to identify and measure the meaning of any sign, but particularly suited for linguistic signs or concepts.

The Semantic Differential consists of a set of bi-polar adjectival scales. The meaning which any concept holds for any individual is obtained by asking him to indicate the direction and intensity of his association of scale and concept by checking one of the intervals or steps between each adjectival pair. The basic assumption is that the bi-polar scales employed in the Differential constitute a representative sample of all the ways in which meaningful judgments can vary.

Osgood's analysis of the logic of semantic differentiation begins (54, p.25) with the postulation, of a semantic space, Euclidean in character and of unknown dimensionality. Each bi-polar scale is assumed to represent a straight-line function that passes through the origin of this space. Research on synesthesia by Karwoski, Odbert, and Osgood (40) and on social

stereotypes by Stagnar and Osgood (69)indicates that many bi-polar adjectival scales are highly inter-correlated. It therefore follows that to define the semantic space with maximum efficiency, it is necessary to factor-analyse the adjectival scales. This procedure permits the identification of the minimum number of orthogonal dimensions required to exhaust the dimensionality of the semantic space. Those scales which are most representative of each dimension may then be used to differentiate the meaning of any concept. In other words, semantic differentiation involves successive judgments of a concept on a set of scales of known dimensionality. Each judgment serves to localize the concept as a point in the semantic space.

We may illustrate Osgood's technique with an example. Let us assume that the factor-analysis of a set of scales has established only two orthogonal dimensions and that the scales "good-bad" and "strong-weak" are most representative of Dimensions I and II respectively. A subject is then asked to rate the concepts MARRIAGE and DEATH against each scale. To permit the registration of intensity of rating, we insert seven intervals between the adjectival poles and assign a numerical value to each. The subject then produces the following record:

MARRIAGE

	+3	+2	+1	0	-1	-2	-3	
good	___	X	___	___	___	___	___	bad
Strong	___	___	___	___	X	___	___	weak

DEATH

Good	___	___	___	___	___	X	___	bad
Strong	___	___	___	___	___	___	X	weak

These ratings may be plotted directly in a semantic space defined

by Dimensions I and II. The results are presented in Figure 6:

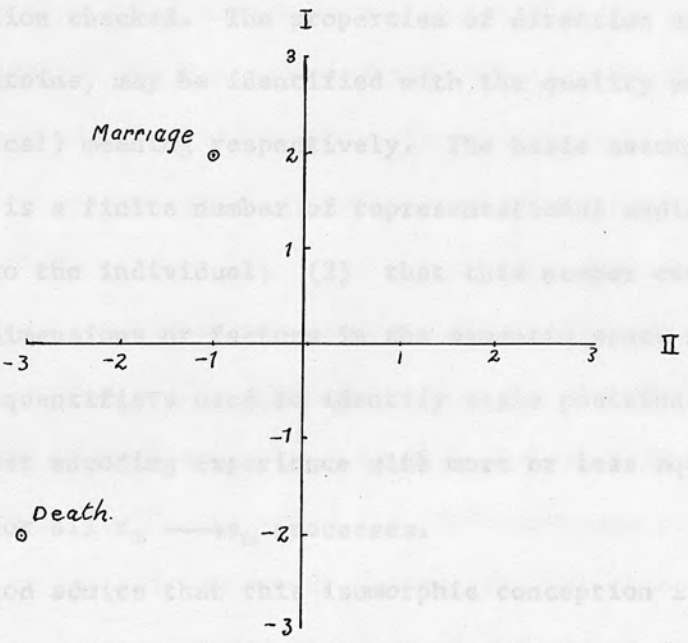

FIGURE 6

TWO CONCEPTS PLOTTED IN THE SEMANTIC SPACE

The Mathematico - Psychological Isomorphism

In effect we now have two definitions of meaning: in terms of the two-stage model, the meaning of a sign in a particular context is the representational mediating process elicited by it; in mathematical terms, the meaning of a sign is operationally defined as a point in the semantic space that is established by dimensional co-ordinate values.

Osgood (54, p.26) assumes that an isomorphic relationship exists between dimensions in the semantic space and the representational mediating processes within the individual. A point in space has two essential properties, namely, direction from the origin, and distance

from the origin. The direction from the origin is determined by the alternative polar terms selected, and the distance, by the particular scale position checked. The properties of direction and distance, Osgood maintains, may be identified with the quality and intensity of (psychological) meaning respectively. The basic assumptions are (1) that there is a finite number of representational mediating reactions available to the individual; (2) that this number corresponds to the number of dimensions or factors in the semantic space and (3) that linguistic quantifiers used to identify scale positions have been associated in past encoding experience with more or less equal degrees of intensity for all $r_m \longrightarrow s_m$ processes.

Osgood admits that this isomorphic conception is something of a tour de force. Indeed it is doubtful whether for many practical purposes, there is any need to tie the Semantic Differential to any particular theory. Osgood, however, feels that the speculative isomorphism may have its merits:

> .....if we are to use the semantic differential as an hypothesis-testing instrument, and if the hypotheses regarding meanings and changes in meaning are to be drawn from learning-theory analysis, some such rationale as has been developed here is highly desirable.
>
> (54, p.30)

The Dimensionality of the Semantic Space

Osgood, Suci and Tannenbaum (54, Chap.2) carried out a series of factor analytic studies designed to isolate and identify the major factors operating in meaningful judgments. In the first investigation, forty common nouns were read in fairly rapid succession to a group of two hundred students. These subjects were required to write down after each stimulus noun the first adjective that occurred to them. A frequency count

was obtained for all adjectives, irrespective of stimulus source. The fifty most frequently used adjectives were then bi-polarized (e.g. 'good' became 'good-bad') and a seven-step intensity scale inserted between each adjectival pair. One hundred students were then asked to rate each of twenty common and diversified concepts against each of the fifty scales. The matrix of intercorrelations among scales was then factored by the centroid method.

Four factors were extracted and rotated into simple structure, maintaining orthogomality among the factors. The first factor, identified as evaluative, and characterized by such scales as 'good-bad', 'beautiful-ugly' and'kind-cruel', accounted for 33.78 per cent of the total variance and 68.55 per cent of the common (extracted) variance. The second factor, identified as a potency variable accounted for 7.62 per cent and 15.46 per cent of the total and common variances respectively. Representative of this factor were such scales as 'large-small', 'strong-weak' and'heavy-light'. The third factor which appeared to be an activity variable accounted for 6.24 and 12.66 per cent of the total and common variances respectively. Typical activity scales were 'fast-slow', 'active-passive' and 'hot-cold'. The fourth factor accounted for a very small percentage of the total and common variances, and since no scale had a loading of greater than 0.27 on this factor, it was left unidentified.

The possibility that the factorial structure of the scales was partly attributable to the concepts used led to a second investigation. The same fifty bi-polar adjectives were employed but no concepts were introduced. Instead, each of the fifty adjectival pairs was presented once with every other pair. Forty subjects were then required to indicate which of the polar terms of one pair most closely resembled a designated

member of the first pair. The measure of relation used in this analysis was the percentage of agreement among subjects for each judgment. The 50 x 50 matrix of percentages was factorized by the D-method (54, p.332).

As in the first study, the first three dimensions extracted were evaluation, potency and activity. A comparison of the factorial structure of the two studies indicated a high degree of similarity.

The third study reported by Osgood, Suci and Tannenbaum involved the selection of seventy-six bi-polar adjectives from Roget's Thesaurus. Twenty concepts were employed. These comprised five groups of four concepts relating to persons, physical objects, abstractions, events and institutions respectively. The concepts were rated by one hundred subjects against each seven-step adjectival scale. Intercorrelations of scales were then entered in a 76 x 76 matrix. This matrix was factored first by the centroid method and then by the Square Root method (90).

The unrotated centroid analysis produced eight factors, the first three of which were evaluation, potency and activity. The first factor, evaluation accounted for about twice as much variance as potency and activity, and these in turn accounted for about twice as much variance as any of the remaining factors. Rotation of this structure did not affect the relative dominance of the first three factors. The remaining factors could not be identified.

Square Root analysis of the same data yielded eight identifiable factors, the first three of which were evaluation, potency and activity. The fourth factor, stability was characterized by such scales as 'sober-drunk', 'stable-changeable','rational-intuitive', and 'sane-insane'. Tautness, the fifth factor seemed to underlie 'angular-rounded', 'straight-curved', and 'sharp-blunt'. The sixth factor, novelty, was characterized by such scales as 'new-old','unusual-usual', and 'youthful-mature'.

Receptivity emerged as the seventh factor. This factor appeared to be somewhat diffuse, producing quite small loadings on a large number of scales. Scales that were predominantly receptive included 'savoury-tasteless', 'colourful-colourless', 'interesting-boring' and 'pungent-bland'. The last factor extracted was aggressiveness, which had a sizeable loading in only one scale, 'aggressive-defensive'.

On the basis of these and other investigations, Osgood, Suci and Tannenbaum (54, p.71) conclude that the semantic space is multi-dimensional but that the relative importance of the different dimensions in mediating judgment varies considerably. Only three factors, Evaluation, Potency and Activity can be considered as dominant in this respect. The authors admit that the relative importance of factors is influenced to some degree by the concepts employed. The factorial composition of scales is relatively unaffected by the method of factor analysis that is employed.

Reliability

The essence of any question relating to reliability is whether score deviations from test to re-test are due to chance or to real differences. Osgood, Luci and Tannenbaum (54, p.126ff) have reported reliability estimates of their semantic differential scales for both groups and individuals. For groups, the probability of obtaining a chance average deviation of one-half of a scale unit (in a seven-step scale) or greater is 0.024 for Evaluative scales. For Potency and Activity scales, the corresponding probability values are 0.009 and 0.017 respectively. Reliability estimates for individual subjects are, as might be expected, considerable poorer. An absolute deviation of 1.50 scale units may occur by chance once in a hundred times for Evaluative scales and approximately five times in a hundred for both Potency and Activity scales.

Validity

The validation of the semantic differential scales and their dimensional attributes presents a serious problem since, as Osgood, Suci and Tannenbaum admit (54, p.140), there is no independent quantitative criterion of meaning with which scales or dimensions can be correlated. They consequently appeal to face validity and cite a number of studies to illustrate the strength of their claim in this respect. For example, in one study (54, p.94) semantic differentiation of ten concepts produced three clusters in the semantic space. The first cluster comprised QUICKSAND, DEATH and FATE; the second included WHITE ROSE-BUDS, GENTLENESS and SLEEP: the third cluster comprised HERO, VIRILITY and SUCCESS. The tenth concept, METHODOLOGY was clearly separated from these three groupings. This is the kind of arrangement we might have expected had no scales been used at all.

A second approach to validation is to predict specific behaviour of individuals on the basis of test performance. Here the assumption is that the behaviour in question is mediated by the same variables that underlie test performance. Osgood, Suci and Tannenbaum (54, p.142) employed this assumption in predicting voting behaviour from semantic differential ratings. Three and a half months prior to the 1952 United States Presidential Election, fifty-five subjects were asked to indicate how they intended to vote. Twelve were very certain that they would vote for Stevenson; twenty-five were just as certain that they would vote for Eisenhower, and eighteen were uncertain. All subjects rated twenty social, economic and political concepts on a form of the Semantic Differential. Osgood, Suci and Tannenbaum argued that if voting behaviour depends upon one's attitudes

and meanings, then the vote of each "Don't know" should be predictable from the correspondence of his concept-meanings with those of the two other groups. Each uncommitted subject's ratings of the twenty concepts on the 'fair-unfair' (evaluative) scale were compared with the mean responses of the prospective Stevenson and Eisenhower groups respectively. Those individuals whose concept-meanings were closer to those of the Stevenson group than to those of the Eisenhower group were regarded as prospective Stevenson voters, and vice versa. Of the eighteen "don't-knows", fourteen voted as predicted, a figure significant at the 5 per cent level. When the ratings on the "strong-weak" (potency) scale were combined with evaluation, correct predictions were made in seventeen out of the eighteen cases, a figure significant at the one per cent level of confidence.

A third approach to the validation of the semantic differential scales takes the form of comparisons of concept ratings with independent clinical judgments. Osgood and Luria (55) report an unusual opportunity that was afforded for such an investigation. Thigpen and Cleckley (72) had submitted to The Journal of Abnormal and Social Psychology a manuscript entitled "A Case of Multiple Personality". Acting on a suggestion from the editor, J. McV. Hunt, Thigpen and Cleckley administered a form of the semantic differential to their patient on two occasions to each of the three personalities assumed by her. Osgood and Luria were informed that they were dealing with a case of multiple personality, that the patient was a married mother, and that she had a job outside of house-keeping. On this information alone, they undertook an analysis of each personality on the basis of the semantic differential protocols. These analyses were then

compared with the clinical observations made by Thigpen and Cleckley. On the whole a fairly close correspondence was noted. By way of illustrations, the semantic structure for one of the personalities, Eve Black, included two major clusters. The concepts DOCTOR, ME, PEACE OF MIND, HATRED, FATHER and FRAUD all shared the common meaning of being both good and strong. The second cluster, comprising CHILD, MY SPOUSE, LOVE, MY JOB, and SEX, was regarded as being both bad and passive. Part of the interpretation offered by Osgood and Luria runs as follows:

> .... Eve Black has achieved a violent kind of adjustment in which she perceives herself as literally perfect, but, to accomplish this break, her way of perceiving 'the world' becomes completely disoriented from the norm.
> .... But if Eve Black perceives herself as good, then she also has to accept HATRED and FRAUD as positive values, since (we assume) she has strong hatred and is socially fraudulent. What are positive values for most people - CHILD, MY SPOUSE, MY JOB, LOVE and SEX - are completely rejected as bad and passive.... Like a completely selfish infant, this personality is entirely oriented around the assumption of its own perfection, personal perfection is apparently the demand acceded to rather than sexuality.
>
> (55, p.584)

Thigpen and Cleckley's observations are remarkably similar:

> .... She lies glibly and without compunction .... Obviously a party girl. Shrewd, childlishly vain and egocentric .... A touch of sexiness seasons every word and gesture. But ..... apparently she had no desire for sexual relations but often enjoyed frustrating her supposed husband by denying herself to him.
>
> (72, p.138)

Still another approach to the validation of the semantic differential scales in clinical work involves the comparison of semantic structure before and after therapy with the clinical observations of the therapist. Osgood, Suci and Tannenbaum (54, p.246) report a study of this kind that was carried out in collaboration with O. H. Mowrer. Two patients, both agoraphobics, responded to a form of semantic differential before, during and after psychotherapy. The form included eight concepts (ME, MOTHER, FATHER, BABY, LADY, GOD, SIN and FRAUD), and twenty scales. Before therapy one of the patients, a young woman, rated ME as closer in meaning to FATHER than to MOTHER. After therapy ME shifted in meaning to form a cluster with MOTHER, LADY and BABY with FATHER losing much of the favourable reactions elicited prior to therapy. Mowrer suggests that this shift corresponded very well with the clinical facts, since one of the patient's major problems was an 'alliance' with her father against her mother. During therapy this situation was explored and eventually repudiated.

Need for Further Research

Osgood, Suci and Tannenbaum admit (54, p.153) that one of the major gaps in the work of validation is that no experimental checks have been made on the assumed isomorphism between meaning as a representational mediating process and meaning operationally defined as a point in the semantic space. Until such a check is made, it is very difficult to draw inferences about the processes underlying sign-learning. Support for the isomorphic relationship would help to clear the way for a greater understanding of the individual differences that might be revealed in the semantic

differential ratings of different clinical groups. The studies reported in this dissertation represent a contribution to this question.

PART II

CHAPTER V

STUDY 1.

AN EXPERIMENTAL INVESTIGATION OF OSGOOD'S MATHEMATICO - PSYCHOLOGICAL ISOMORPHISM OF MEANING.

THE PROBLEM

It follows from Osgood's isomorphic conception of meaning that common or highly similar representational mediating processes must underlie concepts that "cluster" in the semantic space. A corollary of this statement is that signs or concepts that do not cluster in the semantic space must differ with respect to their underlying representational mediating processes. The validity of such an isomorphism may be tested through an experimental investigation of the following hypotheses:

I. An experimentally produced change in the meaning of one sign in a semantic cluster will be associated with corresponding changes in the meaning of other signs in the cluster.

II. An experimentally produced change in the meaning of a sign will not affect the meaning of signs which do not lie in the semantic vicinity.

RELATED RESEARCH

The reasoning upon which these hypotheses rest draws heavily on the literature on semantic generalization. Kapustnik (39) Smolenskaya (66), Kotliarevsky (42), Metzner (49) and Traugott (82) have all demonstrated that a response conditioned to a non-verbal stimulus such as a colour or tone generalizes to the verbal sign

of the conditioned stimulus. Kapustnik (39) also found that a response conditioned to a verbal sign of an object generalizes back to the object itself. Razran (57), Traugott (82) and Riess (58) obtained sign-to-sign generalization and these three investigators agree that generalization is greater for semantically similar words (synonyms) than for phonetically similar words (homonyms). In a subsequent study Riess (59) qualified his position when he found that in early childhood homonym generalization preceds synonym generalization. This position is however reversed as the child grows older.

These findings would have been predicted from Osgood's two-stage learning theory model. It will be recalled that signs which are variably associated with the same representational mediating process constitute a convergent sign hierarchy. This hierarchy is established by associating a group of signs with the same significate. If we associate one of the signs with a new significate we are, in effect, establishing a new representational mediating process which should now become available to the other signs of the hierarchy. In the studies quoted above, generalization was demonstrated with words whose semantic relationships were clearly of a denotative nature, e.g. STYLE and FASHION. However since Osgood makes no distinction between what might be termed demotative convergent sign hierarchies and connotative convergent sign hierarchies, we should expect the latter type to exhibit the same characteristics of generalization.

It should be noted that the "old" representational mediating process linking a hierarchy of signs does not disappear when a new

common representational process is established. Following Hull (as Osgood does) it is possible to reduce the effective reaction potential of a habit, but it is not possible to remove the habit itself. This means that the new meaning must acquire a higher effective reaction potential if it is to compete successfully.

PROCEDURE

The experimental design comprises a three-stage procedure; firstly the construction of a suitable form of a Semantic Differential Scale; secondly, the establishment of equated groups to be designated Experimental and Control, and thirdly the introduction of the treatment condition.

1. Construction of the Scale

A Semantic Differential Scale was constructed, incorporating the following eighteen concepts (signs) and twenty scales:

Concepts	Scales
LOVE	Beautiful - ugly
MARRIAGE	good - bad
LIFE	happy - sad
INTERCOURSE	active - passive
FATHER	relaxed - tense
MOTHER	clean - dirty
MY REAL SELF	healthy - sick
MY IDEAL SELF	safe - dangerous
MY RELIGION	hot - cold
SOCIALISM	large - small
CAPITALISM	sharp - dull
SUICIDE	deep - shallow
DEATH	strong - weak
HATE	fast - slow
FEAR	hard - soft
GUILT	rational - emotional
DIVORCE	serious - humorous
CORPORAL PUNISHMENT	positive - negative
	interesting - boring
	free - constrained

The considerations governing the selection of concepts were that they should have direct relevance for the major purpose of this dissertation; that they should be reasonably representative of significant areas in the life-pattern of the individual and that (on a pure clinical hunch), some of the concepts would cluster, and others would not.

The selection of the scales was a somewhat difficult task. Osgood (54, p.187) has found that the meaning of scales and their relations to other scales appear to vary with the concept being judged. In particular, his research suggests that the more emotionally loaded the concept being judged, the more the meaning of all scales shifts toward evaluative connotation. If this is so, we can make no assumptions about the factorial composition of our scales, since we can be reasonably certain that the concepts employed are emotionally loaded. This means that we cannot merely select groups of relevant scales that are representative of say, evaluation, activity and potency respectively, and by summing and averaging raw scores derive a semantic structure. The inherent dangers of such a procedure can be demonstrated if, for the sake of argument, we select good-bad, active-passive and strong-weak as being representative of the evaluative, activity and potency dimensions respectively. If, as is quite possible, these three scales are all employed as evaluative, the resultant semantic structure, assumed to be three-dimensional, would in fact be unidimensional. To anticipate this difficulty it was necessary to factorize all raw score matrices. The method used is discussed below and in the Appendix.

The Semantic Differential Scale was prepared in the version

described by Osgood (54, p.81) as Form II. One sheet of paper is used for each concept and all scale judgments are elicited successively. A seven step interval was used for each scale.

As was mentioned above, the experimental design calls for two groups equated in terms of responses to the Semantic Differential. Ideally, equating should be in terms of both means and variance, but this seemed to present an impossible task since each subject produces not one but three hundred and twenty raw scores. The best method of overcoming this difficulty appeared to consist of equating in terms of raw score means for each scale and removing subjects whose scores showed extreme deviations from group trends. This proved to be a relatively simple matter since, as was expected, many of the scales correlated highly among themselves.

The Scale was presented individually to eighty-five paid volunteers - unmarried undergraduates of both sexes enlisted in a first-year psychology course. At the first session the following instructions were given to all subjects.

> "The purpose of this study is to measure the meanings of certain things to various people by having them judge them against a series of descriptive scales. In taking this test, please make your judgments on the basis of what these things mean to <u>you</u>. On each page of this booklet you will find a different concept to be judged and beneath it a set of scales. You are to rate the concept on each of these scales in order.
>
> Here is how you are to use these scales:
>
> If you feel that the concept at the top of the <u>page is very closely related</u> to one end of the scale, you should place your check-mark as follows:
>
> Fair ___ ___ ___ ___ unfair

(The examiner then demonstrated check-marking for the other six positions of quite closely related, only slightly related, neutral, etc.).

Sometimes you may feel as though you have had the same item before on the test. This will not be the case, so do not look back and forth through the items. Make each item a separate and independent judgment. Work at fairly high speed through this test. Do not worry or puzzle over individual items. It is your first impressions that we want. On the other hand, please do not be careless, because we want your true impressions. When you have completed this scale please do not discuss it or anything that has transpired during this session. The success of the experiment depends entirely on the silence of the subjects."

All subjects were then instructed to return two weeks later.

2. Equating of Groups

From the total sample of eighty-five subjects, two equated groups of N = 14 (Experimental) and N = 24 (Controls) were obtained.[1] The matrices of raw-score averages for each of the groups are presented in Tables 1(a) and 1(b) respectively. Osgood (54, p.140) has estimated that a deviation of approximately four-tenths of a scale unit is significant at the five per cent level. Of the 320 pairs of entries in our tables, 25 differ by 0.4 scale units or more. However, this is a crude method for equating the groups. It was necessary to establish that in rating the concepts, the groups did not differ in their use of the scales, and that the groups did not differ with respect to the location of the concepts in the semantic space. The first of these questions called for a dimensional analysis of the scales. Each matrix

---

[1]. The difference in the size of the groups is accounted for by the fact that the post-treatment analysis of Experimental and Controls Groups with N = 30 revealed the possibility of a confounding factor due to sex. The original Experimental Group had nineteen males and eleven females. The removal of females from both groups and subsequent re-equating reduced the size of both samples. The practical difficulties involved did not permit the addition of more Experimental subjects.

of raw scale scores were therefore analyzed by the D-method of factoring. Since a full account of this method is given in Appendix A, it will suffice to note here that in using the D-method, it is assumed that the raw-score matrix defines a space of k dimensions such that each scale i has co-ordinates (x...x...s_{ki}) on the k dimensions. The purpose of the analysis is to obtain co-ordinates on a new set of k' dimensions (where k' is less than k) with minimal residual variance. If this goal is realized it follows that at least two of the scales must have a common dimension. Conversely, if the number of dimensions cannot be reduced, complete inter-scale independence must obtain. This point has a particular bearing on the problem of equating by raw-score matrices, since a difference between a pair of cell-entries for a particular scale and concepts will be of greater significance when the scale is dimensionally unique than when it is highly correlated with other scales in the same matrix.

The results of the D-analyses are presented in Table 2. It will be observed that the first dimension (Dim. I), characterized by such scales as 'happy-sad', 'good-bad' and 'beautiful-ugly' accounted for 57.29% and 56.25% of the total variances in the Experimental and Control matrices respectively. The second dimension (Dim. II), represented by such scales as 'deep-shallow', 'large-small' and 'sharp-dull' accounted for only 25.94% and 23.99% of the total variances in the respective matrices. It was decided not to carry the analyses beyond this point since in only one case ('emotional-rational') did more than 50% of the variance within the individual scales remain unaccounted for. Dimension I was identified as Evaluation and Dimension II suggested Potency. The extent to which the Experimental and Control groups agreed

TABLE 1(a) MEAN RAW SCORE MATRIX
EXPERIMENTAL GROUP (PRE-TREATMENT)

N = 14		1 Beaut. Ugly	2 Bad Good	3 Happy Sad	4 Pass. Act.	5 Relax. Tense	6 Clean Dirty	7 Sick Heal.	8 Safe Dang.	9 Hot Cold	10 Large Small	11 Sharp Dull	12 Shall. Deep	13 Strong Weak	14 Slow Fast	15 Soft Hard	16 Emot. Rat.	17 Hum. Ser.	18 Neg. Posit.	19 Int. Bor.	20 Free Const.
1	C.Pun.	-1.78	0.43	-1.43	-1.71	-1.57	-0.36	0.71	-0.50	0.36	0.50	1.21	-0.21	0.64	-0.50	-1.71	1.43	-1.93	0.00	0.64	-0.86
2	Inter.	1.71	-1.93	1.86	-2.07	0.43	1.43	-1.93	0.43	1.57	0.71	1.28	-1.64	1.64	-0.57	0.50	1.86	-0.28	-1.71	1.78	1.57
3	Life	1.78	-1.86	1.71	-2.07	0.36	1.36	-1.64	0.36	0.78	1.21	1.00	-1.57	1.07	-1.50	-0.93	-0.07	0.93	-1.86	2.36	1.43
4	Guilt	-1.57	1.43	-1.93	-0.14	-1.93	-1.14	1.43	-1.14	-0.21	0.57	0.43	-1.14	0.50	0.14	-0.93	1.71	-1.93	0.50	0.28	-1.86
5	Father	0.71	-1.71	1.50	-1.43	0.50	1.71	-1.07	1.21	0.36	1.14	1.00	-1.43	1.43	0.00	-0.07	-0.64	0.50	-1.43	1.57	0.71
6	Divor.	-1.64	1.71	-1.86	-0.07	-1.71	-0.78	1.00	-0.86	-0.86	0.21	0.21	-0.21	-1.28	0.07	-1.21	0.36	-2.21	0.78	-0.07	-1.28
7	Relig.	0.64	-1.21	0.93	-0.21	0.86	1.36	-0.93	1.07	0.14	0.50	0.21	-1.50	0.78	0.14	-0.36	0.50	-1.28	-1.21	1.36	0.78
8	Real S.	0.28	-0.43	1.43	-1.71	0.64	1.28	-1.93	0.93	0.36	0.36	0.93	-1.43	0.57	-0.86	-0.36	-0.71	0.57	-1.21	0.93	1.28
9	Fear	-1.57	1.43	-1.57	-0.21	-2.36	-0.36	0.86	-1.57	-0.93	0.64	0.64	-0.71	0.07	-0.28	-0.86	1.93	-2.07	1.21	0.78	-1.64
10	Suicide	-2.07	1.93	-2.43	-0.28	-2.21	-0.86	2.00	-1.71	-0.57	0.28	0.36	-0.71	-1.14	-0.36	-0.78	1.71	-2.57	1.43	0.57	-0.50
11	Mother	1.71	-2.36	1.57	-1.28	0.78	1.78	-1.71	1.64	0.71	0.21	0.36	-1.21	0.78	-0.21	1.36	1.43	0.64	-1.64	1.71	0.78
12	Death	-0.86	0.28	-1.86	0.93	0.21	0.36	1.21	-0.07	-1.28	0.21	-0.36	-1.57	0.64	-0.28	-1.07	0.36	-2.00	0.57	0.64	-0.07
13	Hate	-2.43	2.50	-2.50	-1.50	-2.36	-1.64	1.71	-1.93	-0.36	0.21	0.86	-0.64	-0.21	-0.57	-1.36	1.93	-2.57	0.93	0.21	-1.28
14	Marr.	2.14	-2.43	2.57	-2.28	1.57	2.36	-2.50	1.14	1.21	1.21	0.93	-2.14	2.36	-0.28	0.86	1.28	0.28	-2.36	2.28	1.00
15	Ideal S.	1.64	-2.07	2.64	-2.64	2.28	2.57	-3.00	1.21	0.93	1.36	1.50	-2.14	2.36	-1.71	-0.28	-1.00	1.21	-2.43	2.57	2.36
16	Love	2.57	-2.57	2.36	-2.21	1.36	2.28	-2.43	1.07	1.43	1.50	1.36	-2.36	2.36	-0.57	1.36	2.07	-0.78	-2.28	2.43	1.93

TABLE 1 (b) MEAN RAW SCORE MATRIX - CONTROL GROUP (PRE-TREATMENT)

= 24	1 Beaut. Ugly	2 Bad Good	3 Happy Sad	4 Pass. Act.	5 Relax Tense	6 Clean Dirty	7 Sick Heal.	8 Safe Dang.	9 Hot Cold	10 Large Small	11 Sharp Dull	12 Shall Deep	13 Strong Weak	14 Slow Fast	15 Soft Hard	16 Emot. Rat.	17 Hum. Ser.	18 Neg. Posit.	19 Int. Bor.	20 Free Const.
C. Pun	-1.92	0.67	-1.21	-1.29	-1.96	-0.29	0.33	-0.75	0.21	0.54	1.42	-0.33	0.75	-0.46	-1.75	0.75	-2.21	-0.04	0.04	-1.04
Inter.	1.75	-2.13	1.71	-2.21	0.46	1.79	-1.96	0.71	1.29	0.92	0.92	-1.50	1.38	-0.50	0.46	2.04	-0.63	-1.88	1.50	1.17
Life	1.79	-1.92	1.17	-2.08	0.21	1.33	-1.75	0.75	0.50	1.25	0.96	-1.96	1.04	-0.92	-0.29	-0.08	0.08	-2.00	2.29	1.00
Guilt	-1.75	1.46	-2.13	0.33	-2.13	-1.17	1.54	-1.29	-0.29	0.50	0.42	-1.00	0.79	0.00	-0.92	0.96	-2.25	0.29	0.21	-1.92
Father	1.00	-2.00	1.08	-1.29	0.13	1.67	-1.08	1.46	0.13	0.96	0.67	1.46	1.75	-0.21	-0.21	-0.79	0.04	-1.38	1.38	0.58
Divor.	-1.46	1.67	-1.79	-0.04	-1.71	-0.75	1.29	-0.96	-0.83	0.33	0.17	-0.17	-1.42	0.17	-1.42	0.21	-2.50	0.88	-0.13	-1.13
Relig.	0.71	-1.33	0.96	-0.33	0.96	1.50	-1.00	1.08	0.33	0.71	-0.08	-1.63	0.79	0.46	-0.13	0.67	-1.58	-0.83	1.46	0.58
Real. S.	0.00	-0.50	1.21	-1.58	0.13	1.38	-1.96	0.83	0.50	0.42	1.00	-1.54	0.38	-0.96	0.33	-0.75	0.29	-1.08	0.79	1.13
Fear	-1.71	1.54	-1.29	0.38	-2.50	-0.38	1.00	-1.71	-0.83	0.46	0.58	-0.96	0.08	-0.21	-0.79	1.83	-2.13	1.50	0.75	-1.50
0 Suicide	-1.96	2.00	-2.38	0.08	-2.08	-0.83	2.13	-1.75	-0.79	0.21	-0.08	-0.63	-1.04	-0.54	-0.75	1.54	-2.50	1.63	0.67	-0.67
1 Mother	1.83	-2.46	1.38	-1.13	0.92	2.17	-1.67	1.83	0.79	0.33	0.50	-1.08	0.92	-0.08	1.25	1.63	0.54	-1.33	1.79	0.71
2 Death	-0.42	0.21	-1.42	1.29	0.50	0.54	0.42	0.17	-1.42	0.46	-0.50	-1.92	0.75	-0.58	-0.83	0.67	-1.96	0.04	0.67	-0.04
3 Hate	-2.46	2.58	-2.29	-1.21	-2.42	-1.58	1.63	-2.08	0.33	-0.25	0.92	-0.54	0.13	-0.33	-1.54	2.08	-2.50	1.08	-0.29	-1.13
4 Marr	2.29	-2.54	2.54	-2.38	1.38	2.21	-2.42	1.29	1.50	1.42	1.00	-2.38	2.00	-0.54	1.04	1.42	-0.38	-2.46	2.17	1.21
5 Ideal S.	1.54	-1.96	2.50	-2.54	2.17	2.54	-2.75	1.38	0.88	1.88	1.83	-2.04	2.54	-1.83	-0.38	-0.83	0.46	-2.50	2.38	2.38
6 Love	2.58	-2.54	2.38	-2.04	1.29	2.25	-2.13	1.17	1.54	1.71	1.25	-2.42	2.38	-0.58	1.13	-2.38	-0.29	-2.25	2.21	1.71

TABLE 2. D^2 - ANALYSES ; EXPERIMENTAL AND CONTROL (PRE-TREATMENT)

	1 Beaut. Ugly	2 Good Bad	3 Happy Sad	4 Act. Pass.	5 Rel. Tense	6 Clean Dirty	7 Heal. Sick	8 Safe Dang.	9 Hot Cold	10 Large Small	11 Sharp Dull	12 Shall. Deep	13 Strong Weak	14 Slow Fast	15 Soft Hard	16 Emot. Rat.	17 Ser. Hum.	18 Pos. Neg.	19 Int. Bor.	20 Free Const.	
EXPERIMENTAL																					
$EXij^2$	45.60	51.38	60.47	38.46	37.03	36.57	48.90	21.80	12.11	10.46	12.75	32.96	28.19	7.60	15.50	29.20	39.55	36.28	36.43	28.59	
(1) C_{Ii}	6.51	6.79	7.77	3.39	5.41	5.39	6.78	4.23	2.97	1.52	1.41	-2.53	3.88	-1.04	2.61	-1.17	4.47	-5.53	3.56	4.87	
(2) C_{IIi}	0.05	-1.17	0.00	-3.99	0.85	-2.40	-1.32	-0.03	-0.52	-2.62	-2.62	5.16	-3.06	2.04	1.49	-3.62	3.82	-1.40	-4.65	-0.81	
(3) % Var. Dim I	92.94	89.72	100.00	29.88	79.04	79.44	94.01	82.06	72.83	22.08	15.61	19.42	53.39	14.21	43.94	4.69	50.52	84.29	34.78	82.97	% Total Var. = 57.29
(4) % Var. Dim II	0.00	2.67	0.00	41.39	1.94	15.75	3.56	0.00	2.23	65.58	53.80	80.79	33.20	54.74	14.32	44.86	36.89	5.40	59.35	2.31	% Total Var. = 25.94
(5) % Resid. Var.	7.06	7.61	0.00	28.73	19.02	4.81	2.43	17.94	24.94	12.34	30.59	0.00	13.41	31.05	41.74	50.45	12.59	10.31	5.87	14.72	% Total Var. = 16.77
CONTROL																					
$EXij^2$	47.27	55.48	51.91	36.09	38.32	38.66	46.17	26.83	12.57	13.78	13.05	36.53	28.66	7.28	16.72	28.55	40.79	37.36	32.22	24.90	
(1) C_{Ii}	6.51	7.02	7.20	3.81	5.34	5.46	+6.52	4.72	2.87	2.03	1.45	-2.60	3.61	-0.96	2.88	-0.46	3.91	-5.46	3.49	4.63	
(2) C_{IIi}	-0.19	-1.27	0.00	-3.15	1.13	-2.63	-1.49	-0.17	-0.49	-2.85	-2.30	5.46	-3.22	1.75	1.28	-3.35	4.64	-2.17	-4.23	-0.18	
(3) % Var. Dim I	89.66	88.82	100.00	40.23	74.43	77.11	92.07	83.04	65.55	29.90	16.09	18.52	45.46	12.64	49.58	0.73	37.48	79.79	37.80	86.10	% Total Var = 56.25
(4) % Var. Dim II	0.06	2.90	0.00	27.49	3.34	17.91	4.81	0.11	1.91	58.93	40.54	81.48	36.18	42.03	9.81	38.89	52.78	12.61	47.89	0.12	% Total Var. = 23.99
(5) % Resid. Var.	10.28	8.28	0.00	32.28	22.23	4.98	3.12	16.85	32.54	11.17	43.37	0.00	18.36	45.33	40.61	60.38	9.74	7.60	14.31	13.78	% Total Var. = 19.76

with respect to their use of the scales is illustrated in Fig. 7. Here the co-ordinate values (CI, CII) for each scale in Table 2 have been plotted. It will be observed that almost perfect agreement exists between the semantic structures. The degree of similarity between the dimensional characteristics of these structures was determined statistically by applying Burt's Coefficient of Proportionality, 'e', (5) to the co-ordinate values, paired by scale, of Experimental and Control groups. The formula for this co-efficient is:

$$e_{ij} = \frac{\sum_k f_{ki} \; g_{kj}}{\sqrt{\left(\sum_k f_{ki}^2\right)\left(\sum_k g_{kj}^2\right)}}$$

where f_{ki} and g_{kj} represent the respective co-ordinates of the kth variable on the i-th and j-th dimensions obtained from the two analyses. For Dimension I, the obtained 'e' value was 0.997 and for Dimension II 'e' = 0.987. Although significance estimates are not available for this statistic, it would appear that since 'e' can be no greater than $\pm$ 1.00, the obtained co-efficients may be considered high enough to warrant the conclusion that the scales were used in the same way by both the Experimental and Control Groups.

The final step in the equating process involved a comparison of the two groups with respect to the meaning of the concepts. Since the D-analyses of the raw-score matrices indicated that the two principal dimensions of meaning were Evaluation (Dim. I) and Potency (Dim. II), it was decided to employ representative scales from each

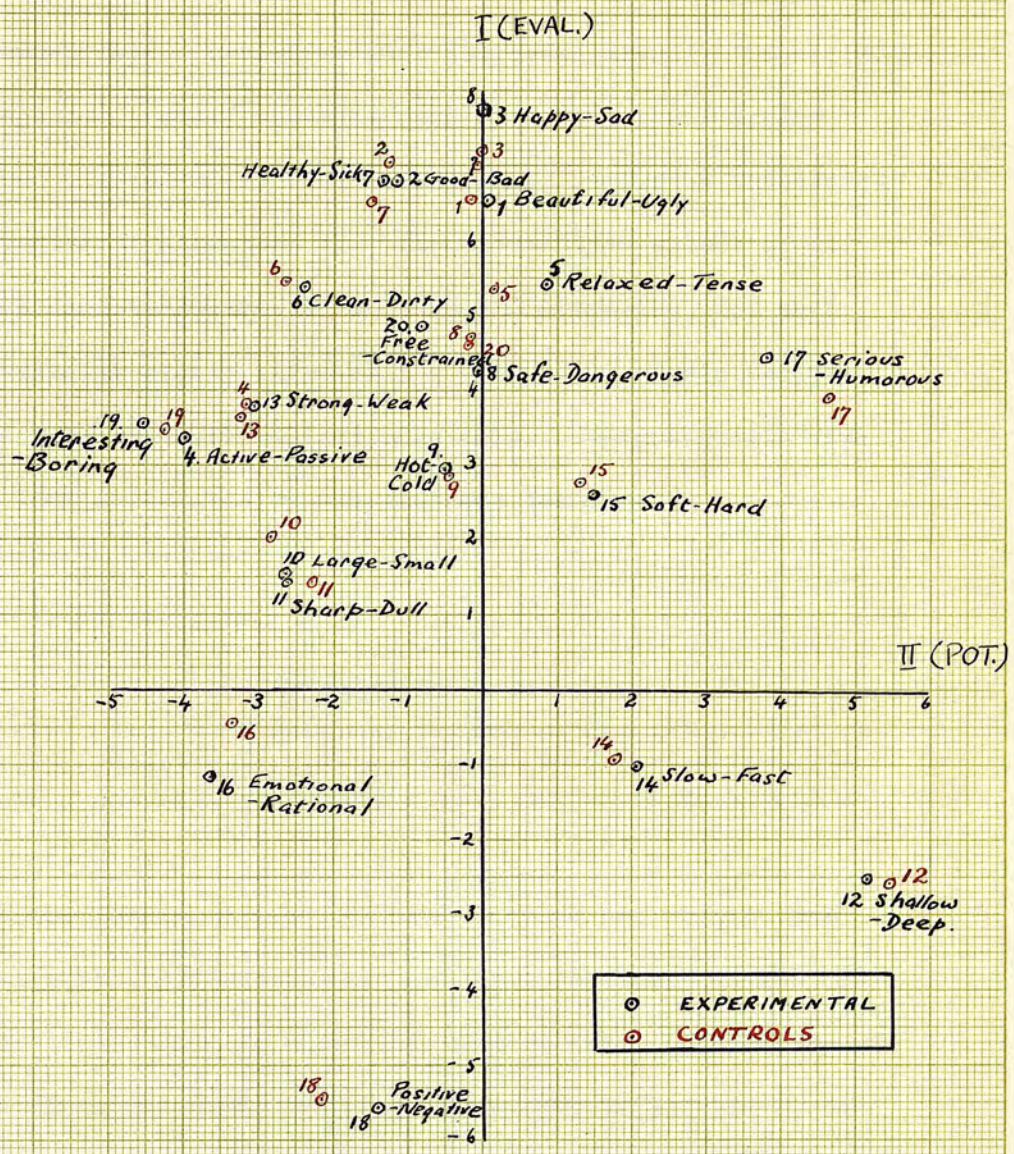

FIGURE 7.

TWO-DIMENSIONAL SEMANTIC STRUCTURE OF THE DIFFERENTIAL SCALES: EXPERIMENTAL VERSUS CONTROLS

of these dimensions. From Dimension I the following ten scales were selected, 'beautiful-ugly,' 'good-bad', 'happy-sad', 'relaxed-tense', 'clean-dirty', 'healthy-sick', 'safe-dangerous', 'hot-cold', 'positive-negative', and 'free-constrained'. Only three scales, 'deep-shallow', 'large-small', and 'sharp-dull' could be considered as representative of Dimension II. The co-ordinate values of all concepts were then calculated by summing and averaging, for each group, the mean raw-scores obtained for each scale within the representative sets (see Tables 1(a) and 1(b)). Concept-Origin distances were then calculated by the distance formula.

$$D_{il} = \sqrt{\sum_{j} d_{il}^{2}}$$

where D_{il} is the linear distance between concept and Origin, and d_{il} is the algebraic difference between the co-ordinate of the concept on a particular dimension and the corresponding co-ordinate of the Origin. Since the co-ordinate values of the Origin are by definition zero, the application of this formula involves no more than determining the square root of the sums of the squares of the co-ordinate values obtained for Dimensions I and II respectively.[1.] The results of this operation are presented in Table 3.

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1. Thus, for example, the distance between the concept 'Corporal punishment' and the Origin is, in the case of the Experimental Group

$$\sqrt{(-0.80 - 0)^2 + (0.64 - 0)^2}$$

or simply

$$\sqrt{(0.80)^2 + (0.64)^2} \left(= 1.02\right)$$

TABLE 3 CONCEPT CO-ORDINATE VALUES AND CONCEPT - ORIGIN DISTANCES: EXPERIMENTAL V.CONTROL (PRE-TREATMENT)

	EXPERIMENTAL			CONTROL		
CONCEPTS	Dim.I	Dim.II	Concept-Origin Dist.	Dim.I	Dim.II	Concept-Origin Dist.
(A) Non-Cluster						
Intercourse	1.46	1.21	1.90	1.49	1.11	1.86
Life	1.31	1.26	1.82	1.24	1.39	1.86
Father	1.09	1.19	1.61	1.05	1.03	1.47
Religion	0.91	0.74	1.17	0.93	0.75	1.20
My Real Self	0.98	0.91	1.34	0.87	0.99	1.32
Mother	1.47	0.59	1.58	1.51	0.64	1.64
Marriage	1.93	1.43	2.40	1.98	1.60	2.55
My Ideal Self	2.11	1.67	2.69	2.06	1.92	2.82
Love	2.03	1.74	2.67	1.98	1.79	2.67
(B) Cluster						
Corporal Punish.	-0.80	0.64	1.02	-0.79	0.76	1.10
Guilt	-1.31	0.71	1.49	-1.40	0.64	1.54
Divorce	-1.25	0.21	1.27	-1.25	0.22	1.27
Fear	-1.35	0.66	1.50	-1.40	0.67	1.55
Suicide	-1.57	0.45	1.63	-1.62	0.25	1.64
Death	-0.56	0.47	0.73	-0.28	0.63	0.69
Hate	-1.76	0.57	1.85	-1.69	0.40	1.74

No assumptions can be made concerning the distribution of either the co-ordinate values or the concept origin distances in a semantic space. For equating purposes it was therefore necessary to employ non-parametric techniques. Since the observations are paired, Wilcoxon's Sign-Rank Test of Differences (17, p.251) is applicable. However, since seven of the sixteen pairs of Dimension I co-ordinate values were negative in sign, it was necessary to consider separately the seven concepts involved.

The nature of this problem is readily appreciated by reference to Fig.8(a) in which all concepts are plotted for each group. It will be noted that 'Corporal Punishment', 'Guilt', 'Divorce', 'Fear', 'Suicide',

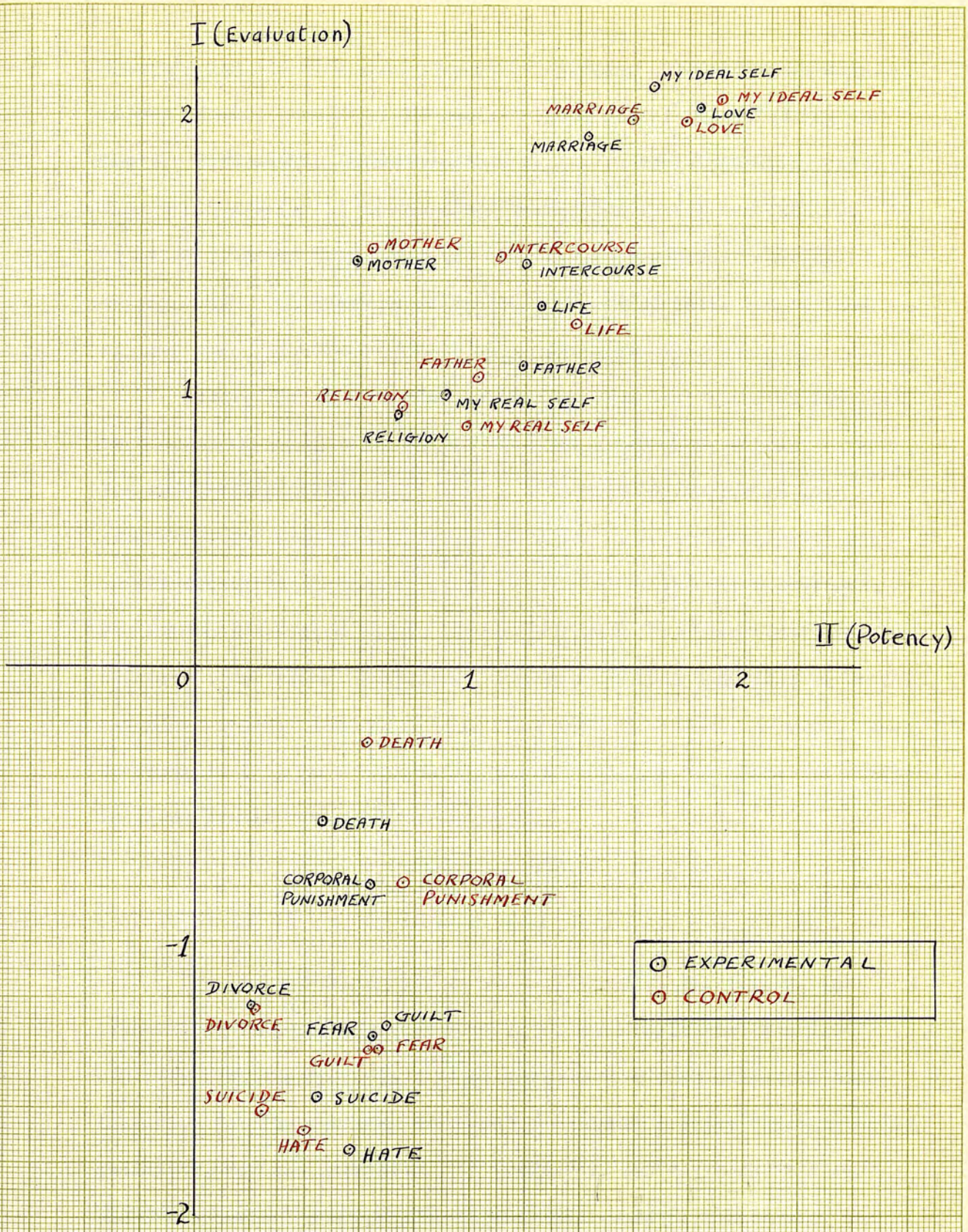


FIGURE 8 (a)
SEMANTIC STRUCTURES OF CONCEPTS:
EXPERIMENTAL VERSUS CONTROL
(PRE-TREATMENT)

'Death', and 'Hate' lie in a negative quadrant and their co-ordinate values cannot, therefore, be pooled with those of the remaining concepts. Fortunately, these concepts fulfilled the expectation that they would cluster in the semantic space, and it follows that for equating purposes they would have had to be considered separately in any case. For these reasons, the concepts in Table 3 have been divided into "Non-Cluster" and "Cluster" respectively.

The application of Wilcoxon's Sign Rank Test involves ranking by size all non-zero differences between paired observations (rank I for the smallest difference). All ranks that correspond to differences whose signs (positive or negative) are in the minority within the total set are then summed arithmetically to give a statistic T. The hypothesis tested is that the differences are symmetrically distributed about a mean difference of zero. If this hypothesis is true, T would coincide with the mean of such sums of randomly selected ranks, $\bar{T}$, which in turn is also half the sum of N successive ranks and which is given by the formula:

$$\bar{T} = \frac{N (N + 1)}{4}$$

(17, p.252)

The greater the deviation between T and $\bar{T}$, the less is the probability that the hypothesis is true, and the greater the probability that the two sets of observations come from different populations. For the purposes of equating we would require that for each dimension, for the concept-origin distances, and for both "Cluster" and "Non-Cluster" concepts, the hypothesis would be upheld with respect to the Experimental and Control Groups. The application of

Wilcoxons' Sign-Rank Test produced the findings summarized in Table 4 below. For the purposes of comparison, T-values required for significance at the .05, .02 and .01 levels are also included.

TABLE 4. APPLICATION OF WILCOXON'S SIGN-RANK TEST OF DIFFERENCES TO EXPERIMENTAL AND CONTROL CONCEPT CO-ORDINATE VALUES AND CONCEPT-ORIGIN DISTANCES (PRE-TREATMENT)

Experimental Versus Control	N	Expected $\bar{T}$	Observed $\bar{T}$ Values	Significant T-Values		
				.05	.02	.01
'Non Cluster'						
Dimension I	9	22.5	11.5	6	3	2
Dimension II	9	22.5	12.0	6	3	2
Concept-Origin	8	18.0	11.5	4	2	0
'Cluster'						
Dimension I	6	10.5	10	0	-	-
Dimension II	7	14.0	12	2	0	-
Concept-Origin	6	10.5	8	0	-	-

Ideally there would be perfect correspondence between the expected and observed $\bar{T}$-values to ensure perfect equating of the Experimental and Control Groups. While this condition has been closely approximated with respect to the "Cluster" concepts, there are considerable differences between the observed and expected $\bar{T}$-values for the 'Non-Cluster' concepts. However since none of these differences approximate significance, it is possible to conclude, albeit with caution, that the groups are equated.

3. Treatment

From the analyses carried out in the second stage of the procedure, a number of concepts appeared to form a distinct "cluster" in the semantic space (see Table 3 and Fig.8(a)). Having identified the dimensional characteristics of this cluster, the concept "Suicide" was selected as the independent variable and two weeks after the first administration of the Semantic Differential Scale, each subject in the Experimental Group was given the following instructions:

> "I would like you to repeat the Scale you completed at the first session, but before you do, I would like to mention one of the concepts, rated by you. Concerning this concept, 'Suicide', I would like to impress on you that suicide may have certain positive attributes. For example, in Japan, suicide represents the greatest sacrifice an individual can make for family or national honour. On occasion, in our own society, the reputations of families and businesses have been preserved by opportune suicides. Finally, suicide for some individuals offers the only means of relief from an intolerable existence, regardless of how right or how wrong such an action may be in the eyes of society. I should like you to bear in mind what I have said when you rate this concept. However, the ratings you give must still reflect your own personal views. To ensure that you have understood, I shall repeat what I have said."

The intention of these instructions was to develop, by suggestion, a more favorable reaction on the subject's part to the concept in question. The major hypothesis of this study states in effect that an experimentally produced change in the meaning of a concept will be associated with corresponding changes in the meanings of only those concepts that have a similar connotative meaning. The specific prediction advanced here is that if the Experimental subjects did react more favorably to the concept 'Suicide' they would also react more favorably to the concepts 'Corporal Punishment', 'Guilt', 'Divorce', 'Fear', 'Death', and 'Hate'.

No such associated changes would occur with respect to the other ('Non-Cluster') concepts in the Scale. The success of the treatment and the evidence for or against the hypothesis were assessed through comparison with the Controls who repeated the Scale under the identical conditions present during the first testing session.

RESULTS

To ensure that the dimensional characteristics of the scales had not changed through the effects of time or treatment, D^2 analyses were carried out on the mean raw-score matrices (Tables 5(a) and 5(b)) of the Experimental (Post-Treatment) and Control (Repeat) Groups respectively. The findings of these analyses are presented in Table 6. Burt's Co-efficient of Proportionality was again used to determine the extent to which the Control and Experimental (Post-Treatment) groups agreed in their use of the scales. The obtained 'e' co-efficients were 0.980 and 0.987 for Dimensions I and II respectively. An opportunity was also afforded for determining the test-re-test reliability of the dimensional characteristics of the scales. For the Experimental Group Burt's 'e' co-efficients were 0.969 and 0.975 for Dimensions I and II respectively; for the Controls the corresponding co-efficients were 0.998 and 0.990. These co-efficients are of high enough order to suggest the dimensional characteristics of the scales remained constant both within and between groups.

Concept co-ordinate values for all concepts were determined by employing the same scales as those used in the final step in the equating process. For Dimension I these were 'beautiful-ugly', 'good-bad', 'happy-sad', 'relaxed-tense', 'clean-dirty', 'healthy-sick', 'safe-dangerous', 'hot-cold', 'positive-negative', and 'free-constrained'.

TABLE 5(b) MEAN RAW SCORE MATRIX
CONTROL (REPEAT) GROUP (N=24)

	1 Beaut. Ugly	2 Bad Good	3 Happy Sad	4 Pass. Act.	5 Relax Tense	6 Clean Dirty	7 Sick Heal.	8 Safe Dang.	9 Hot Cold	10 Large Small	11 Sharp Dull	12 Shall. Deep	13 Strong Weak	14 Slow Fast	15 Soft Hard	16 Emot. Rat.	17 Hum. Ser.	18 Neg. Posit.	19 Int. Bor.	20 Free Const.
1 C. Pun.	-1.83	0.75	-1.58	-1.13	-2.04	-0.54	0.58	-0.58	0.17	0.42	0.92	-0.04	-0.04	-0.21	-1.58	0.29	-2.42	0.38	0.08	-0.92
Inter.	1.79	-2.08	1.88	-2.00	0.83	1.71	-2.08	0.79	1.17	0.71	1.17	-1.58	1.21	-0.58	0.58	1.71	-0.21	-1.96	2.13	1.17
3 Life	1.71	-1.92	1.29	-1.75	-0.13	1.29	-1.71	0.29	0.50	1.58	0.96	-1.79	-1.17	-0.79	-0.54	0.00	-0.13	-2.00	2.33	1.04
4 Guilt	-1.79	1.58	-1.96	0.38	-2.08	-0.92	1.38	-1.38	-0.38	0.38	0.21	-1.13	-0.29	0.17	-1.00	1.04	-2.17	0.71	-0.04	-1.63
5 Father	1.00	-1.67	0.75	-1.46	0.50	1.54	-1.38	1.50	0.25	0.79	-0.88	-1.46	1.79	-0.29	-0.13	-0.50	-0.04	-1.33	1.33	0.38
6 Divor.	-1.79	1.58	-2.29	0.21	-1.67	-0.75	1.50	-0.96	-0.54	0.21	0.04	-0.08	-1.29	0.46	-1.08	0.17	-2.33	1.29	-0.17	-1.21
7 Relig.	0.71	-1.13	0.79	-0.63	0.71	1.42	-0.71	1.04	0.13	0.38	0.13	-1.33	0.42	0.33	0.25	-0.25	-1.25	-0.92	1.21	0.21
8 Real S.	0.29	-0.67	1.42	-1.58	0.50	1.33	-1.88	0.71	0.33	0.63	0.96	-1.46	0.63	-0.71	0.17	-0.42	0.08	-1.29	1.17	0.83
9 Fear	-1.63	1.42	-1.63	0.46	-2.50	-0.58	1.42	-1.42	-0.79	0.00	0.29	-0.75	-0.21	-0.29	-0.50	1.79	-2.17	1.71	0.63	-1.67
10 Suicide	-2.13	1.88	-2.58	-0.25	-2.21	-0.96	2.25	-1.75	-0.42	0.42	0.42	-0.29	-0.96	-0.58	-0.96	1.75	-2.58	1.63	0.46	-0.96
11 Mother	1.46	-2.13	1.67	-1.21	0.50	1.92	-1.58	1.58	0.63	0.42	0.88	-1.17	0.79	-0.17	1.25	1.29	0.50	-1.63	1.54	0.42
12 Death	-0.29	-0.21	-1.33	1.29	0.46	1.21	0.79	-0.21	-0.92	0.83	-0.21	-1.96	0.58	-0.46	-0.58	-0.13	-2.04	-0.42	0.96	-0.17
13 Hate	-2.67	2.67	-1.83	-0.33	-2.42	-1.38	1.92	-2.17	-0.08	-0.17	0.67	-0.75	-0.29	-0.21	-1.38	1.92	-2.42	1.67	-0.29	-1.54
14 Marr.	2.08	-2.29	2.17	-2.04	1.38	1.96	-1.96	1.33	1.04	1.13	-0.83	-2.13	-1.75	-0.42	0.67	1.25	-0.17	-2.17	2.04	0.79
15 Ideal S.	1.63	-2.00	2.33	-2.25	1.71	2.38	-2.58	1.08	0.67	1.38	1.50	-2.08	2.13	-1.50	-0.13	-0.67	0.79	-2.50	2.25	2.00
16 Love	2.33	-2.21	2.00	-1.71	1.33	1.79	-2.04	0.88	1.08	1.25	0.83	-2.00	1.71	-0.25	0.83	2.08	-0.29	-2.04	2.04	1.46

TABLE 5(a) MEAN RAW SCORE MATRIX –
EXPERIMENTAL (POST-TREATMENT) GROUP (N=14)

		1 Beaut. Ugly	2 Bad Good	3 Happy Sad	4 Pass. Act.	5 Relax. Tense	6 Clean Dirty	7 Sick Heal.	8 Safe Dang.	9 Hot Cold	10 Large Small	11 Sharp Dull	12 Shall. Deep	13 Strong Weak	14 Slow Fast	15 Soft Hard	16 Emot. Rat.	17 Hum. Ser.	18 Neg. Posit.	19 Int. Bor.	20 Free Const.
1	C.Pun.	-1.36	0.50	-1.36	-1.50	-1.36	-0.28	0.64	-0.71	0.43	0.50	0.43	-0.28	0.00	-0.28	-1.36	1.28	-1.71	0.28	0.00	-1.21
2	Inter.	1.64	-2.00	1.86	-1.78	0.14	1.36	-1.86	0.28	1.28	0.93	1.36	-1.50	1.43	-1.14	0.64	1.71	-0.07	-1.64	1.78	1.43
3	Life	1.64	-1.64	1.71	-1.93	0.21	1.28	-1.57	0.43	0.64	1.21	0.93	-1.78	1.64	-0.86	-0.21	-0.07	0.64	-1.71	2.36	1.28
4	Guilt	-1.43	1.36	-1.50	0.00	-1.86	-1.14	1.50	-1.14	-0.43	0.21	0.00	-0.78	0.36	0.28	-0.43	1.36	-1.71	1.14	0.21	-1.93
5	Father	0.86	-1.64	1.71	-1.28	0.86	1.28	-1.21	1.14	0.50	0.86	0.93	-1.36	1.36	0.00	0.00	-0.57	0.64	-1.86	1.57	0.78
6	Divorce	-1.28	1.21	-1.64	0.00	-1.43	-0.21	0.86	-0.64	-0.78	0.21	-0.14	-0.21	-0.57	0.07	-1.07	0.50	-2.07	1.14	-0.28	-1.43
7.	Relig.	1.00	-1.43	1.14	-0.28	0.93	1.14	-1.00	1.07	0.28	0.64	0.14	-1.71	0.78	0.21	0.00	0.64	-1.43	-1.00	1.43	0.78
8	Real S.	0.50	-0.50	1.57	-1.86	0.43	1.28	-2.00	0.93	0.78	0.28	0.86	-1.28	0.50	-0.57	-0.28	-0.78	0.64	-1.14	1.07	1.43
9	Fear	-1.71	1.14	-1.50	-0.14	-2.14	-0.28	0.93	-1.36	0.00	0.00	0.57	-0.64	-1.00	-0.36	0.00	1.78	-1.86	1.00	0.50	-1.64
10	Suicide	-1.00	0.93	-1.28	0.07	-2.00	-0.14	1.78	-0.78	-0.36	0.36	0.14	-1.00	-1.14	-0.36	-0.43	1.86	-2.00	1.07	0.14	-1.00
11	Mother	1.64	-2.00	1.78	-0.64	0.78	1.50	-1.28	1.21	0.86	0.28	0.86	-1.64	1.07	0.00	1.36	1.64	0.64	-1.00	1.64	0.93
12	Death	-0.78	0.14	-1.50	1.36	0.36	0.50	1.21	0.36	-1.21	0.36	-0.21	-1.43	-0.21	0.50	-0.43	0.07	-1.86	0.64	0.21	0.00
13	Hate	-2.28	2.36	-2.36	-0.93	-2.14	-1.36	1.64	-2.00	-0.36	0.21	0.78	-0.64	-0.14	-0.50	-1.00	1.71	-1.86	1.07	0.21	-1.36
14	Marr.	2.00	-2.28	2.36	-2.28	1.78	1.36	-2.28	1.28	1.28	1.36	1.14	-2.14	1.78	-0.43	1.00	1.36	0.14	-2.14	2.07	1.21
15	Ideal S.	1.57	-2.00	2.64	-2.28	2.00	2.00	-2.57	1.28	0.78	1.14	-1.64	-1.78	2.14	-1.50	-0.28	-1.36	1.00	-2.36	1.93	1.86
16	Love	2.28	-2.14	2.14	-2.00	1.64	1.86	-2.28	0.93	1.21	1.64	1.21	-2.21	2.21	-0.71	1.36	2.21	0.50	-2.43	2.36	1.78

TABLE 6 D^2 - ANALYSES - EXPERIMENTAL (POST-TREATMENT) AND CONTROLS (REPEAT)

	1 Beaut. Ugly	2 Good Bad	3 Happy Sad	4 Act. Pass.	5 Rel. Tense	6 Clean Dirty	7 Heal Sick	8 Safe Dang.	9 Hot Cold	10 Large Small	11 Sharp Dull	12 Deep Shall.	13 Strong Weak	14 Slow Fast	15 Soft Hard	16 Emot. Rat.	17 Ser. Hum.	18 Pos. Neg.	19 Int. Bor.	20 Free Const.	
EXPERIMENTAL II																					
$EXij^2$	36.99	40.77	51.86	31.87	32.96	23.24	42.61	17.98	10.14	10.12	11.73	31.75	24.04	6.27	9.86	28.84	29.47	34.80	31.14	28.68	
(1) CIi	5.89	+6.10	7.20	+3.69	4.93	4.28	+6.35	3.80	2.72	1.93	2.15	3.02	4.16	-1.31	2.10	-0.68	3.81	+5.65	4.12	5.06	
(2) C_{IIi}	0.11	-0.94	0.00	-2.75	1.07	-1.74	-0.45	0.06	-0.53	-2.25	-2.11	4.76	-1.80	1.02	0.39	-4.03	3.42	-1.14	-3.61	0.07	
(3) % Var. Dim I	93.78	91.27	100.00	42.74	73.73	78.83	94.63	80.31	72.98	36.76	39.39	28.72	72.00	27.43	44.73	1.60	49.27	91.72	54.50	89.26	% Total Var = 63.18
(4) % Var. Dim II	0.32	2.16	0.00	23.72	3.46	13.04	0.47	0.00	2.76	50.00	37.94	71.28	13.48	16.59	1.52	56.31	39.39	3.74	41.84	0.00	% Total Var. = 18.90
(5) % Resid. Var.	5.90	6.57	0.00	33.54	22.81	8.13	4.90	19.69	24.26	13.24	22.67	00.00	14.52	55.98	53.75	42.09	11.34	4.54	3.66	10.74	% Total Var. = 17.92
CONTROL II																					
$EXij^2$	46.42	49.47	51.34	29.21	37.04	33.47	46.23	23.74	7.02	10.35	10.05	32.30	20.89	5.14	11.53	22.58	40.00	40.76	31.98	21.34	
(1) C_{Ii}	6.51	6.52	7.16	3.57	5.33	4.79	6.57	4.32	2.24	1.43	1.33	-2.30	3.63	-0.89	2.67	-0.58	4.32	5.80	3.39	4.30	
(2) C_{IIi}	-0.25	-1.43	0.00	-2.75	0.98	-2.82	-1.14	-0.13	-0.40	-2.62	-2.16	5.20	-1.93	1.39	1.28	-2.60	4.18	-2.13	-4.36	-0.02	
(3) % Var. Dim I	91.30	85.93	100.00	43.62	76.70	68.54	93.36	78.60	71.51	19.71	17.61	16.38	63.09	15.37	61.84	1.51	46.65	82.53	35.93	86.64	% Total Var. = 57.84
(4) % Var. Dim II	0.15	4.12	0.00	25.88	2.59	23.75	2.81	0.08	2.28	66.28	44.48	83.72	17.81	37.55	14.22	29.94	43.68	11.14	59.44	0.00	% Total Var. = 23.50
(5) % Resid. Var.	8.55	9.95	0.00	30.50	20.71	7.71	3.83	21.32	26.21	14.01	37.91	00.00	19.10	47.08	23.94	68.55	9.67	6.33	4.63	13.36	% Total Var. = 18.66

For Dimension II, the representative scales selected were 'deep-shallow', 'large-small', and 'sharp-dull'. As before the raw scale scores for each concept were summed and averaged across each set of representative scales on Dimensions I and II. The co-ordinate values obtained from this operation are presented, together with concept-origin distances, in Table 7. Wilcoxon's Sign-Rank Test of Differences was applied to co-ordinate values and concept-origin distances. The results, summarized in Table 8, bear out the prediction made in Hypothesis II in that no significant differences were found between Experimental and Control Groups with respect to the Non-Cluster Concepts. Of the Cluster-Concept variables, only the Concept-Origin distances appeared to differ in the predicted direction (significant at .05 level). However it will be observed that the T-values computed for Dimensions I and II are substantially smaller than the corresponding T-values for the Pre-Treatment conditions (See Table 4, p.64).

As a check on these findings, Wilcoxon's Sign Test was applied to the test-re-test scores of the Experimental and Control groups respectively. The hypotheses tested here are that no significant differences between Control (Pre-Treatment) and Control (Post-Treatment) with respect to all concept co-ordinate values and concept origin distances; and that for the Experimental Group, the 'Cluster' concept co-ordinate values and concept co-ordinate values will be significantly less in the Post-Treatment conditions than the corresponding values and distances in the Pre-Treatment conditions. No such differences should obtain with respect to the Non-Cluster concepts. The results of this analysis are presented in Table 9.

TABLE 7 CONCEPT CO-ORDINATE VALUES AND CONCEPT-ORIGIN DISTANCES: EXPERIMENTAL V. CONTROL (POST-TREATMENT)

Concepts	Experimental			Control		
	Dim.I	Dim.II	Concept-Origin Dist.	Dim.I	Dim.II	Concept-Origin Dist.
(A) Non-Cluster						
Intercourse	1.35	1.26	1.85	1.55	1.15	1.93
Life	1.21	1.31	1.78	1.16	1.44	1.85
Father	1.18	1.05	1.58	1.03	1.04	1.46
Religion	0.98	0.83	1.28	0.78	0.61	0.99
My Real Self	1.06	0.81	1.37	0.93	1.02	1.38
Mother	1.30	0.93	1.60	1.35	0.82	1.58
Marriage	1.80	1.55	2.37	1.72	1.36	2.19
My Ideal Self	1.91	1.52	2.44	1.89	1.65	2.51
Love	1.87	1.69	2.52	1.72	1.33	2.17
(B) Cluster						
Corporal Punish.	-0.73	0.40	0.83	-0.90	0.46	1.01
Guilt	-1.34	0.33	1.38	-1.38	0.57	1.49
Divorce	-1.06	0.09	1.06	-1.36	0.11	1.36
Fear	-1.17	0.40	1.24	-1.48	0.35	1.52
Suicide	-1.03	0.50	1.14	-1.68	0.38	1.72
Death	-0.43	0.53	0.69	-0.10	0.86	0.87
Hate	-1.69	0.54	1.77	-1.84	0.42	1.89

TABLE 8 APPLICATION OF WILCOXON'S SIGN-RANK TEST OF DIFFERENCES TO EXPERIMENTAL AND CONTROL CONCEPT CO-ORDINATE VALVES AND CONCEPT-ORIGIN DISTANCES (POST-TREATMENT)

Experimental Versus Control	N	$\bar{T}$	Observed T-Values	Significant T-Values		
				.05	.02	.01
'Non-Cluster'						
Dimension I	9	22.5	11.0	6	3	2
Dimension II	9	22.5	16.0	6	3	2
Concept-Origin	9	22.5	13.0	6	3	2
'Cluster'						
Dimension I	6[1]	10.5	6	0	-	-
Dimension II	6	10.5	7	0	-	-
Concept-Origin	6	10.5	0	0	-	-

1. The independent variable 'Suicide' is, of course, excluded from this analysis.

TABLE 9 APPLICATION OF WILCOXON'S SIGN-RANK TEST OF DIFFERENCES TO (1) EXPERIMENTAL (PRE-TREATMENT) AND EXPERIMENTAL (POST-TREATMENT) (2) CONTROL (PRE-TREATMENT) AND CONTROL (POST-TREATMENT) CONCEPT CO-ORDINATE AND CONCEPT-ORIGIN DISTANCES

Exp. (PRE-TR) v. Exp. (POST-TR)	N	$\bar{T}$	Observed T-Values	Significant T-Values .05	.02	.01
Non-Cluster						
Dimension I	9	22.5	6	6	3	2
Dimension II	9	22.5	22	6	3	2
Concept-Origin	9	22.5	10	6	3	2
Cluster						
Dimension I	6	10.5	1	0	-	-
Dimension II	6	10.5	2	0	-	-
Concept-Origin	6	10.5	0	0	-	-
Control (Pre-TR) V. Control (Post-TR)	N	$\bar{T}$	Observed T-Values	Significant T-Values .05	.02	.01
'Non-Cluster'						
Dimension I	9	22.5	5	6	3	2
Dimension II	9	22.5	16	6	3	2
Concept-Origin	9	22.5	8.5	6	3	2
'Cluster'						
Dimension I	6	10.5	7	0	-	-
Dimension II	6	10.5	5	0	-	-
Concept-Origin	6	10.5	6.5	0	-	-

Contrary to expectations, there was a significant drop in the magnitude of the Dimension I co-ordinate values of the 'Non-Cluster' concepts rates by the Experimental Group. However, since the Controls show a corresponding drop in the re-test, it is unlikely that the treatment was an operative factor. In any case, the intensities of rating as measured by Concept-Origin distances did not change significantly in either the Experimental or Control Groups.

A somewhat clearer picture emerges with respect to the 'Cluster' concepts. While the Controls remain fairly constant in their ratings, the Experimental subjects manifested a marked and significant reduction in rating intensity. A comparison of the Experimental and Control Concept-Origin distances reveals a consistent difference between the two sets (P= .05) in the direction predicted by the major hypothesis of the study.

DISCUSSION

For the purposes of discussion, it will be useful to refer to Figure 8(b) in which the differences between the Controls and Experimental Subjects are illustrated by a graph. It will be observed that as compared with Figure 8(a) (see p.62), the 'Cluster' concepts rated by the Experimental Group are relatively closer to the Origin of the Semantic Space than those of the Controls. The most marked discrepancy is with respect to the independent variable 'suicide'. The movement of this concept to the Origin was, of course, in the direction predicted by the treatment. We also observe that the essential identity of the 'Cluster' has been maintained, with, if anything, a greater cohesiveness among its members. This effect is apparently due to mediated generalization, and constitutes positive support for Osgood's isomorphism.

This interpretation rests on the assumption that the observed change in the ratings of 'suicide' by the Experimental subjects reflected a genuine shift in the meaning of this concept. However it would be possible to argue that the subjects were influenced more by a desire to

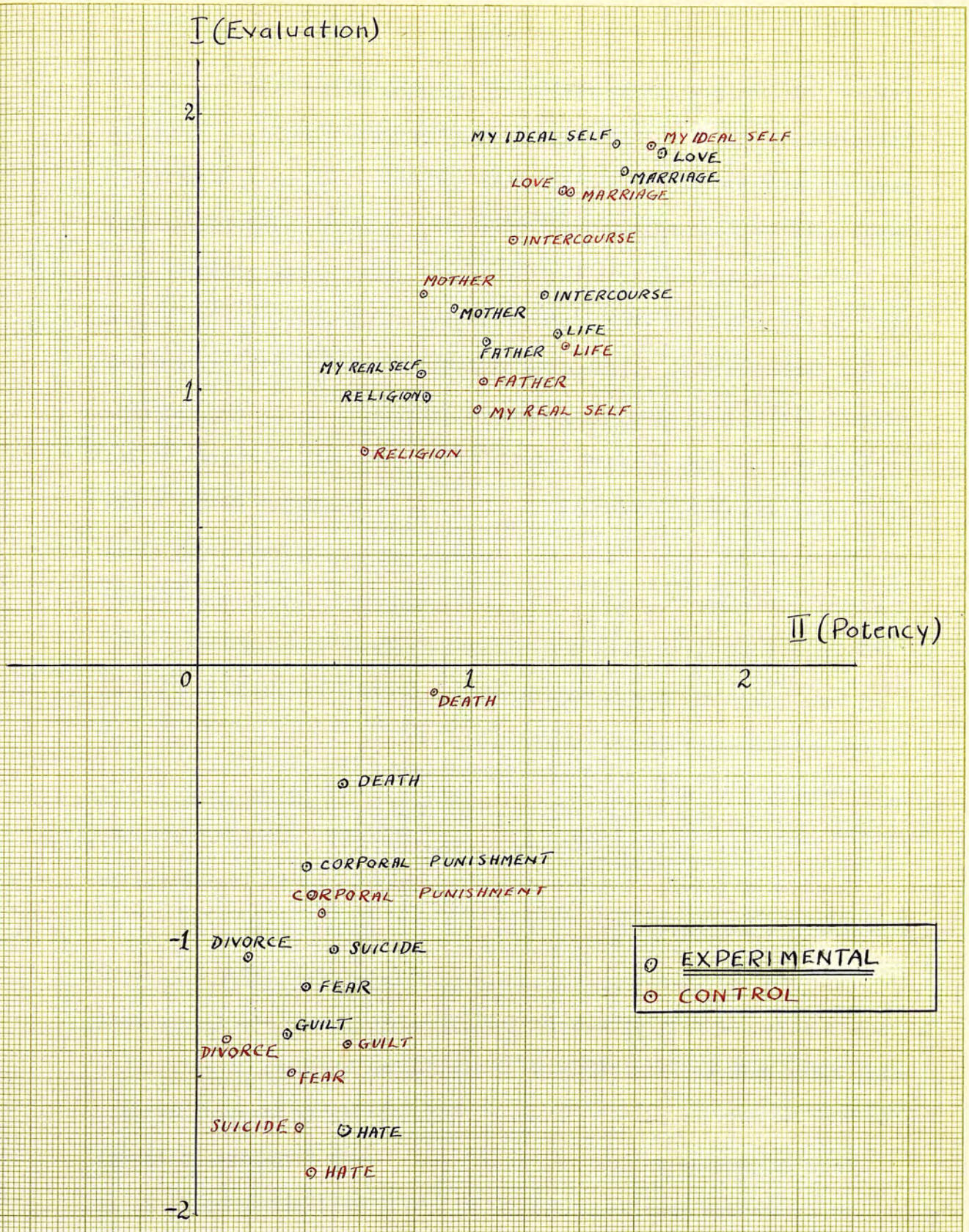


FIGURE 8(b)
SEMANTIC STRUCTURE OF CONCEPTS
EXPERIMENTAL VERSUS CONTROLS
(POST-TREATMENT)

please the experimenter than by the nature of his suggestion. Alternatively, it could be argued that the very nature of the suggestion elicited acquiescence responses that did not correspond with the true feelings of the subjects. A number of investigations including Edwards (12, 13, 14), Hanley (29), Kenny (41), Taylor (71), Wiggins and Rumrill (88), Cowen and Tongas (8), Wright (89) and Hillmer (33), have found that ratings of statements in personality questionnaires and attitude scales are apparently determined in part by a social desirability factor in behaviour. It will be recalled that the instructions given to the Experimental Group in the treatment phase consisted principally of references to the attitudes of other people to 'suicide' together with a number of assertions from a possible authority figure (the Experimenter). These assertions ran counter to the notion that taking one's own life is necessarily a bad thing. It would then be possible to conclude that the total effect of the instructions constituted an implicit criticism of the ratings given to 'suicide' in the pre-treatment administration of the Semantic Differential, together with pointers on the direction in which changes should be made.

This interpretation is plausible enough to cast serious doubt that a genuine shift occurred with respect to the meaning of 'suicide'. However, if the observed changes in the meaning of this concept were a function of acquiescence or social desirability, to what could the observed changes in the remaining concepts in the cluster be attributed? If the Experimental Group had divined the real object of the study, it is possible that the desire to please could have determined the changes. However, it is very unlikely that students taking an introductory course

in psychology would be capable of such an insight. A more acceptable suggestion would be the possibility that the factor of social desirability determining the shift in 'suicide' generalized to the other concepts in the same cluster. Stated more explicitly, the revision of the ratings of 'suicide' to conform to the views of others might have given rise to a re-examination of the other concepts on similar grounds. But even this interpretation presents serious difficulties, since there would be no reason to suppose that the generalization of social desirability would be restricted to a particular group of concepts. The results indicate that there was no significant change in the ratings of concepts lying outside of the 'suicide' cluster. It seems likely therefore that there were common bonds of meaning within the cluster and that if social desirability did in fact enter into the ratings, its influence was highly selective and in a manner consonant with the major hypothesis advanced in this investigation. Nevertheless, while the social desirability hypothesis confirms, if anything, the claim that clusters of concepts in the semantic space are isomorphic with the organization of meanings within the individual, it does cast serious doubt on the validity of the co-ordinate values of these clusters as indices of the intensity of (psychological) meaning.

In any investigation that calls for the analysis of reactions to stimuli that have personal and social connotations, it seems inevitable that social desirability will constitute a confounding element. Unfortunately we do not know enough about the nature of this factor to predict the extent of its influence.

Perhaps the most encouraging aspect of the present study is that, notwithstanding the possible influence of social desirability, a certain degree of support is offered for the notion that the organi-

zation of concepts in the semantic space reflects their organization within the personality structure of the individual. We may have, therefore, in the Semantic Differential a diagnostic instrument of considerable promise. The second study in this dissertation pursues this question.

SUMMARY

Two groups of single, male, undergraduates were equated on a form of the Semantic Differential Scale and designated Experimental and Control respectively. Each subject in the Experimental Group was then presented with the suggestion that one of a cluster of negatively evaluated concepts might have positive attributes. An experimentally produced change in the meaning of this concept was successfully obtained. Other concepts in the cluster changed in the same direction (i.e. elicited more favorable ratings). Concepts radically different in meaning to that of the independent variable did not appear to be affected by the treatment. The Control Group, who repeated the Scale under the original conditions, showed no such modifications in their ratings. The findings were interpreted as constituting to some extent, positive evidence for Osgood's isomorphic conception of the relationship between the Semantic Space and the mediational processes that underlie the acquisition of connotative meaning.

CHAPTER VI

STUDY II

A COMPARATIVE INVESTIGATION OF NORMAL AND NEUROTIC SEMANTIC DIFFERENTIAL RATINGS

THE PROBLEM

This study represents an attempt to determine whether or not neurotic and normal groups differ with respect to their ratings of concepts that are commonly acknowledged to have positive emotional significance. In the previous investigation evidence was adduced to support Osgood's contention that there may be an isomorphic relationship between dimensions in the Semantic Space and the mediational processes that underlie sign-learning. If a paradigm of neurotic sign-learning behaviour can be fitted satisfactorily within the framework of Osgood's theory of meaning, it should be possible to predict the nature of any differences that might be expected between the Semantic Differential ratings of normal and neurotic personalities.

It seems reasonable to assume that there are few concepts that elicit unequivocally positive emotional reactions in the average person. This is because the circumstances under which these concepts are learned are seldom unequivocally pleasant or drive-reducing. This point is of considerable importance in personality theory, since it has a direct bearing on ambivalent behaviour, a characteristic feature of emotional disturbances. The circumstances in which ambivalent reactions arise are varied, but of particular significance are those in which the sign

(or concept) derives its connotative meaning from its co-occurrence with two significates. The latter may be related through common stimulus properties but, nevertheless, elicit reciprocally antagonistic reactions. An example of this is presented in Figure 9. Here, the sign ($\bar{S}$) "Mother" is associated with two significates ($\dot{S}_1$ and $\dot{S}_2$) that are, in effect, two different kinds of stimulation emanating from a common source ('mother'). According to Osgood's Principal of Congruity (54, p.200) the reciprocally antagonistic process $r_m \longrightarrow s_m$ and $\bar{r}_m \longrightarrow \bar{s}_m$ would exert a modifying influence on each other.

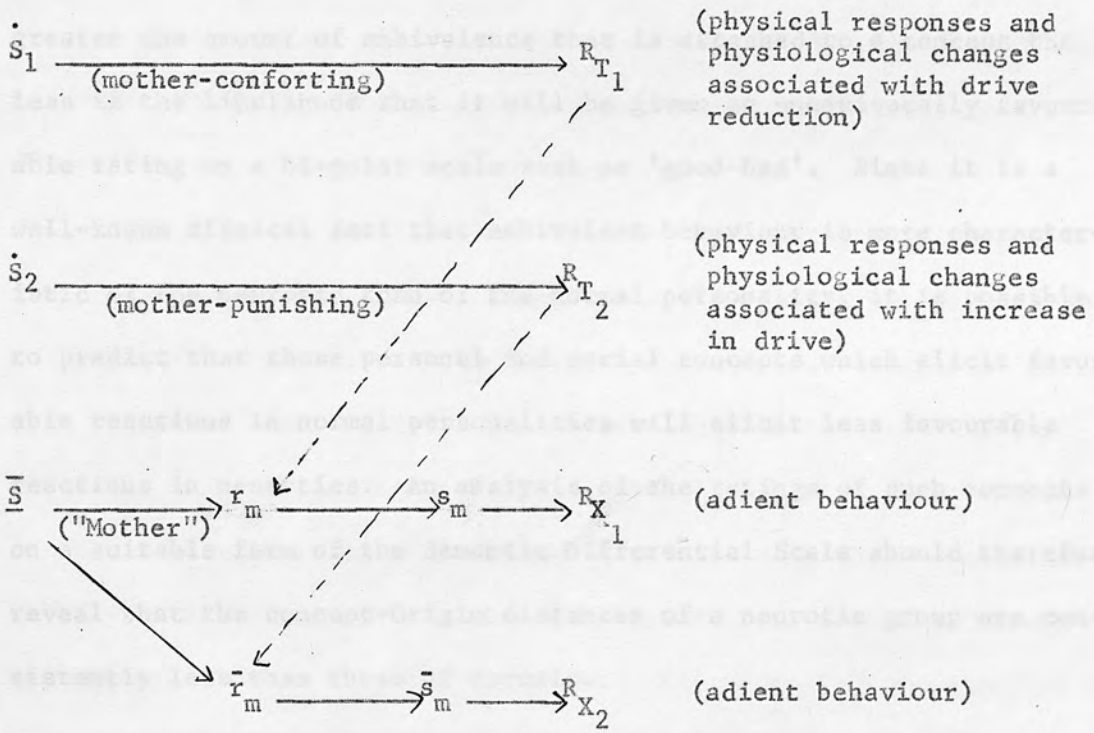


FIGURE 9

A LEARNING THEORY PARADIGM OF AMBIVALENCE

Thus, if the intensity of $r_m \longrightarrow s_m$ were strong and well-established, and that of $\bar{r}_m \longrightarrow \bar{s}_m$ weak and poorly established, the former would be only slightly reduced in intensity while the latter would be considerably reduced in intensity. In short, there would be a compromise, with the weaker $\bar{r}_m \longrightarrow \bar{s}_m$ yielding the greater amount of ground. This example is probably fairly typical of the circumstances under which most of us learn the connotative meaning of "MOTHER". It could happen however that the intensity of the $\bar{r}_m \longrightarrow \bar{s}_m$ would be quite strong, producing a correspondingly greater modifying effect on $r_m \longrightarrow s_m$. In this case a greater degree of ambivalence would be attached to the concept.

If Osgood's isomorphism is sound, one would expect that the greater the amount of ambivalence that is attached to a concept the less is the likelihood that it will be given an unequivocally favourable rating on a bi-polar scale such as 'good-bad'. Since it is a well-known clinical fact that ambivalent behaviour is more characteristic of the neurotic than of the normal personality, it is possible to predict that those personal and social concepts which elicit favourable reactions in normal personalities will elicit less favourable reactions in neurotics. An analysis of the ratings of such concepts on a suitable form of the Semantic Differential Scale should therefore reveal that the concept-Origin distances of a neurotic group are consistently less than those of normals.

PROCEDURE

The Semantic Differential Scale used in the first study (see p. 50) seemed to be appropriate for the present purpose. The concepts employed in that study fall into two fairly discrete classes as follows:

Class A (positively valued) - 'Intercourse,' 'Life', 'Father', 'Religion', 'My Real Self', 'Mother', 'My Ideal Self', 'Marriage', and 'Love'.

Class B (negatively valued) - 'Corporal Punishment', 'Guilt', 'Divorce', 'Fear', 'Suicide', 'Death', and 'Hate'. Although the primary interest in this investigation centred on the Class A concepts, the Class B concepts were included for two reasons: first, by interspersing them with the Class A concepts, it was hoped to reduce the danger of position errors in rating; second, it could not be safely assumed that the dimensional characteristics of the twenty scales employed would be identical for both the normal and neurotic groups, and it was therefore necessary to anticipate D^2 analyses of the mean raw scale score matrices (see below) by providing a varied selection of concepts. As in conventional types of factor analysis, this procedure facilitates, among other things, the identification of extracted dimensions.

The Rorchach Ink Blot Test (60) was administered individually to sixty-eight unmarried female students enrolled in a first-year psychology course at the University of Edinburgh. Two groups, designated "Normals" and "Neurotics" respectively, were established on the basis of the Miale and Harrower-Erickson classification of neurotic signs (50). In this study, the minimum number of signs for a "Neurotic" classification was arbitrarily fixed at six. Of the total samples, fifteen Rorschach protocols met this criterion. The "Normals" consisted of the fifteen subjects whose protocols contained the least number of neurotic signs. The distribution of neurotic signs for each individual in each group is presented in Table 10.

The Semantic Differential Scale, described above, was administered

TABLE 10 RORSCHACH SIGNS OF NEUROSIS
NORMALS V. NEUROTICS

	NORMAL SUBJECTS															TOTALS	NEUROTIC SUBJECTS															TOTALS
SIGNS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
R < 25	x		x	x		x		x		x	x				x	8	x	x	x	x	x	x	x		x	x	x	x	x	x	x	14
M > 1																-	x	x	x	x	x		x	x	x	x	x	x	x	x	x	14
FM > M		x		x	x					x					x	5	x		x	x			x	x	x	x	x	x	x	x	x	12
K shock																-	x		x	x		x	x	x	x	x	x	x	x	x	x	13
C shock																-	x		x	x	x	x		x	x			x	x		x	10
reject.																-	x	x	x	x	x	x		x	x	x	x	x	x	x	x	14
F % > 50		x	x		x								x			4		x	x		x		x	x	x		x			x		8
A % > 50	x	x						x				x	x			5	x	x	x		x	x					x	x		x		8
FC > 1					x			x							x	3		x	x		x	x	x	x		x	x	x			x	10
TOTALS	2	3	2	2	3	1	-	3	-	2	1	1	2	-	3	25	7	6	9	6	7	6	6	7	7	6	8	8	6	7	7	103

Abbreviations:
R = Responses
M = Human Movement
FM = Animal Movement
K = Shading
C = Colour
F% = Percentage of Responses determined by Form
A% = Percentage of Responses with Animal Content
FC = Form and Colour Response

individually to subjects in both groups. Within each group, the average scale score for each concept was obtained. This procedure generated a sixteen-by-twenty matrix of mean raw scale scores for each group. Both matrices were analysed by the D^2-method. Scales representative of the extracted dimensions were then employed to determine dimensional co-ordinate values for all concepts. Concept-Origin distances were then calculated. The hypothesis tested was that the Class A concept Origin distances of the "Neurotics" would be significantly smaller than those of the "Normals". This called for the application of Wilcoxon's Sign-Rank Test of Differences.

RESULTS

The Dimensional Characteristics of the Scales

The mean raw score matrices for the Normals and Neurotics are presented in Tables 11 (a) and 11 (b) respectively. From Table 12, which shows the results of the D^2 analyses of these matrices, it will be seen that only two dimensions could be considered as contributing substantially to the total matrix variances. Dimension I, passing through the pivotal scale 'happy-sad', accounts for substantial proportions of the variance of the scales 'beautiful-ugly', 'good-bad', 'clean-dirty', 'healthy-sick', and 'safe-dangerous'. This dimension appeared to be Evaluative in nature. Dimension II, passing through 'deep-shallow' and making a considerable contribution to the variance of scales 'large-small', 'sharp-dull', 'serious-humorous' and 'interesting-boring' suggested a 'Potency' factor.

The similarity between the two groups with respect to the dimensional characteristics of the scales was determined by computing Burt's Coefficient of Proportionality for each dimension in turn. The obtained

TABLE 11(a) NORMAL GROUP - MEAN RAW SCORE MATRIX

N = 15	1 Beaut. Ugly	2 Good Bad	3 Happy Sad	4 Passive Acti.	5 Relax Tense	6 Clean Dirty	7 Sick Heal	8 Safe Dang.	9 Hot Cold	10 Large Small	11 Sharp Dull	12 Shall. Deep	13 Strong Weak	14 Slow Fast	15 Soft Hard	16 Emot. Rat.	17 Hum. Ser.	18 Neg. Posit	19 Int. Bor.	20 Free Const.
1 C. Pun.	-2.07	0.67	-1.47	-1.60	-2.00	0.13	-0.13	-0.27	1.07	0.27	1.13	-0.80	-0.07	-1.00	-1.87	-0.73	-2.53	-0.67	0.93	-1.20
2 Interc.	2.13	-2.33	2.47	-2.60	0.40	1.67	-2.27	1.07	1.47	0.80	1.00	-2.07	1.60	-0.40	0.27	2.13	-1.67	-2.27	2.47	0.80
3 Life	2.07	-2.73	2.07	-2.73	0.00	1.40	-2.07	0.33	1.07	1.33	1.73	-2.40	2.07	-1.60	0.93	-1.20	-0.40	-2.73	-2.87	1.87
4 Guilt	-1.80	1.27	-2.07	-0.53	-2.00	-0.53	-0.13	-0.67	-0.13	1.07	1.00	-1.73	1.20	0.13	-1.33	0.40	-2.33	-0.80	1.07	-1.67
5 Father	1.93	-2.20	2.13	-2.00	1.40	2.47	-1.80	2.13	0.60	1.07	0.33	-1.53	1.80	0.20	0.47	0.13	0.53	-2.33	2.47	1.13
6 Divor.	-2.00	1.60	-2.27	-1.40	-2.40	-0.87	1.60	-1.40	-0.20	0.93	1.33	-0.73	-0.87	0.33	-1.80	0.80	-2.67	-0.60	1.47	-0.33
7 Relig.	1.93	-2.20	1.80	-1.00	1.00	-2.00	-1.40	1.20	0.47	1.33	1.33	-1.87	1.07	0.80	0.47	-0.07	-2.07	-1.87	2.07	1.40
8 Real S.	0.47	-1.07	2.07	-1.47	0.20	1.87	-2.53	1.33	1.00	0.13	1.20	-1.93	1.13	-0.47	0.53	0.60	-0.20	-1.53	1.73	0.20
9 Fear	-2.13	1.33	-1.87	-0.73	-2.80	-0.13	0.87	-1.80	-0.80	0.73	1.33	-1.80	1.40	0.00	-1.27	2.27	-2.20	-0.20	1.40	-1.40
10 Suic.	-2.73	2.60	-2.93	-0.27	-2.93	-1.00	2.80	-1.93	0.00	1.13	1.60	-1.67	-2.13	0.07	-0.87	2.27	-2.67	0.87	1.40	-0.13
11 Mother	2.20	-2.47	2.07	-2.20	0.00	2.40	-1.73	2.27	0.87	0.47	1.07	-2.20	1.67	-0.73	1.60	1.47	0.13	-2.33	2.80	1.20
12 Death	0.00	-0.47	-1.33	0.93	1.40	1.07	0.00	1.13	-1.07	-1.13	0.53	-2.53	-2.20	-0.20	-1.27	0.20	-2.33	-1.47	1.67	1.20
13 Hate	-2.87	2.73	-2.47	-1.73	-2.73	-1.87	2.13	-2.67	0.73	0.73	1.40	-1.47	0.73	-0.13	-2.00	2.20	-2.47	0.00	0.60	-0.60
14 Marr.	2.13	-2.47	2.40	-2.67	1.67	2.40	-2.73	1.67	1.20	1.40	0.93	-2.53	2.33	0.47	0.87	1.27	-1.07	-2.67	2.73	2.00
15 Ideal S.	2.27	-2.53	2.53	-2.40	2.27	2.47	-2.80	1.53	1.27	0.07	1.67	-2.33	2.40	-1.13	0.87	-0.53	0.80	-2.67	2.87	2.47
16 Love	2.73	-2.80	2.33	-2.53	1.07	2.33	-2.73	1.07	1.73	2.00	1.67	-2.67	2.67	0.13	0.67	2.40	-1.40	-2.67	2.80	1.93
$EXij^2$	70.23	70.97	75.87	54.77	51.84	48.11	62.51	38.28	15.21	17.23	25.51	62.16	47.69	6.86	22.67	32.69	53.77	55.09	70.33	30.79

TABLE 11(b) NEUROTIC GROUP - MEAN RAW SCORE MATRIX

N = 15	1 Beaut. Ugly	2 Good Bad	3 Happy Sad	4 Pass. Act.	5 Relax. Tense	6 Clean Dirty	7 Sick Healthy	8 Safe Dang.	9 Hot Cold	10 Large Small	11 Sharp Dull	12 Shall. Deep	13 Strong Weak	14 Slow Fast	15 Soft Hard	16 Emot. Rat.	17 Hum. Ser.	18 Neg. Pos.	19 Int. Bor.	20 Free Const.
1 C. Pun	-1.80	-0.40	-2.13	-1.20	-2.00	-0.40	0.33	-0.47	0.27	0.67	1.13	-0.53	0.27	-1.13	-1.80	0.67	-2.73	-0.87	1.13	0.13
2 Interc.	1.00	-1.53	1.53	-1.67	0.73	1.47	-1.67	0.40	1.53	1.20	1.00	-1.60	1.87	-0.67	0.00	1.73	-1.73	-1.93	2.27	1.20
3 Life	1.93	-1.73	0.87	-2.67	-0.27	1.20	-2.07	0.00	0.87	2.07	1.53	-2.53	1.60	-1.80	-1.27	0.47	-1.20	-2.13	2.93	0.47
4 Guilt	-2.53	1.07	-2.13	-0.73	-2.20	-0.67	0.13	-1.47	-0.40	0.93	0.20	-1.87	0.33	0.07	-1.33	0.47	-2.47	-0.40	0.60	-0.80
5 Father	1.33	-2.40	1.53	-2.27	0.07	2.40	-2.40	2.47	0.53	0.53	1.40	-1.93	1.93	-0.47	-0.33	-0.33	0.00	-2.07	2.00	-0.27
6 Divor.	-2.20	2.47	-2.87	-0.60	-2.53	-0.87	1.33	-1.27	-0.87	0.53	0.53	0.47	-1.20	0.07	-1.07	0.47	-2.80	0.93	1.00	-0.27
7 Relig.	1.73	-2.27	1.33	-1.40	0.67	1.60	-2.20	1.67	0.00	1.40	0.20	-1.73	1.73	0.53	-0.27	-0.53	-2.07	-1.87	2.47	1.00
8 Real S.	0.40	-1.07	0.67	-1.60	-0.33	2.00	-1.87	0.87	1.00	0.20	0.73	-1.73	0.40	-0.27	1.00	0.73	-0.13	-1.20	1.20	-0.13
9 Fear	-2.00	1.60	-1.60	-0.47	-2.60	-0.80	0.27	-1.53	-1.00	0.93	0.47	-1.87	0.67	-0.13	-0.40	1.80	-2.00	0.07	1.00	-0.87
10 Suic.	-2.20	2.33	-2.93	0.07	-2.73	-1.20	2.40	-1.53	-0.27	0.80	0.27	-1.00	-1.53	-0.80	-0.40	2.40	-2.87	0.47	1.47	-1.07
11 Mother	1.80	-2.27	1.40	-1.93	-0.20	2.33	-1.60	2.07	0.80	-0.27	0.47	-1.47	1.20	-0.40	1.27	1.80	-0.27	-1.67	1.93	0.00
12 Death	0.73	-0.87	-0.80	0.60	1.67	1.27	-0.20	0.80	-1.53	0.87	-0.07	-1.67	0.87	-0.53	-0.40	-0.53	-2.20	-2.07	1.67	1.27
13 Hate	-2.87	2.73	-2.53	-1.60	-2.53	-1.13	1.20	-2.40	0.07	0.80	1.60	-1.33	1.27	0.00	-1.53	2.00	-2.47	-1.13	0.07	-0.67
14 Marr.	2.20	-2.60	2.33	-2.20	1.47	2.00	-2.73	2.07	0.73	1.47	0.73	-2.27	2.40	0.20	0.27	0.47	-1.27	-2.13	2.27	1.27
15 Ideal S.	2.20	-2.13	2.40	-1.67	2.67	2.67	-2.80	2.20	0.80	0.20	0.87	-1.93	1.80	-0.87	0.80	-0.07	0.60	-2.27	2.67	2.47
16 Love	2.80	-2.47	1.73	-2.53	1.40	2.20	-2.40	1.27	1.53	2.13	1.33	-2.80	2.67	-0.53	0.60	1.67	-1.40	-2.40	2.40	1.13
$EXij^2$	62.50	63.55	59.29	42.82	51.10	43.65	53.99	39.91	12.94	19.31	13.61	50.60	37.29	7.73	14.46	24.56	57.31	43.29	55.92	16.43

TABLE 12 D^2 - ANALYSES OF RORSCHACH NEUROTIC AND NORMAL GROUP RAW SCORE MATRICES

	1 Beaut. Ugly	2 Good Bad	3 Happy Sad	4 Act. Pass.	5 Relax. Tense	6 Clean Dirty	7 Heal. Sick	8 Safe Dang.	9 Hot Cold	10 Large Small	11 Sharp Dull	12 Deep Shall.	13 Strong Weak	14 Slow Fast	15 Soft Hard	16 Emot. Rat.	17 Ser. Hum.	18 Posit. Neg.	19 Int. Bor.	20 Free Const.	
NORMAL GROUP																					
ΣXij^2	70.23	70.97	75.87	54.77	51.84	48.11	62.51	38.28	15.21	17.23	25.51	62.16	47.69	6.86	22.67	32.69	53.77	55.09	70.33	30.79	
C_{Ii}	8.06	8.00	8.71	3.70	5.70	5.90	7.27	5.39	2.55	0.70	0.70	2.50	4.15	-0.63	3.67	0.15	- 2.78	4.96	3.84	4.37	
C_{IIi}	0.09	1.67	0.00	5.29	-1.85	3.09	2.14	-0.32	1.72	3.67	4.66	7.47	4.56	-0.77	-1.83	4.29	6.02	5.23	7.25	1.86	
% Var. DI	92.50	90.18	100.00	25.00	62.67	72.36	84.55	75.89	42.74	2.84	1.92	10.05	36.11	5.80	59.42	0.06	14.38	44.65	20.97	62.03	% Total Var = 45.40
% Var. DII	0.01	3.93	0.00	51.09	6.60	19.85	7.33	0.26	19.46	78.18	85.14	89.77	43.59	8.60	14.78	56.29	67.40	49.65	74.73	11.24	% Total Var = 34.40
% Resid. Var.	7.49	5.89	0.00	23.92	30.73	7.79	8.12	23.80	37.80	18.98	12.94	0.18	20.30	85.60	25.80	43.65	18.22	5.70	4.30	26.73	% Total Var = 20.20
NEUROTIC GROUP																					
ΣXij^2	62.50	63.55	59.29	42.82	51.10	43.65	53.99	39.91	12.94	19.31	13.61	50.60	37.29	7.73	14.46	24.56	57.31	43.29	55.92	16.43	
C_{Ii}	7.59	7.01	7.70	2.88	6.11	5.19	6.08	5.52	2.36	0.28	0.34	1.75	2.14	-0.11	1.58	-1.25	-3.62	3.26	2.30	2.77	
C_{IIi}	2.24	2.48	0.00	5.33	-1.38	3.38	3.72	1.03	1.03	3.86	3.02	6.89	4.08	-1.69	-0.94	3.29	5.85	5.29	6.46	1.06	
% Var. D.I	92.18	77.32	100.00	12.14	73.05	61.72	68.48	76.35	43.04	0.41	0.88	6.05	12.28	0.07	17.29	6.35	22.86	24.56	9.46	46.68	% Total Var = 37.56
% Var. DII	8.03	9.68	0.00	66.35	3.72	26.16	25.63	2.66	8.19	77.16	67.01	93.95	44.65	39.56	6.08	44.06	59.71	64.63	74.62	6.82	% Total Var = 36.43
% Resid. Var.		13.00	0.00	21.51	23.23	12.12	5.89	20.99	48.77	22.43	32.11	100.00	43.07	60.37	76.63	49.59	17.43	10.81	15.92	46.50	% Total Var = 26.01

'e' values were 0.99 and 0.97 for Dimensions I and II respectively. It was now possible to advance with the knowledge that any differences that might be found between the Neurotics and Normals with respect to the meanings of the concepts, could not be attributed to differences between the groups with respect to the meanings of the scales.

The Meaning of the Concepts: Normals versus Neurotics

The co-ordinate values of the concepts were determined by summing and averaging the mean concept ratings on those scales selected as most representative of each dimension. For Dimension I (Evaluation), the scales selected were 'happy-sad', 'beautiful-ugly', 'good-bad', and 'safe-dangerous'; the scales 'deep-shallow', 'sharp-dull', 'large-small' and 'interesting-boring' were considered most representative of Dimension II (Potency). The co-ordinate values obtained through this procedure are presented in Table 13. The Concept-Origin values, which are also shown, constitute the focus of interest in this study.

The application of Wilcoxon's Sign Rank Test of Differences to the Class 'A' Concept-Origin distances produced a T-value of zero, since all differences are in the same direction. Since the probability of this occurring by chance is exactly one in five hundred and twelve ($P = .002$), it seems reasonable to reject the hypothesis that no real differences exist between the groups. It would appear that those personal and social concepts that are favourably rated by normal female students receive less favourable ratings from those females that have neurotic personalities as measured by the Rorschach.

TABLE 13

CONCEPT CO-ORDINATE VALUES AND ORIGIN-CONCEPT DISTANCES:
NORMALS v. NEUROTICS (RORSCHACH CRITERION)

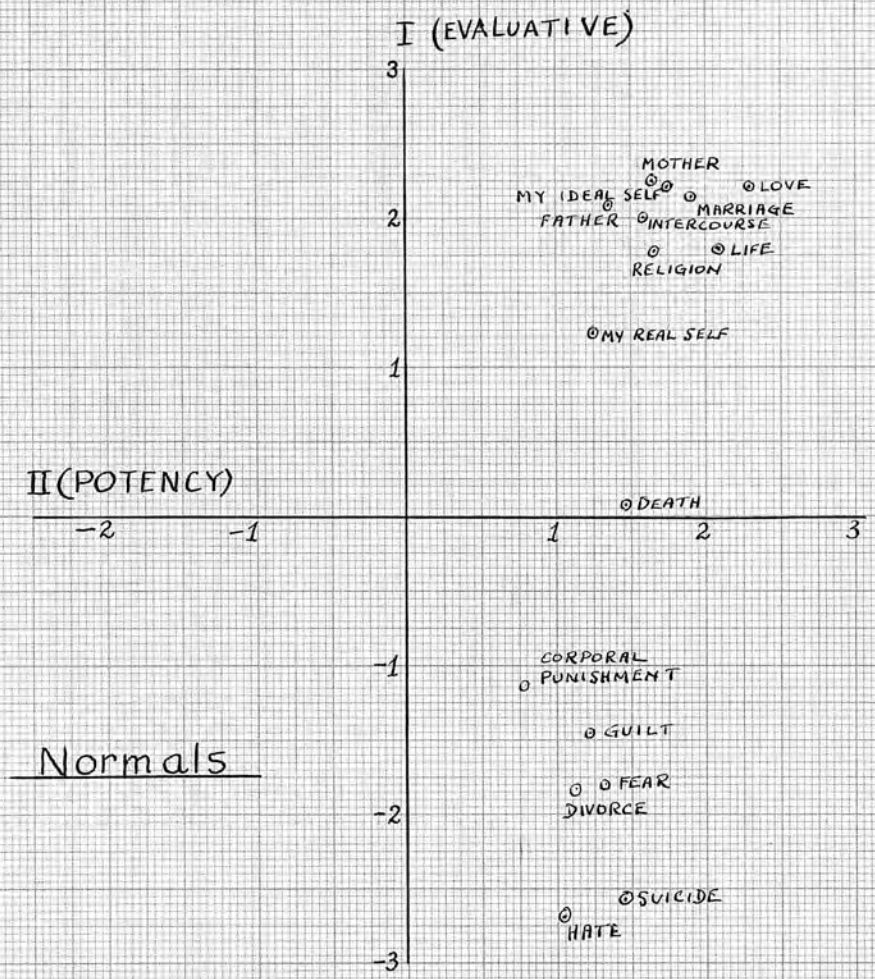
	NORMALS			NEUROTICS		
	DI	DII	Concept-Origin Distance	DI	DII	Concept-Origin Distance
"A" Concepts						
Intercourse	2.00	1.59	2.56	1.12	1.52	1.89
Life	1.80	2.08	2.57	1.13	2.27	2.54
Father	2.10	1.35	2.50	1.93	1.47	2.43
Religion	1.78	1.65	2.43	1.75	1.45	2.27
My Real Self	1.24	1.25	1.76	0.75	0.97	1.23
Mother	2.25	1.64	2.96	1.89	0.90	2.32
Marriage	2.17	1.90	2.88	1.80	1.69	2.47
My Ideal Self	2.22	1.74	2.82	2.23	1.42	2.64
Love	2.23	2.29	3.22	2.08	2.17	3.01
"B" Concepts						
C. Punish	-1.12	0.78	1.37	-1.00	0.87	1.33
Guilt	-1.45	1.22	1.90	-1.80	0.90	2.01
Divorce	-1.82	1.12	2.14	-2.20	0.40	2.24
Fear	-1.78	1.32	2.22	-1.68	1.07	1.99
Suicide	-2.55	1.45	2.93	-2.25	0.89	2.42
Death	0.07	1.47	1.47	0.040	1.04	1.12
Hate	-2.69	1.05	2.89	-2.63	0.95	2.80

DISCUSSION

Perhaps the most important feature of findings is that the statistical significance of the differences found between Normals and Neurotics does not depend on a one-tailed test. If no hypothesis concerning the direction of differences had been advanced, the P value of .004, based on a two-tailed test is still highly significant. The conclusion that there are apparently real differences between Normals and Neurotics with respect to their ratings of so-called positively-valued concepts, is in itself of some value. That it was possible to predict the direction of the differences, constitutes a certain degree of support for the theory advanced in the introduction to this particular study.

The differences between the two groups are illustrated by the graph in Figure 10. Here the co-ordinate values of the concepts in Table 13 have been plotted in a semantic space defined by the two dimensions, Evaluation and Potency. It will be observed that the differences between the corresponding Class A concept pairs show some variability. It may be that while the Neurotics have attached a greater degree of ambivalence to these concepts as a whole, the severity of this reaction varies with the concept rated.

The findings lend themselves to a second interpretation. Is it possible that the differences between the Normals and Neurotics are attributable to some factor or factors other than ambivalence? For example, the concept 'Intercourse' may have received its comparatively low rating because it aroused only moderately positive reactions in the Neurotics. Here the underlying factor would not be one of conflict, but rather a relative lack of emotional involvement with respect to the



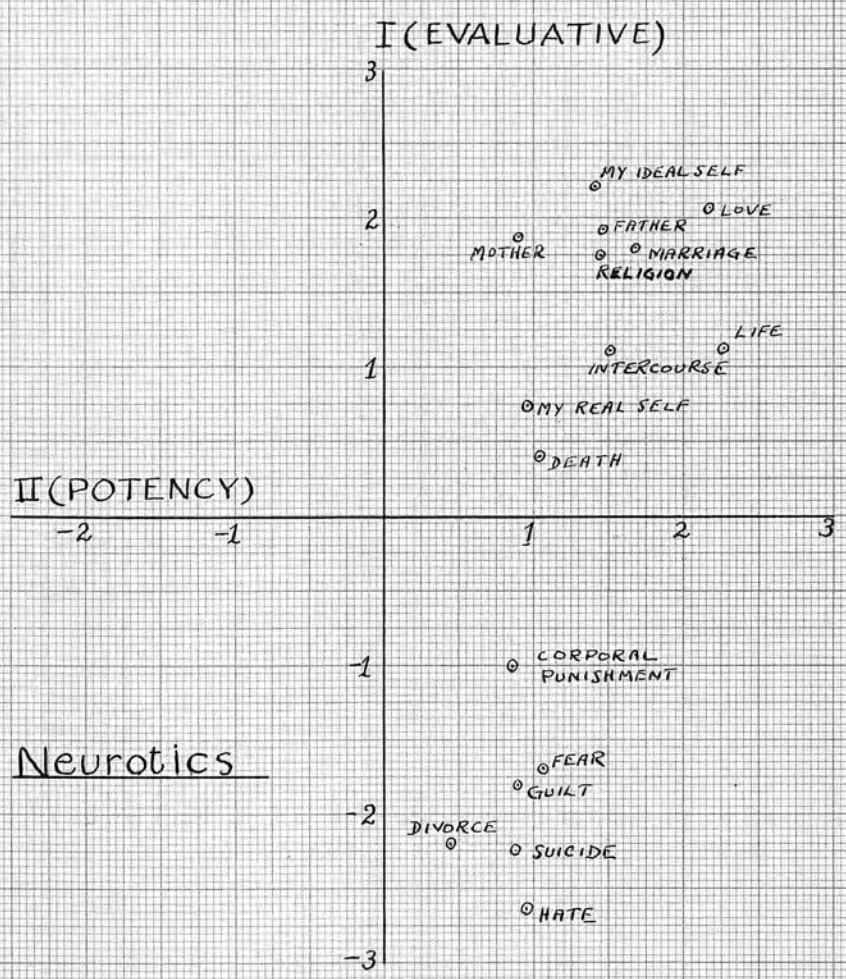


FIGURE 10.

THE SEMANTIC STRUCTURES OF NORMALS AND NEUROTICS (RORSCHACH CRITERION)

"A" concepts. Such a possibility was regarded as unlikely unless the validity of the classification "Neurotics" were suspect. Since the Maudsley Personality Inventory (9) had been administered to all subject in this study (purely as a matter of interest) it was decided to follow up this question. A check of both the Neuroticism and Extraversion scores of the (Rorschach) Normals and Neurotics revealed the interesting pattern presented in Table 13. When the M.P.I. high Neuroticism scores and low Neuroticism scores were compared with the

TABLE 14 CONTINGENCY TABLE: RORSCHACH v: M.P.I.

	RORSCHACH CLASSIFICATION	
M.P.I. Classification	Neurotics	Normals
(1) High Neur.:Low Extr. (Dysthymics)	10	-
(2) High Nur.: High Extr. (Hysterics)	-	3
(3) Total Neurotics ((1) + (2))	10	3
(4) Low Neur: Low Extr. (Normals)	4	1
(5) Low Neur: High Extr. (Normals)	1	11
(6) Total Normals ((4) + (5))	5	12

Rorschach Normals and Neurotics in a 2 x 2 contingency table the resulting χ^2 value of 4.68 (with Yates' correction) was significant with $P < .05$. This suggested a fair measure of agreement between the Rorschach and the M.P.I. with respect to the classification of Neurotics and Normals. However when the Extraversion scores were dichotomized and a new 2 x 2 contingency table was set up, the chi-

square test (χ^2 = 19.20) of the null hypothesis was again rejected at less than the 1 per cent level of confidence. These findings suggested that the Rorschach neurotic is more likely to be an M.P.I. dysthymic than an hysteric, and the Rorschach normal is more likely to be an M.P.I. Extravert than an Introvert. In the light of this it appeared that if the Maudsley Personality Inventory were used as a criterion of neurosis, such differences as had been found between the Rorschach neurotic and normal groups with respect to the Semantic Differential Scale used in this study would be attributable to both neuroticism and introversion. This conclusion suggested a second study employing the Maudsley Personality Inventory as a criterion of both neuroticism and introversion.

CHAPTER VII

STUDY III

A COMPARATIVE INVESTIGATION OF NORMAL, DYSTHYMIC AND HYSTERIC SEMANTIC DIFFERENTIAL RATINGS..

The results of the previous study suggested that both neuroticism and introversion are associated with relatively weak ratings of positively valued concepts as compared with normals and extraverts. From this position a number of hypotheses, relating to the intensity of ratings of positively valued concepts, can be advanced.

H 1 Neurotics will produce ratings that are consistently less intense than those of normals.

H2 Introverts will produce ratings that are consistently less intense than those of extraverts.

H3 Neurotic introverts (Dysthymics) will produce ratings that are consistently less intense than those of neurotic extraverts (Hysterics).

H4 Normal introverts will produce ratings that are consistently less intense than those of normal extraverts.

H5 Neurotics introverts (Dysthymics) will produce ratings that are consistently less intense than those of normal introverts.

H6 Neurotic extraverts (Hysterics) will produce ratings that are consistently less intense than those of normal extraverts.

H7 Neurotic introverts (Dysthymics) will give consistently less intense ratings than will normal extraverts.

H8 Normal introverts and neurotic extraverts will not differ in the intensities of their ratings.

PROCEDURE

The Maudsley Personality Inventory (9) was administered to 82 unmarried female students enrolled in a first-year psychology course at the University of Edinburgh. This test purports to measure two

orthogonal dimensions of personality, extraversion-introversion and neuroticism. According to Eysenck (17, p.58), there seems to be a fair amount of agreement among personality theorists on the following points concerning extraverts and introverts: the introvert has a more subjective outlook than the extravert; the introvert shows a higher degree of cerebral activity and self control (inhibition) than the extravert. Eysenck (17, p.49) identifies neuroticism with a lack of personality organization and characterized by low sociability (17, p.53), high suggestibility, low persistence and either very high or very low perseveration (17, p.256). The M.P.I. attempts to identify two types of neuroses, in which both neuroticism and extraversion - introversion are the principal descriptive parameters. The first of these is dysthymia, a neurosis characterized by anxiety, reactive depression, and obsessional tendencies (17, p.246). The dysthymic describes himself as having feelings that are easily hurt; as being self-conscious, nervous and given to feelings of inferiority; moody, prone to day-dreaming and withdrawal on social occasions. On vocabulary tests dysthymics tend to do extremely well. Their levels of aspiration are unduly high, but they tend to under-rate their own performance. The second type of neurosis is hysteria, which is characterized by a tendency to develop hysterical conversion symptoms. Hysterics show little energy and have narrow interests. They describe themselves as being troubled by stammering or stuttering, as being accident-prone, disgruntled and troubled by aches and pains. On vocabulary tests they tend to do rather poorly. Their level of aspiration is low but they tend to over-rate their performances. (17, p.247).

Eysenck's work has been the subject of a number of critical investigations. Foulds (23) and Foulds and Caine (24, 25) suggest that personality questionnaires of the type used by Eysenck fail to take account of the difference between symptom-clusters (syndromes) and trait-clusters (personality types). These authors claim that the hysteric may exhibit either a hysteroid or an obsessive personality, and that the dysthymic may also fall into either category. Foulds and Caine found that some psychological tests differentiate between hysterics and dysthymics regardless of personality type, while still other tests differentiated between hysteroids and obsessives, regardless of diagnostic classification. Sigal, Star and Franks (62) found that Eysenck's Extraversion and Neuroticism Scales do not retain orthogonality in hysteria and dysthymia; that hysterics have lower neuroticism scores than do dysthymics, and that hysterics not only fail to be more extraverted than normals, but actually have higher introversion scores. McGuire, Mowbray and Vallance (48) report findings that constitute both direct and indirect support for the studies cited above. These investigators administered the Maudsley Personality Inventory to an unselected group of psychiatric patients. All diagnostic groups were differentiated from normals on the Neuroticism Scale but neither the Neuroticism nor the Extraversion Scales permitted differentiation between the diagnostic groups. Of particular interest is their finding that hysterics and dysthymics were not differentiated on the Extraversion Scale.

In the face of this criticism, Eysenck and Claridge (19) tested three groups: normals, hysterics and dysthymics. Factor analysis and

discriminant function analysis of objective laboratory tests and questionnaires administered to all subjects revealed that hysterics are apparently extraverted and neurotic while dysthymics are introverted and neurotic. Eysenck and Claridge found however that while perfect discrimination between hysterics and dysthymics was obtained, an analysis of the questionnaire scores indicated a departure from linearity of regression of introversion and neuroticism scores at the upper end of the respective scales.

In attempting to reconcile their findings with those of Foulds and Caine, Eysenck and Claridge argue that introversion and extraversion have been used in a misleading way. They maintain that a constitutional extravert (an individual in whom the innate balance of excitation and inhibition in the central nervous system is tilted in the direction of high inhibition and low excitation) may, through the process of learning, develop introverted traits. Similarly a constitutional introvert may behave like an extrovert. The Maudsley Personality Inventory, Eysenck and Claridge suggest, may be a good measure of behavioural rather than constitutional extraversion. They do not stress the point, however, that if the M.P.I. cannot discriminate between constitutional and behavioural introverts and extraverts, its effectiveness as a test is substantially reduced.

In a later study, Eysenck and Eysenck (20) administered a questionnaire containing all of the M.P.I. items to groups of subjects rated by judges for extraversion, introversion, normality and neuroticism. A close agreement was found between self-rated and judge-rated behaviour for extraversion. Little agreement was obtained with respect to neuroticism -- a finding which Eysenck and Eysenck attribute to a

failure on the part of the judges to differentiate between introverted and neurotic shyness.

From this review of the related literature, it is evident that the concurrent validity of the M.P.I. is still subject to question. The designation of the different groups in this study is made, therefore, with great reservation. With this in mind, tentative acceptance was made of Eysenck's claim that dysthymics tend to score high on the Neuroticism Scale but low on the Extraversion Scale, while hysterics score highly on both Scales. For the purposes of this study it was necessary to obtain four groups of subjects: one Dysthymic (High N, Low E,); one Hysteric (High N, High E.); one Normal Introvert (Low N, Low E,); and one Normal Extravert (Low N, High E). For the purposes of obtaining distinctive classifications it would have been desirable to select only those cases that falling at least 1 sigma above and below the means of the respective scales in Eysenck's standardization samples (16, p.5), it was found that in our sample of 32 cases, some modification of this criterion was necessary in order to obtain enough subjects to carry out an analysis. The maximum number of cases in each group was restricted to 5. Table 15 shows the scores of each subject in the different groups. Eysenck's standardization data for each classification are also included to facilitate comparisons.

The Semantic Differential Scale used in the previous study was administered individually to each of the twenty subjects. The mean raw score matrices for each of the four groups are presented in Tables 16(a), 16(b), 16(c) and 16(d). It might have sufficed to utilize only those eight scales whose dimensional characteristics had been established as most satisfactory in the Rorschach study ('happy-sad', 'good-bad',

TABLE 15

MAUDSLEY PERSONALITY

INVENTORY SCORES: NORMALS v. NEUROTICS

GROUP DESCRIPTION	SUBJECT	N-SCORE	E-SCORE	EYSENCK DATA
Normals a(Low N, Low E	1 2 3 4 5	12 16 8 16 11	15 14 16 17 18	N mean = 19.89 N σ = 11.02 E mean = 24.91 E σ = 9.71
Normals b) Low N, High E	1 2 3 4 5	12 8 12 17 17	38 34 37 38 35	
Neurotic (Dysthymics) a) High N, Low E	1 2 3 4 5	38 36 40 39 32	16 8 16 18 8	N mean = 38.18 N σ = 10.84 E mean = 17.86 E σ = 10.02
Neurotic (Hysterics) b) High N, High E	1 2 3 4 5	43 42 32 30 38	37 32 34 38 40	N mean = 30.82 N σ = 11.84 E mean = 24.91 E σ = 9.26

TABLE 16(a) MEAN RAW SCORE MATRIX - NORMAL INTROVERTS

N = 5	1 C. Pun	2 Interc.	3 Life	4 Guilt	5 Father	6 Divor.	7 Relig.	8 Real.S.	9 Fear	10 Suic.	11 Mother	12 Death	13 Hate	14 Marr.	15 Ideal S.	16 Love
Beaut. - Ugly	-1.60	1.40	2.20	-2.60	1.40	-2.60	1.80	0.40	-2.60	-3.00	2.20	-0.40	-3.00	2.20	1.80	2.60
Good - Bad	+1.20	+1.60	+2.20	-1.60	+2.40	-2.80	+2.80	+1.20	-1.00	-2.80	+2.40	+0.60	-2.80	+2.60	+2.40	+2.00
Happy - Sad	-1.00	1.80	2.00	-2.00	2.40	-3.00	1.40	1.80	-1.40	-3.00	2.40	-2.20	-2.20	2.60	2.80	2.80
Passive - Act.	-2.00	-1.40	-2.60	-0.80	-1.40	-1.40	-1.60	-1.40	-1.00	-2.00	-2.20	0.60	-2.40	-2.20	-1.60	-2.20
Relaxed - Tense	-2.00	0.40	0	-1.60	0.40	-2.80	0.60	0.40	-2.80	-2.60	-0.20	0.80	-2.60	1.00	2.60	1.00
Clean - Dirty	0.80	1.40	1.60	-0.40	2.20	-0.80	2.00	2.40	-0.20	-0.80	2.40	1.00	-1.60	2.00	2.60	2.00
Sick - Healthy	-1.20	-1.80	-2.20	-0.40	-2.20	1.20	-2.00	-2.40	0.60	2.60	-2.00	-0.40	1.40	-2.80	-3.00	-2.40
Safe - Dang.	0.20	0.60	0.20	-1.20	1.80	-1.60	2.40	1.80	-1.00	-1.80	2.20	0.20	-3.00	2.20	1.20	0.60
Hot - Cold	1.00	1.00	0.60	-0.60	0.80	-0.40	0.20	0.40	-0.80	-1.00	1.00	-1.40	0	0.80	0.80	1.20
Large - Small	0.20	0.40	1.20	0.80	0.20	0	1.60	-0.40	0.60	0.20	-0.60	1.40	0.80	1.60	0	1.80
Sharp - Dull	1.00	0.40	1.00	1.20	0.40	0.40	1.20	0.40	1.00	1.20	0.20	1.00	1.40	1.20	0.80	1.20
Deep - Shallow	+1.20	+1.20	+2.20	+1.60	+2.00	+0.80	+2.40	+1.60	+2.00	+1.20	+1.60	+1.80	+1.80	+2.40	+2.20	+3.00
Strong - Weak	1.80	1.20	2.20	1.20	2.20	-0.40	2.00	1.60	1.80	-2.60	1.60	1.40	1.20	2.60	2.60	2.80
Slow - Fast	-1.00	0	-0.80	0.40	-0.20	-0.40	0.60	0	-0.40	-0.40	-0.20	-0.20	0	-0.60	-0.60	-0.40
Soft - Hard	-2.40	-0.40	-0.40	-1.00	-0.80	-0.60	-0.60	1.00	-1.60	-2.00	0.20	-2.20	-1.40	-0.60	-0.20	0
Emot. - Rat.	-0.60	1.60	0.80	0.80	-1.00	1.60	-0.80	0.60	1.80	2.60	1.40	0.60	2.60	0.60	0	2.00
Hum. - Serious	-2.80	-1.20	0	-3.00	0	-3.00	-1.80	0	-2.00	-3.00	-0.40	-2.20	-3.00	-0.80	0.80	-0.80
Neg. - Positive	-2.00	-0.20	-2.20	-1.60	-1.80	-1.20	-2.20	-0.80	-1.00	-1.20	-1.20	-1.60	-1.00	-2.00	-1.80	-1.80
Int. - Boring	0.40	0.80	3.00	0.40	2.00	0.60	2.00	0.60	1.00	0.60	2.20	1.20	0.40	2.20	2.60	1.80
Free - Constr.	-0.80	0.20	1.80	-0.60	0.20	1.00	1.40	-0.20	-0.40	1.40	0	1.40	0	1.60	2.00	2.00

TABLE 16(b) MEAN RAW SCORE MATRIX - DYSTHYMICO (HIGH NEUROTICISM - LOW EXTRAVERSION)

N = 5	1 C. Pun	2 Interc.	3 Life	4 Guilt	5 Father	6 Divor.	7 Relig.	8 Real.S.	9 Fear	10 Suic.	11 Mother	12 Death	13 Hate	14 Marr.	15 Ideal S.	16 Love
Beaut. - Ugly	-2.20	-0.80	1.40	-2.80	1.60	-1.80	1.20	1.00	-2.80	-1.20	2.20	0.60	-3.00	2.20	2.40	2.80
Good - Bad	-0.20	+1.00	+1.40	-2.20	+2.40	-1.80	+1.60	+1.40	-2.40	-1.60	+2.00	-0.20	-3.00	+2.80	+1.20	+2.60
Happy - Sad	-2.40	0.40	-0.20	-2.80	0.80	-2.80	0.40	-0.80	-1.80	-3.00	0.80	-2.20	-2.80	2.00	2.40	0.80
Passive - Active	-0.60	-2.20	-2.80	0.60	-1.60	-0.20	-0.60	-1.40	0	0.20	-1.60	0	-1.60	-1.80	-0.80	-2.80
Relaxed - Tense	-2.20	0.20	-2.00	-2.80	-2.20	-2.20	0	-1.60	-2.80	-3.00	-1.40	0.20	-2.80	1.20	3.00	0.20
Clean - Dirty	-1.20	1.20	0.40	-1.40	2.00	-1.00	1.60	1.40	-1.40	-0.80	1.40	0.80	-1.80	2.00	2.60	2.00
Sick - Healthy	1.00	-1.40	-1.20	1.00	-2.20	1.80	-1.00	-1.20	0.80	2.60	-1.20	1.20	2.20	-2.60	-2.60	-2.40
Safe - Dang.	-1.00	0.40	-1.00	-2.60	0.20	-1.80	1.00	-0.40	-2.80	-1.40	0.80	-0.40	-3.00	1.80	2.20	0.20
Hot - Cold	0.40	2.20	1.40	-1.00	0.40	-0.60	-0.80	1.20	0	1.20	0.60	-1.80	-0.60	0.40	1.40	2.20
Large - Small	0.40	1.40	2.00	0.80	0.40	-0.40	0.60	0.40	0.60	1.00	-1.80	1.20	0.60	0.80	-0.20	2.80
Sharp - Dull	1.60	1.60	1.20	-1.60	1.40	0.40	-0.80	1.00	0.40	-0.20	0.40	1.20	1.00	0.20	0.80	2.00
Deep - Shallow	+0.80	+1.20	+2.40	+1.60	+1.20	+1.00	-0.20	+2.40	+1.80	+1.40	+0.40	+2.00	+1.80	+2.20	+1.20	+3.00
Strong - Weak	-0.20	2.40	1.80	-1.20	1.80	-1.00	0.40	-0.20	-0.60	-0.80	-0.20	1.20	1.60	1.80	1.60	2.40
Slow - Fast	-1.40	-1.00	-2.00	0.60	-0.80	-0.40	-0.20	-0.40	0.20	0.40	-1.00	0.60	0	-0.20	-1.40	-1.20
Soft - Hard	-1.00	-0.40	-1.80	-0.80	-1.40	-1.00	0.20	0	0.60	0.60	1.20	-1.60	-2.40	0.80	0.60	-0.60
Emot. - Rat.	1.40	2.80	1.60	1.60	0.40	0	1.00	0.40	1.80	2.20	1.60	-0.60	2.60	0.20	-0.20	2.20
Hum. - Serious	-2.80	-2.60	-2.20	-2.60	-1.20	-2.60	-2.00	-1.00	-2.60	-2.80	0.40	-2.40	-2.80	-0.80	0.00	-1.60
Neg. - Positive	1.40	-2.60	-1.80	2.80	-1.60	2.80	-0.80	-1.40	1.00	1.40	1.00	0	0.40	-2.00	-2.80	-2.60
Int. - Boring	2.00	2.80	2.80	1.60	2.40	1.60	2.40	1.80	1.00	2.20	1.60	0.80	0.40	1.80	2.60	2.60
Free - Constr.	-0.60	1.40	-0.60	-2.20	-1.60	-0.20	-0.60	-0.40	-1.40	-1.00	0.60	1.20	0	1.00	3.00	1.80

TABLE 16(c) MEAN RAW SCORE MATRIX - HYSTERICS (HIGH NEUROTICISM - HIGH EXTRAVERSION)

N = 5	1 C. Pun	2 Interc.	3 Life	4 Guilt	5 Father	6 Divor.	7 Relig.	8 Real.S.	9 Fear	10 Suic.	11 Mother	12 Death	13 Hate	14 Marr.	15 Ideal S.	16 Love
Beaut. - Ugly	-2.00	2.00	2.40	-2.20	1.60	-1.80	1.60	0.40	-2.60	-1.80	1.80	0.40	-2.20	1.80	2.20	2.60
Good - Bad	0	+2.20	+2.40	-0.80	+2.00	-0.40	+1.60	+0.60	-1.00	-1.60	+2.40	+1.20	-2.00	+2.20	+2.60	+2.40
Happy - Sad	-1.80	2.20	2.20	-2.00	2.00	-1.60	2.00	1.60	-1.80	-1.80	2.40	-1.20	-1.80	1.80	2.40	2.40
Passive - Act.	-1.20	-2.60	-2.60	-1.00	-2.20	-1.60	-1.20	-2.00	-2.60	0.20	-2.20	1.40	-2.20	-2.40	-2.40	-2.60
Relaxed - Tense	-1.80	0.20	-1.40	-1.80	1.40	-2.00	2.00	-1.40	-2.60	-2.60	-0.20	2.40	-2.60	1.20	2.20	0
Clean - Dirty	0	1.20	1.20	-1.00	2.60	-0.60	1.80	2.20	-0.40	-1.00	2.60	1.60	-1.40	1.80	2.40	2.40
Sick - Healthy	0	-2.20	-2.20	-0.60	-2.00	0.60	-1.40	-2.60	-0.60	1.80	-2.00	-1.00	1.00	-2.20	-2.40	-2.60
Safe - Dang.	0	1.00	0.40	-1.00	2.40	-1.00	1.80	0.20	-0.60	-1.40	2.00	1.40	-2.60	1.80	1.80	0.80
Hot - Cold	0.20	1.00	1.80	-0.80	0.80	-0.40	1.20	1.60	-1.00	-1.00	0.40	-2.20	0.60	1.40	1.40	2.00
Large - Small	0.60	1.00	1.40	1.60	1.00	1.40	1.40	0.40	1.80	1.80	1.20	1.20	1.80	1.00	0.20	1.40
Sharp - Dull	1.40	0.80	2.40	0.60	0.20	1.60	0.80	1.60	1.00	1.80	0.60	-0.80	1.80	0.60	1.80	1.80
Deep - Shallow	+0.80	+1.60	+2.20	+1.80	+1.20	+1.80	+1.20	+1.40	+2.20	+2.20	+2.20	+2.40	+1.00	+2.20	+2.00	+2.40
Strong - Weak	-0.20	1.20	2.40	1.40	1.20	0	1.20	0.80	2.40	-2.00	1.00	1.80	2.40	2.00	2.00	2.20
Slow - Fast	-1.40	-0.80	-2.00	0	-0.60	1.20	2.20	-1.20	0	-0.60	-0.80	-0.60	0.40	1.60	-1.60	0.60
Soft - Hard	-1.60	1.20	-2.00	-2.20	0.20	-2.00	0.60	0.40	-2.40	-0.60	2.20	-0.40	-2.60	1.00	1.60	1.60
Emot. - Rat.	-1.60	1.80	2.00	0.20	2.40	-1.00	-0.20	2.00	2.20	2.40	1.60	-1.00	1.60	1.00	0.20	2.60
Hum. - Serious	-2.40	-1.80	-1.80	-1.80	0.60	-2.40	-2.60	-1.00	-2.20	-2.60	-1.00	-2.40	-2.60	-2.40	-0.20	-2.60
Neg. - Positive	-1.00	-2.20	-2.60	-2.00	-2.20	-1.20	-1.40	-2.00	-1.80	0.40	-2.20	-2.40	-2.40	-2.40	-2.40	-2.60
Int. - Boring	1.00	2.20	2.40	1.40	2.40	1.20	1.60	1.60	2.00	1.40	2.40	1.80	1.60	2.00	2.60	2.60
Free - Constr.	-0.60	0.80	2.00	-1.80	0.60	-1.00	0.80	0.40	0.20	-0.40	0	1.60	-0.60	1.00	2.00	0.80

TABLE 16(d) MEAN RAW SCORE MATRIX - NORMAL EXTRAVERTS

N = 5	1 C. Pun	2 Interc.	3 Life	4 Guilt	5 Father	6 Divor.	7 Relig.	8 Real.S.	9 Fear	10 Suic.	11 Mother	12 Death	13 Hate	14 Marr.	15 Ideal S.	16 Love
Beaut. - Ugly	-2.00	1.40	2.40	-1.00	1.80	-2.00	2.20	0.60	-1.60	-3.00	1.80	0.60	-2.80	2.40	2.40	3.00
Good - Bad	-1.80	+2.20	+2.60	-0.40	+2.40	-1.80	+2.40	+1.40	-1.80	-2.80	+2.60	+1.00	-2.60	+2.40	+2.40	+3.00
Happy - Sad	-2.20	2.60	2.40	-1.20	2.40	-2.80	2.00	2.40	-2.40	-3.00	2.00	-1.20	-3.00	2.80	2.80	2.40
Passive - Active	-2.60	-3.00	-2.80	-1.40	-2.60	-1.60	-1.20	-1.80	-0.60	-2.00	-2.40	0.60	-2.80	-2.80	-3.00	-2.60
Relaxed - Tense	-2.80	0.80	0.80	-2.40	2.40	-2.60	0.60	1.60	-3.00	-3.00	-0.80	2.20	-3.00	2.40	2.80	1.80
Clean - Dirty	-0.40	1.80	2.20	0.40	2.80	-0.60	1.00	2.80	-0.80	-1.20	3.00	1.20	-1.40	3.00	3.00	2.60
Sick - Healthy	1.00	-1.60	-2.60	0.20	-2.60	1.80	-1.80	-2.80	0.60	2.40	-1.20	0	1.80	-3.00	-3.00	-2.80
Safe - Dang.	0.40	1.20	0.40	0	2.80	-1.20	1.20	2.20	-2.60	-2.40	2.40	1.20	-2.80	1.60	1.60	1.00
Hot - Cold	0.80	1.60	0.80	1.00	0.20	0.40	0.40	0.80	-1.40	0.20	0.60	-1.00	1.20	1.00	0.80	1.80
Large - Small	0.20	0.20	0.80	0.40	-0.20	0.80	0.60	0.80	1.20	0.80	0.60	0.40	1.20	0.60	0.20	1.80
Sharp - Dull	0.80	1.20	2.20	1.00	1.60	1.00	1.40	1.60	0.80	2.20	1.20	0	2.60	1.20	2.00	1.20
Deep - Shallow	0	+2.40	+3.00	+2.20	+2.20	+1.40	+2.40	+2.40	+2.00	+2.20	+2.60	+3.00	+2.80	+2.40	+2.80	+2.80
Strong - Weak	-1.20	2.00	1.60	0.40	1.60	-2.20	1.40	1.20	1.60	-1.60	2.40	1.80	1.60	2.20	2.20	3.00
Slow - Fast	-1.40	-0.60	-2.60	0.40	-0.60	0.20	0.40	-1.20	-0.60	-1.60	-0.80	-1.00	-1.20	0.20	-1.20	-1.60
Soft - Hard	-2.00	0.80	-0.80	-1.60	1.00	-1.80	0.20	1.00	-1.00	-1.60	1.60	-0.60	-2.20	1.00	0.60	0.40
Emot. - Rat.	0.80	2.20	-0.20	-0.20	-1.00	0.60	-1.20	0.40	2.60	2.60	2.40	-0.80	2.80	0.80	-0.80	2.00
Hum. - Serious	-2.80	-2.60	-0.60	-2.40	0.40	-3.00	-2.60	0	-2.80	-3.00	0	-2.80	-2.80	-2.40	1.40	-2.40
Neg. - Positive	-1.60	-2.80	-2.80	-1.40	-2.60	-1.60	-1.80	-1.80	-0.60	-2.00	-2.80	-3.00	-1.80	-2.40	-2.40	-2.80
Int. - Boring	2.00	2.80	3.00	0.40	2.00	1.60	2.20	2.20	1.00	1.40	2.40	3.00	0.40	2.40	1.60	3.00
Free - Constr.	-0.40	1.60	1.60	-0.40	1.20	0	1.40	1.20	-1.40	-0.60	1.60	-0.40	-1.40	160	2.80	1.40

'beautiful-ugly' and 'safe-dangerous' representing Evaluation; 'deep-shallow', 'interesting-boring', 'large-small' and 'sharp-dull' representing Potency). However, as a check on the dimensional stability of scales across subjects, it was decided to repeat the D^2 analyses, but confine these analyses to the combined Neurotics (Dysthymics and Hysterics) and the combined Normals (Extraverts and Introverts) respectively. This arrangement yielded two matrices of mean raw scores, each based on N = 10, and these are presented in Tables 17(a) and 17(b). D^2 analyses were then carried out on each matrix. The results of these analyses are presented in Table 18. As in the Rorschach study, only two dimensions accounted for the greater proportions of scale variances. The Evaluative dimension again predominated with Potency assuming a minor role. There was, however, a slight difference between the two studies with respect to the dominant scales. While 'beautiful-ugly', 'good-bad', and 'happy-sad' are again strongly evaluative, 'safe-dangerous' was selected in preference to 'relaxed-tense' whose dimensional characteristics proved to be somewhat ambiguous since 32.01% and 40.26% of the respective variances for Normals and Neurotics remained unknown. With respect to the Potency dimension, 'deep-shallow', 'large-small', 'interesting-boring' and 'sharp-dull' again emerged as the most representative scales.

The last step in the procedure was to obtain mean concept ratings by summing and averaging the raw score ratings on each of the four scales representing Dimension I (Evaluation). This procedure was repeated with the four scales representing Dimension II (Potency). From these mean co-ordinate values, all concept-origin values were computed directly.

TABLE 17(a) MEAN RAW SCORE MATRIX

TOTAL NORMALS (INTROVERTS & EXTRAVERTS)

N = 10	1 Beaut. Ugly	2 Bad. Good	3 Happy Sad	4 Pass. Act.	5 Relax Tense	6 Clean Dirty	7 Sick Heal.	8 Safe Dang.	9 Hot Cold	10 Large Small	11 Sharp Dull	12 Shall. Deep	13 Strong Weak	14 Slow Fast	15 Soft Hard	16 Emot. Rat.	17 Hum. Ser.	18 Neg. Pos.	19 Int. Bor.	20 Free Const.
1 C. Pun	-1.80	0.30	-1.60	-2.30	-2.40	-0.20	-0.10	0.30	0.90	0.20	0.90	-0.60	0.30	-1.20	-2.20	0.10	-2.80	-1.80	1.20	-0.60
2 Inter	1.40	-1.90	2.20	-2.20	0.60	1.60	-1.70	0.90	1.30	0.30	0.80	-1.80	1.60	-0.30	0.20	1.90	-1.90	-1.50	1.80	0.90
3 Life	2.30	-2.40	2.20	-2.70	0.40	1.90	-2.40	0.30	0.70	1.00	1.60	-2.60	1.90	-1.70	-0.60	0.30	-0.30	-2.50	3.00	1.70
4 Guilt	-1.80	1.00	-1.60	-1.10	-2.00	0.00	-0.10	-0.60	0.20	0.60	1.10	-1.90	0.80	0.40	-1.30	0.30	-2.70	-1.50	0.40	-0.50
5 Father	1.60	-2.40	2.40	-2.00	1.40	2.50	-2.40	2.30	0.50	0.00	1.00	-2.10	1.90	-0.40	0.10	-1.00	0.20	-2.20	2.00	0.70
6 Divor.	-2.30	2.30	-2.90	-1.50	-2.70	0.70	1.50	-1.40	0.00	0.40	0.70	-1.10	-1.30	-0.10	-1.20	1.10	-3.00	-1.40	1.10	0.50
7 Relig.	2.00	-2.60	1.70	-1.40	0.60	1.50	-1.90	1.80	0.30	1.10	1.30	-2.40	1.70	0.50	-0.20	-1.00	-2.20	-2.00	2.10	1.40
8 Real S.	0.50	-1.30	2.10	-1.60	1.00	2.60	-2.60	2.00	0.60	0.20	1.00	-2.00	1.40	-0.60	1.00	0.50	0.00	-1.30	1.40	0.50
9 Fear	-2.10	1.40	-1.90	-0.80	-2.90	-0.50	0.60	-1.80	-1.10	0.90	0.90	-2.00	1.70	-0.50	-1.30	2.20	-2.40	-0.80	1.00	-0.90
10 Suicide	-3.00	2.80	-3.00	-2.00	-2.80	-1.00	2.50	-2.10	-0.40	0.50	1.70	-1.70	-2.10	-1.00	-1.80	2.60	-3.00	-1.60	1.00	0.40
11 Mother	2.00	-2.50	2.20	-2.30	-0.50	2.70	-1.60	2.30	0.80	0.00	0.70	-2.10	2.00	-0.50	0.90	1.90	-0.20	-2.00	2.30	0.80
12 Death	0.10	-0.80	1.70	0.60	1.50	1.10	-0.20	0.70	-1.20	0.90	0.50	-2.40	1.60	-0.60	-1.40	-0.10	-2.50	-2.30	2.10	0.50
13 Hate	-2.90	2.70	-2.60	-2.60	-2.80	-1.50	1.60	-2.90	0.60	1.00	2.00	-2.30	1.40	-0.60	-1.80	2.70	-2.90	-1.40	0.40	-0.70
14 Marr.	2.30	-2.50	2.70	-2.50	1.70	-2.50	-2.90	1.90	0.90	1.10	-1.20	-2.40	2.40	-0.20	0.20	0.70	-1.60	-2.20	2.30	1.60
15 Ideal S.	2.10	-2.40	2.80	-2.30	2.70	-2.80	-3.00	1.40	0.80	0.10	1.40	-2.50	2.40	-0.90	0.20	-0.40	1.10	-2.10	2.10	2.40
16 Love	2.80	-2.50	2.60	-2.40	1.40	2.30	-2.60	0.80	1.50	1.80	1.20	-2.90	2.90	-1.00	0.20	2.00	-1.60	-2.30	2.40	1.70
$EXij^2$	69.20	72.20	85.26	63.75	59.62	53.34	62.99	43.89	11.24	10.23	22.68	72.12	52.80	9.43	20.48	34.63	68.50	55.47	52.74	20.82

TABLE 17(b) MEAN RAW SCORE MATRIX
TOTAL NEUROTICS (DYSTHYMICS + HYSTERICS)

N =	10	1 Beaut. Ugly	2 Bad Good	3 Happy Sad	4 Pass. Act.	5 Relax. Tense	6 Clean Dirty	7 Sick Heal.	8 Safe Dang.	9 Hot Cold	10 Large Small	11 Sharp Dull	12 Shall. Deep	13 Strong Weak	14 Slow Fast	15 Soft Hard	16 Emot. Rat.	17 Hum. Ser.	18 Neg. Posit.	19 Int. Bor.	20 Free Const.
1	C.Pun.	-2.10	0.10	-2.10	-0.90	-2.00	-0.60	0.50	-0.50	0.30	0.50	1.50	-0.80	-0.20	-1.40	-1.30	-0.40	-2.60	0.20	1.50	-0.60
2	Inter.	1.40	-1.60	1.50	-2.40	0.20	1.20	-1.80	0.70	1.60	1.20	1.20	-1.40	1.80	-0.90	0.40	2.30	-2.20	-2.40	2.50	1.10
3	Life	1.90	-1.90	1.00	-2.70	-1.70	0.80	-1.70	-0.30	1.60	1.70	1.80	-2.30	2.10	-2.00	-1.90	1.80	-2.00	-2.20	2.60	0.70
4	Guilt	-2.50	1.50	-2.40	-0.20	-2.30	-1.20	0.20	-1.80	-0.90	1.20	-0.50	-1.70	0.10	0.30	-1.50	0.90	-2.20	+0.40	1.50	-2.00
5	Father	1.60	-2.20	1.40	-1.90	-0.40	2.30	-2.10	1.30	0.60	0.70	0.80	-1.20	1.50	-0.70	-0.60	1.40	-0.30	-1.90	2.40	-0.50
6	Divor.	-1.80	1.10	-2.20	-0.90	-2.10	-0.80	1.20	-1.40	-0.50	0.50	1.00	-1.40	-0.50	0.40	-1.50	-0.50	-2.50	0.80	1.40	-0.60
7	Relig.	1.40	-1.60	1.20	-0.90	1.00	1.70	-1.20	1.40	0.20	1.00	0.00	-0.50	0.80	1.00	0.40	0.40	-2.30	-1.10	2.00	0.10
8	Real S.	0.70	-1.00	0.40	-1.70	-1.50	1.80	-1.90	-0.10	1.40	0.40	1.30	-1.90	0.30	-0.80	0.20	1.20	-1.00	-1.70	1.70	0.00
9	Fear	-2.70	1.70	-1.80	-1.30	-2.70	-0.90	0.10	-1.70	-0.50	1.20	0.70	-2.00	0.90	0.10	-0.90	2.00	-2.40	-0.40	1.50	-0.60
10	Suicide	-1.50	1.60	-2.40	0.20	-2.80	-0.90	2.20	-1.40	0.10	1.40	0.80	-1.80	-1.40	-0.10	0.00	2.30	-2.70	0.90	1.80	-0.70
11	Mother	2.00	-2.20	1.60	-1.90	-0.80	2.00	-1.60	1.40	0.50	-0.30	0.50	-1.30	0.40	-0.90	1.70	1.60	-0.30	-0.60	2.00	0.30
12	Death	0.50	-0.50	-1.70	0.70	1.30	1.20	0.10	0.50	-2.00	1.20	0.20	-2.20	1.50	0.00	-1.00	-0.80	-2.40	-1.20	1.30	1.40
13	Hate	-2.60	2.50	-2.30	-1.90	-2.70	-1.60	1.60	-2.80	0.00	1.20	1.40	-1.40	2.00	0.20	-2.50	2.10	-2.70	-1.00	1.00	-0.30
14	Marr.	2.00	-2.50	1.90	-2.10	1.20	1.90	-2.40	1.80	0.90	0.90	0.40	-2.20	1.90	0.70	0.90	0.60	-1.60	-2.20	1.90	1.00
15	Ideal S.	2.30	-1.90	2.40	-1.60	2.60	2.50	-2.50	2.00	1.40	0.00	1.30	-1.60	1.80	-1.50	1.10	0.00	-0.10	-2.60	2.60	2.50
16	Love	2.70	-2.50	1.60	-2.70	0.10	2.20	-2.50	0.50	2.10	2.10	1.90	-2.70	2.30	-0.30	0.50	2.40	-2.10	-2.60	2.60	1.30
$EXij^2$		61.61	50.94	53.49	45.72	53.00	40.26	45.56	32.08	20.32	19.51	19.35	48.46	32.25	12.85	23.74	36.18	66.24	41.28	61.43	18.61

TABLE 18 D^2 ANALYSES - M.P.I. NORMAL AND NEUROTIC
RAW SCORE MATRICES

	1 Beaut. Ugly	2 Good Bad	3 Happy Sad	4 Act. Pass.	5 Relax. Tense	6 Clean Dirty	7 Heal. Sick	8 Safe Dang.	9 Hot Cold	10 Large Small	11 Sharp Dull	12 Deep Shall.	13 Strong Weak	14 Slow Fast	15 Soft Hard	16 Emot. Rat.	17 Ser. Hum.	18 Posit. Neg.	19 Int. Bor.	20 Free Const.
NORMALS																				
$EXij^2$	69.20	72.20	85.26	63.75	59.62	53.34	62.99	43.89	11.24	10.23	22.68	72.12	52.80	9.43	20.48	34.63	68.50	55.47	52.74	20.82
(1) CIi	7.90	7.94	9.23	3.01	6.16	6.05	7.20	5.66	2.13	0.36	0.62	2.44	4.54	-0.48	3.39	-1.18	-3.13	2.08	3.25	3.23
(2) CIIi	0.02	1.70	0.22	7.29	-1.61	3.63	2.86	0.44	1.12	2.74	4.51	8.13	4.92	-2.09	-2.31	3.71	6.76	6.94	6.13	2.23
(3) %Var.Dim.I	90.19	87.31	100.00	14.21	63.65	68.62	82.29	73.00	40.39	1.27	1.68	8.25	39.03	2.44	56.10	4.01	14.31	7.81	20.02	50.10
(4) %Var.Dim II	0.00	4.00	0.00	83.36	4.34	24.71	12.99	0.04	11.12	73.41	89.68	91.75	45.85	46.34	26.07	39.73	66.71	86.82	71.26	23.87
(5) %Resid.Var.	9.81	8.69	0.00	2.43	32.01	6.67	4.72	26.96	48.49	25.32	8.64	0.00	15.12	51.22	27.83	56.26	18.98	5.37	8.72	26.13
NEUROTICS																				
$EXij^2$	61.61	50.94	53.49	45.72	53.00	40.26	45.56	32.08	20.32	19.51	19.35	48.46	32.25	12.85	23.74	36.18	66.24	41.28	61.43	18.61
(1) CIi	7.25	6.10	7.32	2.26	4.92	4.96	4.66	4.92	2.95	0.62	0.28	0.25	2.20	-0.92	3.42	0.31	-2.92	3.59	1.18	2.83
(2) CIIi	1.58	2.70	0.00	5.57	-2.73	3.14	1.36	0.03	1.94	3.90	3.60	6.95	4.19	-1.51	-1.29	4.50	6.92	4.80	7.34	1.28
(3) %Var.Dim.I	85.31	73.05	100.00	11.18	45.68	61.10	47.67	75.47	42.81	2.31	0.41	0.12	15.01	6.61	49.28	0.28	12.88	31.23	2.26	43.04
(4) %Var.Dim II	4.06	14.31	0.00	67.85	14.06	24.49	4.06	0.00	18.50	77.96	66.98	99.67	54.45	17.74	6.99	55.97	72.30	55.81	87.71	8.81
(5) %Resid.Var.	10.63	12.64	0.00	20.98	40.26	14.41	48.27	24.53	38.68	19.73	32.61	0.21	30.54	75.64	43.72	43.75	14.82	12.96	10.03	48.15

RESULTS

The data derived from the final step in the procedure are presented in Tables 19, 20 and 21. Although the hypotheses concern the concept--origin distances of the "A" (positively valued) concepts only, the "B" (unpleasant) concept co-ordinate and concept-origin distances are also included as a matter of interest. Each of the eight major hypotheses in this study was tested by application of the Sign Test to the appropriate sets of concept-origin distances. The results are as follows:

H 1 (Neurotics versus Normals): 8 of 9 differences in predicted direction ($P = .02$). Significant.

H2 (Introverts versus Extraverts): 8 of 9 differences in predicted direction ($P = .02$). Significant.

H3 (Dysthymics versus Hysterics): 7 of 8 differences in predicted direction ($P < .05$). Significant.

H4 (Normal Introverts versus Normal Extraverts): 7 of 9 differences in predicted direction ($P < .10$). Non-significant.

H5 (Dysthymics versus Normal Introverts): 6 of 9 differences in predicted direction ($P < .30$). Non-significant.

H6 (Hysterics versus normal Extraverts): 9 of 9 differences in predicted direction ($P = .002$). Significant.

H7 (Dysthymics versus Normal Extraverts): 9 of 9 differences in predicted direction ($P = .002$). Significant.

H8 (Normal introverts versus Hysterics): 7 of 9 differences in same direction ($P < .20$). Non-significant.

TABLE 19

CONCEPT CO-ORDINATE VALUES AND ORIGIN-CONCEPT DISTANCES :
NORMALS V. NEUROTICS
(M.P.I. CRITERION)

	NORMALS			NEUROTICS		
	D I	D II	Distance to Origin	D I	D II	Distance to Origin
"A" Concepts						
Intercourse	1.60	1.18	1.99	1.30	1.58	2.05
Life	1.80	2.10	2.77	1.13	2.10	2.38
Father	2.18	1.28	2.53	1.63	1.28	2.07
Religion	2.03	1.73	2.67	1.40	0.88	1.65
My Real Self	1.48	1.15	1.87	0.50	1.33	1.42
Mother	2.25	1.28	2.59	1.80	0.88	2.00
Marriage	2.35	1.75	2.93	2.10	1.35	2.50
My Ideal Self	2.18	1.53	2.66	2.15	1.38	2.55
Love	2.18	2.08	3.01	1.83	2.33	2.96
"B" Concepts						
C. Punish	-0.85	0.73	1.12	-1.20	1.08	1.61
Guilt	-1.25	1.00	1.60	-2.10	0.75	2.23
Divorce	-2.13	0.83	2.29	-1.63	1.08	1.96
Fear	-1.80	1.20	2.16	-1.98	1.35	2.40
Suicide	-2.73	1.23	2.99	-1.73	1.45	2.26
Death	-0.03	1.48	1.48	-0.05	1.23	1.23
Hate	-2.78	1.43	3.13	-2.55	1.25	2.84

TABLE 20

CONCEPT COORDINATE VALUES AND ORIGIN - CONCEPT DISTANCES : EXTRAVERTS (NEUROTIC & NORMAL) VERSUS INTROVERTS (NEUROTIC & NORMAL) M.P.I. CRITERION

	INTROVERTS			EXTRAVERTS		
	D I	D II	Distance to Origin	D I	D II	Distance to Origin
"A" Concepts						
Intercourse	1.00	1.23	1.59	1.85	1.53	2.40
Life	1.03	1.98	2.23	1.90	2.18	2.89
Father	1.63	1.25	2.05	2.18	1.30	2.54
Religion	1.58	1.15	1.95	1.85	1.45	2.35
My Real Self	0.80	0.98	1.26	1.18	1.50	1.91
Mother	1.86	0.50	1.93	2.18	1.15	2.46
Marriage	2.30	1.55	2.77	2.10	1.55	2.61
My Ideal Self	2.08	1.25	2.43	2.28	1.65	2.81
Love	1.80	2.28	2.90	2.33	2.15	3.17
"B" Concepts						
C. Punish	-0.88	0.95	1.29	-1.18	1.35	1.79
Guilt	-2.23	0.80	2.37	-1.08	1.18	1.60
Divorce	-2.15	0.55	2.22	-1.58	1.35	2.08
Fear	-1.98	1.05	2.24	-1.80	1.50	2.34
Suicide	-2.23	0.95	2.42	-2.23	1.73	2.82
Death	-0.50	1.33	1.42	0.43	1.38	1.45
Hate	-2.85	1.03	3.03	-2.48	1.65	2.98

TABLE 21

CONCEPT CO-ORDINATE VALUES AND ORIGIN - CONCEPT DISTANCES
NORMAL AND NEUROTIC SUB-GROUPS (M.P.I. CRITERION)

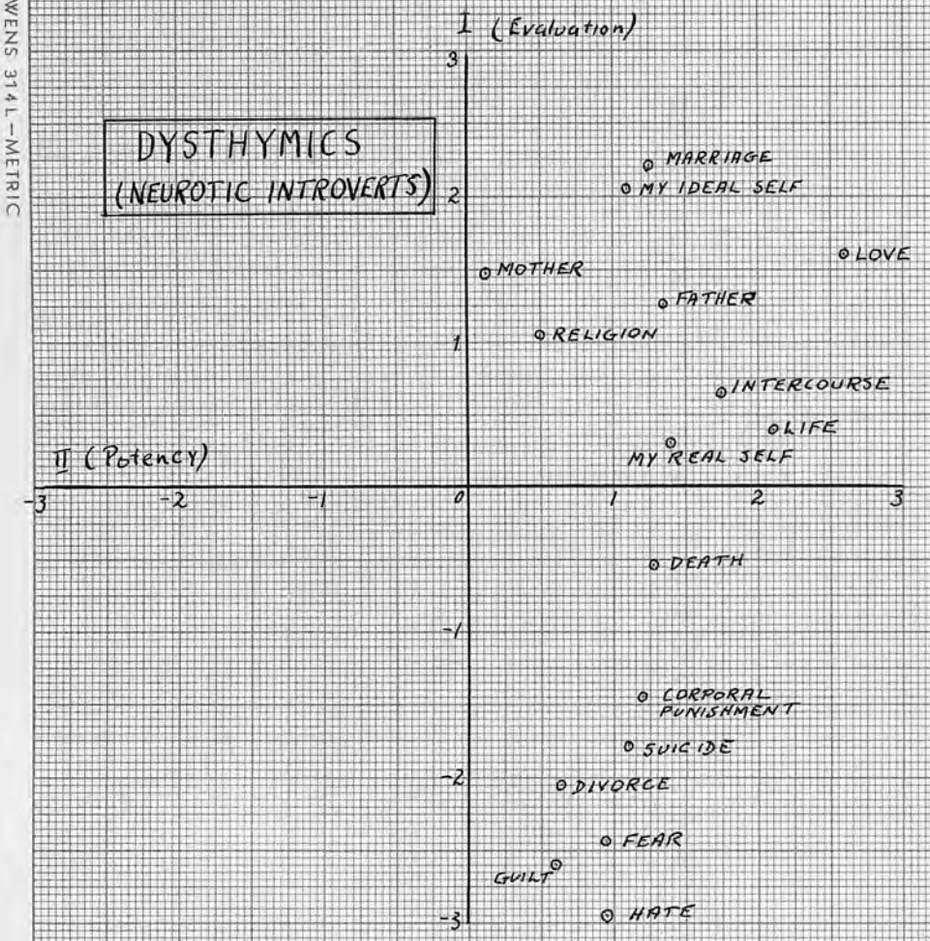
	DYSTHYMICS			HYSTERICS			NORMAL INTROVERTS			NORMAL EXTRAVERTS		
	D I	D II	Distance to Origin	D I	D II	Distance to Origin	D I	D II	Distance to Origin	D I	D II	Distance to Origin
"A" Concepts												
Intercourse	0.65	1.75	1.87	1.85	1.40	2.32	1.35	0.70	1.52	1.85	1.65	2.48
Life	0.40	2.10	2.14	1.85	2.10	2.80	1.65	1.85	2.48	1.95	2.25	2.98
Father	1.25	1.35	1.84	2.00	1.20	2.33	2.00	1.15	2.31	2.35	1.40	2.73
Religion	1.05	0.50	1.08	1.75	1.25	2.15	2.10	1.80	2.77	1.95	1.65	2.55
My Real Self	0.30	1.40	1.43	0.70	1.25	1.43	1.30	0.55	1.41	1.65	1.75	2.41
Mother	1.45	0.15	1.46	2.15	1.60	2.68	2.30	0.85	2.45	2.20	1.70	2.78
Marriage	2.20	1.25	2.53	1.90	1.45	2.39	2.40	1.85	3.03	2.30	1.65	2.83
My Ideal Self	2.05	1.10	2.33	2.25	1.65	2.79	2.10	1.40	2.52	2.30	1.65	2.83
Love	1.60	2.60	3.05	2.30	2.10	3.11	2.00	1.95	2.79	2.35	2.20	3.22
"B" Concepts												
C. Punish	-1.45	1.20	1.88	-0.95	0.95	1.34	-0.30	0.70	0.24	-1.40	0.75	1.59
Guilt	-2.60	0.60	2.67	-1.50	1.35	2.02	-1.85	1.00	2.10	-0.65	1.00	1.19
Divorce	-2.05	0.65	2.15	-1.20	1.50	1.92	-2.25	0.45	2.29	-1.95	1.20	2.29
Fear	-2.45	0.95	2.63	-1.50	1.75	2.30	-1.50	1.15	1.89	-2.10	1.25	2.44
Suicide	-1.80	1.10	2.11	-1.65	1.80	2.44	-2.65	0.80	2.77	-2.80	1.65	3.25
Death	-0.55	1.30	1.41	0.45	1.15	1.23	-0.45	1.35	1.42	0.40	1.60	1.65
Hate	-2.95	0.95	3.10	-2.15	1.55	2.65	-2.75	1.10	2.96	-2.80	1.75	3.30

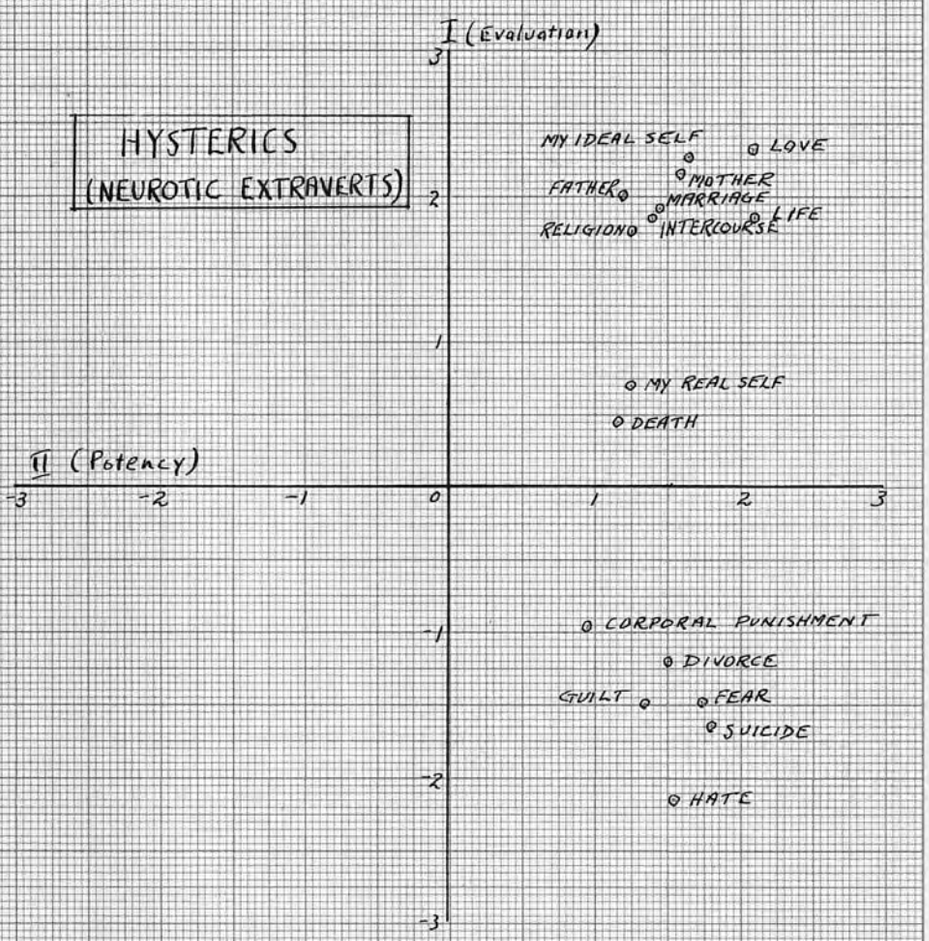
DISCUSSION

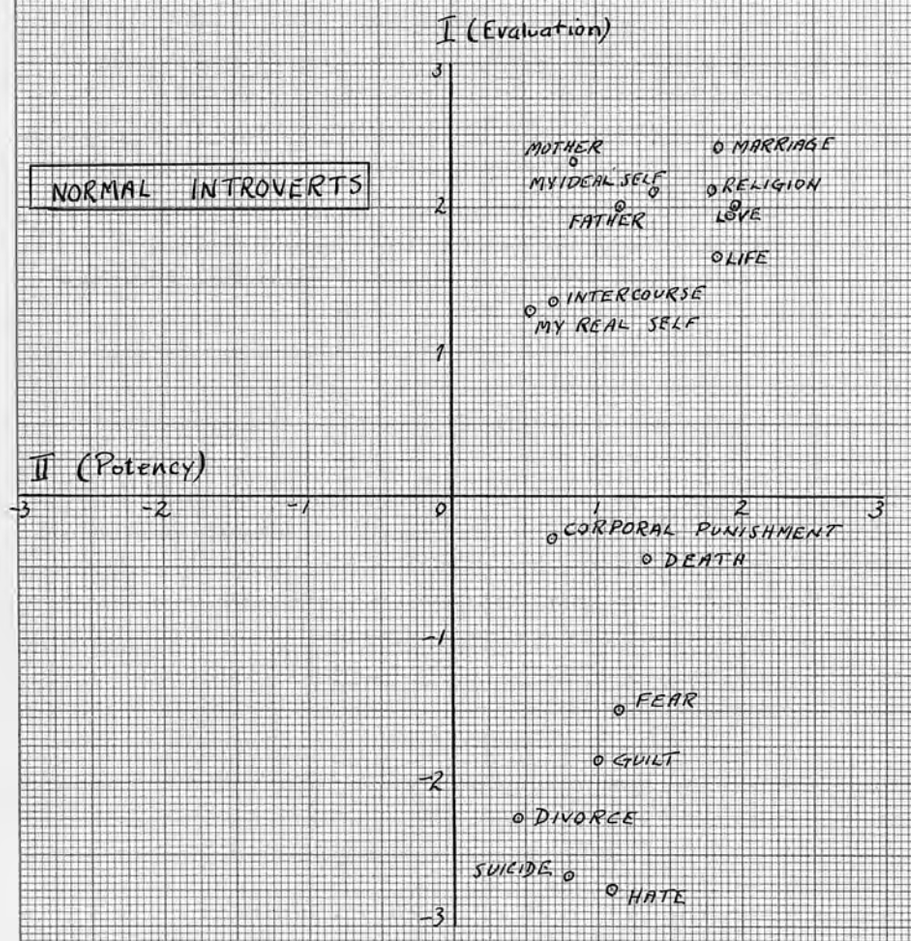
Although the total neurotic group and the total introvert groups tend to produce consistently lower ratings than the normals and the extraverts respectively, it would appear that the influence of introversion and neuroticism varies with the particular ways in which they are combined. Dysthymics (introverted neurotics) rate consistently lower than hysterics (extraverted neurotics), but normal introverts do not rate significantly lower than normal extraverts. Hysterics produce consistently lower ratings than normal extraverts but the differences between dysthymics and normal introverts show no significant trend in either direction. Finally, the clearest differences in the predicted direction emerge in the comparison of the Dysthymics with the normal extraverts.

For the purposes of further discussion, it will be convenient to refer to Figure 11, in which the concept co-ordinate values for all subgroups are plotted in the two-dimensional semantic space. The most striking feature of these graphs is not, as we might have expected, the differences in concept-origin distances, but rather the differences in cluster characteristics. It will be observed that the positively-valued concepts cluster more closely in the case of the normal extraverts than in that of the normal introverts. This barely noticeable difference becomes markedly extended, however, in the graphs of the hysterics and the dysthymics, tempting the speculation that dysthymics over-discriminate the meanings of positively-valued concepts while hysterics do not discriminate sufficiently.

The notion that poor discrimination is characteristic of neurosis







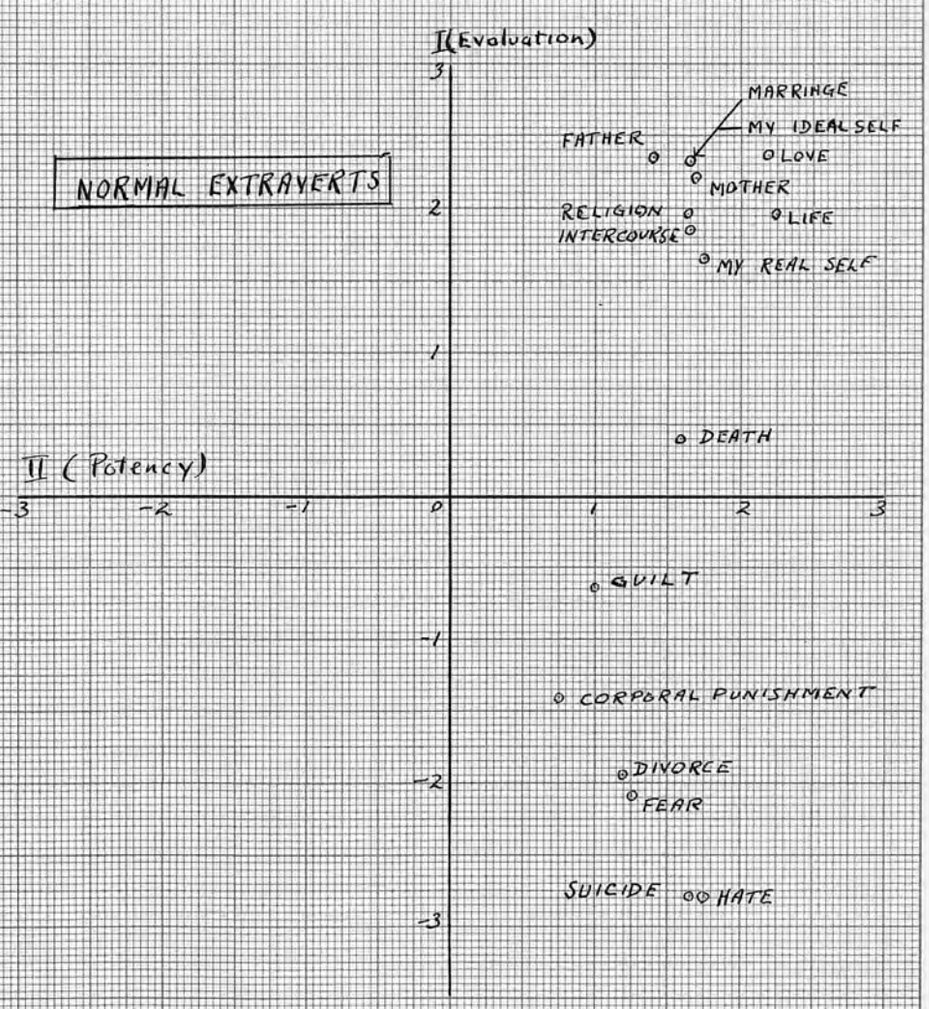


FIGURE II

SEMANTIC STRUCTURES OF DYSTHYMICS, HYSTERICS, NORMAL INTROVERTS AND EXTRAVERTS (M.P.I. CRITERION)

is not new to psychologists who have adopted learning-theory approaches to psycho-pathology. Dollard and Miller (11), for example, devote considerable attention to maladaptive discriminations and contend that successful psychotherapy demands, among other things, the establishment of good discriminatory responses in the patient. But why should the hysterics and dysthymics differ so distinctively in the nature of their respective deviations from optimal discriminations? One explanation is suggested by the work of Eriksen (15) who presents evidence to indicate that hysterics are strong repressors and that dysthymics, on the other hand exhibit poor capacity for repressing. If this were indeed the case, it would be expected that the hysterics would have greater difficulty in identifying and labelling ambivalent reactions than would dysthymics. We should expect, therefore that this difficulty would be reflected in impoverished verbal discriminations among concepts that are possibly the source of conflicts.

The apparent over-discrimination among the same concepts by the dysthymics might be a function of their inability to control anxiety by repression. It seems reasonable to expect that the constant brooding and preoccupation with personal inadequacies that characterize this group would involve a heightened sensitivity to areas of conflict. In this respect, it is interesting to note that in Figure 11 that there is a negative correlation between intensity of rating of the positively valued concepts on Dimension I and intensity of rating on Dimension II (Spearman's rho = -0.667 with $p < .05$). This correlation suggests that the greater the conflict elicited by a concept, the greater the "potency" or significance it has for the dysthymic.

A second explanation for the unexpected difference in cluster characteristics between the dysthymics and hysterics invokes the factor of social desirability that was discussed in Study I. Traub (81, p.54) has adduced evidence to suggest that the psychological basis of the general factor of social desirability is extraversion. If this is indeed the case, it might be argued that the normal extraverts rated the positively-valued concepts not in terms of their personal feelings, but rather with a view to reflecting what would be socially acceptable. Within the frame of reference provided by the scales, the extraverts might then endorse all of the positively-valued concepts in approximately the same way. Adherence to the norm is thus achieved at the price of discrimination. The effect of neuroticism, on this interpretation, must take the form of heightening the stereotypy of socially desirable responses. Precisely the reverse situation would obtain with the introverts and the dysthymics.

The crucial difference between these two interpretations is that the first credits the subjects with honesty in responding to the Semantic Differential while the second does not. It is clear that the problem of social desirability will always arise when the individual is presented with a stimulus situation that is structured in such a way that he can form hypotheses concerning the probable responses of others to it.

SUMMARY

In a comparative study of the Semantic Differential ratings of normal and neurotic females it was hypothesized that concepts eliciting favorable reactions in normals would produce less intense reactions in neurotics. Two groups of female students were designated "Normal" and "Neurotic" on the basis of Rorschach test performance. A Semantic Differential Scale consisting of sixteen concepts and twenty scales was administered to subjects in both groups. A comparison of the mean Concept-Origin distances revealed that the neurotic groups produced consistently less favorable ratings of positively evaluated concepts than did the normal groups. Additional personality test data indicated that introversion may have been contributed to the obtained differences. This hypothesis was tested in a second investigation employing the Maudsley Personality Inventory as a measure of both Neuroticism and Introversion. The results indicated that both introversion and neuroticism are associated with relatively less intense ratings of positively valued concepts, but it was observed that in the case of neurotic introverts (dysthymics), the lower the rating of a concept on the Evaluative scales, the higher its rating was on the Potency scales. The effect of this negative correlation was reflected in Concept-Origin distances. The cluster characteristics exhibited by the various combinations of Introversion and Neuroticism were discussed.

PART III

CHAPTER VIII

CONCLUSIONS AND IMPLICATIONS FOR FURTHER RESEARCH

The first study reported in this dissertation represented an attempt to test the validity of an assumed isomorphism between meaning as a representational mediating process and meaning as defined by co-ordinate points derived from Semantic Differential ratings and plotted in the Semantic Space. It was hypothesized that if this isomorphism were valid, Semantic Differential ratings of concepts would be subject to the influence of mediated generalization. The results of this study were positive and are interpreted as constituting partial support for the isomorphism. It is important to note that the observed mediated generalization does not constitute proof that meaning is in fact a representational mediating process. In this respect, the safest conclusion that can be drawn is that differences and similarities in meaning as defined by Semantic Differential performance appear to be valid indices of certain internal determinants of behaviour. Furthermore, the inter-relationships of meanings revealed in the Semantic Space appear to reflect the organization of these determinants within the individual.

The second and third studies revealed that the factors of neurosis (or neuroticism) and introversion are associated with fairly distinctive patterns of meaning as measured by the Semantic Differential scales. Borrowing from the findings of the first study it was hypothesized that ambivalent reactions to positively-valued concepts would produce shorter concept-origin distances in the Semantic Differential protocols

of neuotics than in those of normals. This hypothesis was supported in both the second and third studies. The third study also suggested that introverts tend to produce shorter concept-origin distances than do normals.

From all of the studies reported, it is possible to draw a number of general conclusions concerning the use of the Semantic Differential in personality research:

1. The Semantic Differential appears to be a valid index of connotative meaning.

2. The Semantic Differential scales appear to have fairly stable dimensional characteristics over time and subjects. Since there is some possibility that these characteristics are partly a function of the particular concepts rated, it would be necessary to factorize scales where the degree of concept-scale interaction is unknown.

3. The Semantic Differential appears to have considerable promise as a research tool in comparative studies of different clinical groups.

In each of the studies reported, there arose problems that have implications for both the theoretical and research aspects of Osgood's approach to meaning. In this, the concluding section of the dissertation, it is possible to review these problems in the light of the findings taken as a whole, and to suggest solutions that might be tested in subsequent investigations.

The major and recurring difficulty concerns the social desirability factor in Semantic Differential performance. In the first study, although it was argued that the findings could not be satisfactorily

explained in terms of social desirability, the discussion centred on the post-treatment analysis. No reference was made to the possibility that the pre-treatment performance of both the control and experimental groups could have been influenced by a desire to reflect the socially accepted meanings of the concepts that formed the subject of the investigation. From the subsequent studies, however, it became evident that in simple comparative investigations in which no experimental treatment was introduced, social desirability constituted a possible source of variance. It will be recalled that an examination of the cluster characteristics and the concept-origin distances of the various groups indicated that if in fact the factor of social desirability did influence scale ratings, then its influence was largely restricted to the performance of extraverts. This suggests that research should be carried out to test this hypothesis. If the hypothesis is supported, it might be of value to repeat the first investigation but restricting the sample to introverts. Alternatively, both extraverts and introverts could be employed if a suitable design were developed (for example, analysis of covariance).

These suggestions ignore, of course, the challenge posed by the hypothesized existence of the social desirability factor for Osgood's approach to meaning. Before passing to a discussion of the second problem arising from these investigations, therefore, some consideration should be given to this issue.

Perhaps the simplest way of handling socially desirable responses within the framework of Osgood's theory of learning is to treat them as attempts to reduce anxiety produced by ambivalence of connotative meaning. Let us assume that the individual is asked to say what a concept means to him. If this concept has

been previously associated with significates that gave rise to responses of both approach and avoidance, ambivalence of meaning will be present. The co-existence of reciprocally antagonistic meanings would normally mediate, as was suggested in Studies II and III, a response that constituted a compromise between the responses that might be mediated by the respective meanings considered singly. However, if we assume that the individual has either been punished, or has not been reinforced for producing compromises in the past, we would predict that this kind of response would be suppressed, and one of the two responses forming the initial basis of the conflict would be elicited. Reinforcement of the response would strengthen the probability of its occurrence. Now since the constitution of reinforcing agencies (in the shape of people) is subject to variation it would be expected that the major determinant of any of the alternative responses (extreme or compromise) would be the social context in which the concept is presented. This leads to the prediction that the detection of a socially desirable response to a concept would be facilitated by manipulating the situational variables.

There is nothing in this analysis to suggest that a socially desirable response is a response that does not reflect a "true" meaning of a concept for the individual. The analysis implies rather that a socially desirable response is one of a number of alternative responses elecited by a concept, and what is involved here is not a sin of commission but one of omission.

The second problem arising from the investigation concerns the use of personality tests for the purpose of obtaining clinically

differentiated groups. A review of the findings of Studies II and III reveals that comparisons of Semantic Differential performance across groups are of limited value when differentiating criteria (in this case, the Rorschach and the Maudsley Personality Inventory) do not correlate highly. This problem is, of course, as old as the history of personality test development, and there is still no evidence of an imminent solution. Related to this issue is that posed by the Foulds and Caine studies cited earlier, namely, the behavioural variability of individuals assigned to a given personality type on the basis of test performance. It is obvious that if test-designated dysthymics behave either like dysthymics or hysterics, there is something wrong either with the test or with the behavioural analysis.

In the light of this problem, it is suggested that in comparative investigations of Semantic Differential performance, both test and symptom-clusters should be employed as the bases for group differentiation. In this respect, there need not necessarily be any close degree of agreement between behavioural analysis and clinical designation by personality test. Furthermore it is not outwith the bounds of possibility that the development of a suitable form of the Semantic Differential may serve not merely as a dependent variable, but also as an important independent variable in establishing distinctive clinical groups. It may very well be that this technique may serve to discriminate between individuals whose sympton-clusters correspond to their personality types and those in whom such correspondence is absent.

If further research continues to support the validity of the Semantic Differential as a quantitative measure of connotative meaning, this instrument should prove to have considerable value in clinical

work. The principal advantage lies in the fact that the psychologist may explore the meaning of any area in the life of the patient or client without relying exclusively on his own subjective impressions. It is obvious, of course, that through the operation of a reaction formation or some other defence-mechanism, the patient may give misleading responses. This suggests that precautions should be taken to include scales whose meanings are not obvious but which correlate highly with those scales that might cue defensive reactions.

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APPENDIX A

THE D-METHOD OF FACTORING [1]

This technique of factoring is essentially equivalent to Thurstone's Diagonal Method (58). We begin with the raw-score matrix:

		SCALES					
		1	f	g	h	i	m
	1	X_{11}	X_{1f}	X_{1g}	X_{1h}	X_{1i}	X_{1m}
	.	.	.	.	.	.	.
	.	.	.	.	.	.	.
concepts	j	X_{j1}	X_{jf}	X_{jg}	X_{jh}	X_{ji}	X_{jm}
	.	.	.	.	.	.	.
	.	.	.	.	.	.	.
	k	X_{k1}	X_{kf}	X_{kg}	X_{kh}	X_{ki}	X_{km}

The elements of the matrix are semantic differential ratings by an individual, or the mean ratings by a group, scored in the system +3, +2, +1, 0, -1, -2, -3, where the size of the number is an index of rating intensity and the algebraic sign indexes the adjectival pole. The assumption made is that the matrix defines a space of $\underline{k}$ dimensions such that each scale, $\underline{i}$ has co-ordinates $X_{1i} \ldots X_{ji} \ldots X_{ki}$ on the $\underline{k}$ dimensions. The goal is to find the co-ordinates on a new set of $\underline{k}$ dimensions where k is less than k.

For k-dimensional space the following definitions are made (all summations are over j, where $j = 1, 2, \ldots, k$):

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[1] Adapted from Osgood, C.E., Suci, G.J., and Tannenbaum, P.H. The Measurement of Meaning (1957).

$D_{oi}^2 = \sum X_{ji}^2$; the squared distance between scale $\underline{i}$ and the origin $\underline{o}$. (1)

$D_{hi}^2 = \sum (X_{jh} - X_{ji})^2$; the squared distance between any two scales $\underline{h}$ and $\underline{i}$. (2)

θ_{hi} ; the angle between two vectors where one vector extends from $\underline{o}$ to $\underline{h}$ and the other from $\underline{o}$ to $\underline{i}$. (3)

In $\underline{k}$-dimensional space:

$$D_{hi}^2 = D_{oh}^2 + D_{oi}^2 - 2D_{oh}D_{oi}\cos\theta_{hi} \quad (4)$$

therefore
$$D_{oi}\cos\theta_{hi} = \frac{D_{hi}^2 - D_{oh}^2 - D_{oi}^2}{-2D_{oh}} = c_{I_i} \quad (5)$$

Here, c_{I_i} is the co-ordinate of scale $\underline{i}$ on a dimension I passing through $\underline{h}$. To find the co-ordinates on a second dimension II, orthogonal to I, the distances in $\underline{k}$-space must be reduced to their k-1 values by subtracting from the D^2 values their squared components on dimension I. The reduced distances $(D')^2$ may be substituted in equation (5) to find c_{II_i}, the co-ordinate value of scale $\underline{i}$ on dimension II. The components of the D_{oi} are c_{I_i}, and the components of the D_{hi} are $(c_{I_h} - c_{I_i})$

Selecting a scale $\underline{g}$ through which dimension II is to pass in $\underline{k}$-1 space:

$$c_{II_i} = \frac{(D_{gi}')^2 - (D_{og}')^2 - (D_{oi}')^2}{-2D_{og}}, \quad \text{where} \qquad (6)$$

$$(D_{gi}')^2 = D_{gi}^2 - (c_{I_g} - c_{I_i})^2 \qquad (7)$$

$$(D_{oi}')^2 = D_{oi}^2 - c_{I_i}^2, \quad \text{and} \qquad (8)$$

$$(D_{og}')^2 = D_{og}^2 - c_{I_g}^2 \qquad (9)$$

To find a third dimension, orthogonal to I and II, select a scale f through which III will pass in k-2 space. Find the distances D in k-2 space by subtracting their components on I and II and substitute in (5) to find the co-ordinates on the third dimension:

$$c_{III_i} = \frac{(D_{fi}'')^2 - (D_{of}'')^2 - (D_{oi}'')^2}{-2D_{of}''}, \quad \text{where} \qquad (10)$$

$$(D_{fi}'')^2 = D_{fi}^2 - (c_{I_f} - c_{I_i})^2 - (c_{II_f} - c_{II_i})^2, \qquad (11)$$

$$(D_{oi}'')^2 = D_{oi}^2 - c_{I_i}^2 - c_{II_i}^2, \quad \text{and} \qquad (12)$$

$$(D_{of}'')^2 = D_{of}^2 - c_{If}^2 - c_{IIf}^2 \qquad (13)$$

This process is continued until the co-ordinates are reduced to zero or a negligible amount.

In practice it is more convenient to work with sums of cross-products and squares than with distances. By substitution of the equivalences given in (1) and (2) in equation (5), and by reducing, we find:

$$c_{I_i} = \frac{\sum X_{jh}X_{ji}}{\sqrt{\sum X_{jh}^2}} \qquad (14)$$

Similarly we find c_{II_i} by substituting in (6), and reducing to

$$c_{II_i} = \frac{\sum X_{jg}X_{ji} - c_{I_g}c_{I_i}}{\sqrt{\sum X_{jg}^2 - c_{I_g}^2}} \qquad (15)$$

For a third dimension substitution is made in (10), and reducing, we find

$$c_{III_i} = \frac{\sum X_{jf}X_{ji} - c_{I_f}c_{I_i} - c_{II_f}c_{II_i}}{\sqrt{\sum X_{jf}^2 - c_{If}^2 - c_{IIf}^2}} \qquad (16)$$