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PERS 242 CROSS-CULTURAL DIFFERENCES IN COGNITIVE FLEXIBILITY

PART ONE: THEORY AND HYPOTHESES FOR PROPOSED RESEARCH

NATIONAL INSTITUTE FOR PERSONNEL RESEARCH

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1. INTRODUCTION

This study examines the possibility of cultural variables influencing performance on certain measures of flexibility. Before discussing the interaction of culture with personality and cognition, an overview of research in the field of flexibility/rigidity is presented. Since much of the work in this area is devoted to an examination of rigidity as a unitary trait and seems to reflect some of the confusion regarding the status of personality traits in general, trait theory is discussed as a prelude to the examination of rigidity/flexibility.

2. TRAIT THEORY

Trait theory represents an attempt to classify and order human differentiation. Individual differences are expressed in a quantitative and not a qualitative form. Trait distributions tend to be continuous, with individuals being described as possessing a greater or a lesser amount of a particular trait, rather than as belonging exclusively to one discrete personality group or another. Tyler (1965) prefers the term "dimension" to trait, regarding it as a more accurate reflection of an individual's placing on a scale representing some quality (or trait). On a multidimensional scale, an individual can be assigned a position which indicates his simultaneous standing on many different trait-scales.

The differences which psychologists attempt to quantify by means of trait descriptions, can occur within an individual, (along a time-scale, perhaps, or on different attributes) between individuals, and between groups. Some of the lack of clarity in the field is perhaps due to the indiscriminate use of the word "trait" to describe all these types of differences which cannot realistically be expected to exhibit the same consistency, stability, or pattern of correlation. The earlier studies dealt mainly with "common traits", which characterised either people in general or large groups of people, and could be measured by standardised tests with group norms. With an upsurge of interest in the idiosyncratic behaviour of the individual, and the development of techniques such as projective tests for the intensive

/study ...

study of the individual subject, more emphasis was placed on the study of unique individual traits. This led to a questioning of the usefulness of a process which described the individual in terms of what he had in common with others (common trait) rather than what set him apart from others (individual trait). This debate is by no means settled, and will perhaps only end in an acceptance of the usefulness of the less sensitive but more standardized tests for answering research questions different to those which can be answered by more subjective clinical techniques.

The first person to articulate a type of trait theory was Spearman, in 1904. According to his two-factor theory, all intellectual activities have in common a general factor (g), described as "mental energy". In addition there exist specific factors (s), which are unique to each activity. Later on Spearman also identified group factors, which fell somewhere between (g) and (s), being neither as general nor as specific, and described additional general factors which determined the way g was utilised. The general factor of perseveration, for example, he described as inertia of mental energy.

From this beginning, more factors were defined, and new theories put forward to explain their organisation. The British and American schools expressed divergent theories, which Tyler (1965, p 94) ascribes partially to the different populations of subjects they were working with. The British experimenters tested their theories on school children, and their emphasis on the g-factor may be the result of the still-undifferentiated intelligence of their subjects. The Americans, on the other hand, took college students as their subjects, and found little evidence for the existence of a general intelligence factor. The British workers, such as Burt and Vernon, proposed a multilevel or hierarchical theory of trait organisation, beginning with g and developing through major and minor group factors to specific factors. The Americans (e.g. Thurstone) put forward multiple-factor theories which proposed a number of fairly wide group factors, each entering with different weights into different tests. The two classes of theory are not, however, as dissimilar as they would at first appear. The factor-

/analytic ...

analytic methods of the American investigators identify traits first, and then correlate trait measurements with one another to identify types as second order factors, while the British factor-analytic methods identify first types and then traits. (Tyler, 1965, p 176)

Although there was a great deal of controversy among the earlier trait theorists, it centred mainly around whether or not general abilities could be improved, the relationship between traits and abilities and the different levels at which traits functioned. There was little doubt that intellectual traits existed, and the experimental evidence for their existence was quite substantial. Once factor analysis was applied, however, traits were sought within the field of personality and the picture changed.

Firstly, research workers were hampered by what Anastasi (1958, p 342) refers to as "the paucity of definitive knowledge regarding personality organisation". Partly because of this lack of knowledge, and partly because of the complexity of personality, the task of identifying all the separate ways in which persons differ, and organising these differences into traits, was an enormous and almost impossible one. For those traits which were most easily identifiable, the problem of validation was severe. Tyler (1965, p 153) writes that "there seem to be no life situations where success depends on possession of (a personality trait) to the extent that school success depends on intelligence". Even ratings by people who know the testee well do not provide an entirely reliable criterion. They often reflect the appearance of the testee, rather than measuring a deeper personality.

Given all these difficulties, although personality traits were sought and found with as much confidence as intellectual abilities, the experimental evidence became more meagre (Mischel, 1968; Vernon, 1964). This was not necessarily taken to mean that personality traits do not exist. Various explanations were put forward for the low correlations between supposed measures of a given construct. For example, there is a greater uniformity and standardisation of experience in the intellectual than in the emotional or motivational sphere. The mind of every person is, to a greater or lesser degree, trained while we do not (yet)

/have ...

have standardised 'schools' for personality. Also, an item in a personality test is more likely to have a 'private' meaning for the testee than an item on an intelligence scale (Anastasi 1948). As the study of the intellect is better established, it may be that the instruments used are more refined. Potentially high correlations in personality study may be obscured by extraneous variance produced by crude measures.

One of the most crucial issues in the personality trait debate is that of stability and consistency of traits. Kagan and Moss (1962), describing findings from the longitudinal investigation of 89 white children from birth through adulthood, conclude that many behaviours exhibited by 6-10 years, and some behaviours of 3-6 year olds, are good predictors of related behaviour during early adulthood. This prediction is most reliable in the areas of "passive withdrawal from stressful situations, dependency on family, ease-of-anger arousal, involvement in intellectual mastery, social interaction anxiety, sex-role identification, and pattern of sexual behaviour in adulthood". The most important finding from this study is the differential stability of passivity, dependency, and aggression for males and females. Behaviour which is frowned on by society, passivity in males, for example, and aggression in females, is gradually suppressed as the child grows older. Kagan and Moss conclude therefore (p 269) that "when a childhood behaviour is congruent with traditional sex-role characteristics, it is likely to be predictive of similar behavior in adulthood".

Bloom (1964), in a summary and discussion of research into the stability of human characteristics, agrees with Kagan and Moss on the personality areas which appear to exhibit the greatest stability. He concludes (p 177) that "by an average age of about two ... at least one-third of the variance at adolescence on intellectual interest, dependency, and aggression is predictable. By about age five, as much as one-half of the variance at adolescence is predictable for these characteristics". He emphasises, however, that a considerable amount of change still takes place between the ages of ten and twenty-one, and that although most studies have concentrated on changes occurring between birth and early adulthood, changes in interests, attitudes and personality occur throughout life.

/Tyler ...

Tyler (1965, p 40) summarises the position as follows: "some traits are more stable than others (and) ... environmental factors help to determine whether stability or change will predominate".

Stability is usually claimed, not for specific traits, but for more general factors such as aggression or dependence. Lack of cross-situational correlations in an individual's behaviour are sometimes explained by means of a distinction between source traits and surface traits (see footnote 2 on p. 12) Thus, anxiety over parental rejection may produce a phobic reaction in a very young child, which changes to excessive obedience as the child gets older. In this case the source trait, anxiety, has remained constant while expressing itself in two seemingly unrelated surface traits. (Mischel 1968).

Theorists, such as Mischel (1968, 1969) claim that cross-situational correlations are low because the different behaviours of an individual are determined, not by stable and enduring traits, but by specific situations and a dynamic changing personality. He writes (1969, p 1017): "We do need to recognise that discontinuities, real ones and not merely superficial or veneer changes, are part of the genuine phenomena of personality ... . To be more than nominally dynamic our personality theories will have to have as much room for human discrimination as for generalisation, as much place for personality change as for stability, and as much concern for man's self-regulation as for his victimisation by either enduring intra-psychic forces or by momentary environmental constraints". He documents his disenchantment with trait theory on the grounds of low correlation, lack of validity, and lack of reliability, in his book 'Personality and Assessment' (1968).

A compromise solution for the trait controversy appeared to be possible with the use of the term 'moderator variable' to explain different reactions from a supposedly homogeneous population. However, this term has been given such a broad interpretation as to render it almost meaningless. Alker (1972), for example, applauds the use of moderator variables to redirect research from a monotrait to a multitrait strategy. This is done by splitting a population into different groups

/on the basis ...

on the basis of a moderator variable such as anxiety, before another characteristic, perhaps risk-taking, is studied. In effect the interaction of the two (or more) traits is then studied. Both Wallach and Leggett (1972) and Endler (1973) found that using moderator variables in the manner suggested by Alker, to divide populations into normal and abnormal groups, did not produce meaningful results. Bem (1972) takes the moderator variable concept further by suggesting that it should apply to situational as well as personality variables. Any behaviour contingent upon unique situational or personal factors could then be described as a function of certain moderator variables.

Another suggestion made by Bem is that individuals monitor selected areas of their behaviour and that behaviour is consistent within this monitored area. Thus a highly sex-typed individual would produce consistent "masculine" or "feminine" responses, but might be inconsistent in areas such as honesty, which are not sex-linked. (This could also be due to defective learning, where an individual never learns responses appropriate to the other sex-role.) Whether such monitored behaviour could be regarded as a trait or not remains open for speculation, although it would appear that such a self-imposed trait is real for the subject himself.

Wallach (1972) suggests that the mistaken assumption underlying moderator variables and other methods was examining measures not of interest in their own right, but simply as predictors. He claimed that the place to look for consistency, and he has no doubt that human beings are consistent, is behaviour itself.

Obviously, no definite conclusions have been reached on the existence or non-existence of personality traits. This is partially because it is impossible to prove definitively that a trait does NOT exist - there can only be a lack of evidence that it does exist. Much of the debate has involved wrangling over the explanations for ambiguous results which could be interpreted as evidence in either direction. There has, however, been a definite movement away from a search for large, constant, global traits. Averill (1973), while accepting the

/existence ...

existence and validity of traits, cautions that they can only be usefully ascribed under appropriate circumstances (his italics). Unfortunately, he does not explain what these circumstances are. Alker (1972), calling for a multitrait approach, stresses the importance of paying attention to persons rather than particular responses, while Wallach (1972) asks for more research to be concerned with inherently meaningful information about people instead of "presumptive signs of hypothetical entities" (p 327). From the other camp, Mischel (1968) does not believe that all behaviour is situation specific, but accepts that a stable environment can lead to consistent behaviour, and that stimulus conditions which have much in common may evoke similar behaviours. He argues that existing data do not support the existence of stimulus-free, highly-generalized behavioural sets, but he does not dispute the occurrence of long-term individual differences in response to stimuli. Endler (1973) regards the whole person-situation debate as a pseudo-issue, as it is important that the relative contributions of both situations and individuals to behaviour should be examined, as well as their interaction. He points out that experimental methodology often influences results - trait supporters use correlation techniques - while mean differences are used by supporters of environmental influence. The model that he favours is interactional, and he quotes several studies indicating that person by situation interaction accounts for more variance than either person or situation alone.

Whether one chooses to emphasise stability or change in behaviour across time and situation, the work discussed above does provide some guidelines for further research. Areas researched should be compact and clearly defined, with emphasis on actual behaviours rather than hypothesised broad relationships - on the person and his actual, rather than a theoretical, context. The possibility of the influence of situational variables, and personality variables other than those being studied, should be borne in mind.

/3. ...

3. EARLY STUDIES

3.1 Perseveration

English and English define perseveration as the "tendency of organismic activity to recur without apparent associative stimulus". It was the study of this tendency which gave rise to later rigidity studies, so a brief overview may provide some understanding of the term 'rigidity'.

Eysenck (1953) divides the phenomena which have been studied in order to produce various measures of perseveration, into four classes. The first two classes, ideational and emotional perseveration, are closely linked, and occur when emotions and/or ideas continue or come into consciousness again when the stimulus that has triggered them has been removed. The third type of perseveration is in the sensory field, and takes place when successive stimuli appear to fuse into one. For example, a burning coal moved in a circle will create the illusion of a glowing circle. In motor perseveration, Eysenck's fourth class, the after-effect of one task hinders the effective execution of another task.

According to studies quoted by Eysenck (1953) and Levine (1955), little attention was paid to ideational and emotional perseveration, results were inconclusive, and the subject was soon abandoned. Biesheuvel (1938) ascribed the inconclusive results obtained with motor perseveration to faulty experimental procedure, the effect of extraneous variables such as will or effort, and ambiguous results which were obtained when high scores could indicate either lack of perseveration or extreme perseveration leading to a mental set which facilitated test completion. He suggested that the flicker-fusion test, a sensory test in which a light is flashed on and off with diminishing intervals until the subject perceives the flashes to have fused, would be free of the drawbacks of the ideomotor tests, although he cites other sensory experimenters whose results were inconclusive. His data, against the criterion of a "Behavioural Questionnaire" answered by school teachers, showed that "behavioural perseveration and sensory perseveration, measured in terms of the threshold for flicker, tend to vary together" (p 37).

/Cattell ...

Cattell (1946, a) and b); 1949) took up the study of motor perseveration in great earnest. He contended that two separate processes were involved in motor perseveration, and that failure to acknowledge this had led to the inconclusive and contradictory evidence in the field. The two processes were: "Inertia of mental processes" and "inertia of structural disposition" or "disposition rigidity".

The first process manifested itself when a subject was required to switch quickly from one task to an equivalent but different task, e.g. writing first a row of As, then a row of Bs. These activities, following one another in rapid temporal succession, produce interference by their inertia or after-effect. The second process shows itself in 'creative effort' tests where the score is measured as "the difference between performing a task in some old accustomed fashion and performing it in some new but not intelligence-demanding fashion" (p 231) Such a task might involve first writing a name, and then writing it backwards. rapid temporal succession is not important.

Cattell's further work was devoted to disposition rigidity as measured by motor tests. Although he found a general factor of disposition rigidity across a wide range of motor performances, he emphasised that correlations and reliabilities remained low, and even with the same tasks he found a general factor in some populations and not in others. He also warned that the validity of his findings was limited to motor performance, and that "to claim that perseveration extends also through all dispositions to think or feel perseveratively is a speculation undertaken at one's own risk" (1946 (a) p 232).

Without any definite conclusions begin reached, perseveration studies simply ceased begin carried out, and Eysenck wrote in 1953 (p 70) that "in the last decade or so, the concept of perseveration has ceased to attract much attention, and in its stead the trait of rigidity has been widely studied".

With perseveration studies simply having drifted into rigidity studies, it is difficult to get a clear picture of the final state of experimentation in this field. Some trends however, do emerge, and it is

/important...

important to take cognisance of them, as many of them are mirrored in the later rigidity research. The first is that most writers (Eysenck, 1953; Rim, 1955; Levine, 1955), have concluded that there is no unitary factor of perseveration. This has not prevented researchers from using isolated perseveration indices in specific areas, (e.g. flicker-fusion, motor tests), but when writers have attempted to generalize to global personality types or traits, the experimental links have often become tenuous.

Writing of the problems of defining perseveration Levine (1955), makes the point that the very earliest studies treated perseveration as 'stability' or 'perseverance', a positive trait until Spearman's conception of perseveration as mental inertia[1] brought with it negative connotations, and perseveration began to be linked with "bigotry, ineducability ... extreme dislike of change" (p 118). The Heymans-Wiersma temperament theory, which classified perseveration as a cerebral secondary function, regarded it as a positive trait, as opposed to primary function or "impulsivity". At what point does ability to ignore distractions become inability to respond to new stimuli ? Or, to use terms which have been rather loosely used in the research, when does persistence become perseveration ?

Levine (1955) puts forward the following equations to distinguish between the three overlapping concepts (p 120):

Rigidity = Perseveration - Will
Persistence = Perseveration + Will

This is not altogether satisfactory, as the concept of "will" is rather difficult to define and we are left somewhat in the dark as to the meaning of perseveration (except for the tautological 'rigidity + will'). However, the idea of conscious control would seem to be an important one. We will combine it with the key concept 'stimulus' from the English and English definition of perseveration, and define

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[1] The general law of mental inertia proposed by Spearman in 1927 is as follows: "Cognitive processes always both begin and cease more gradually than their apparent causes".

/persistence ...

persistence or perseverance for the purposes of this study as "a response, partially consciously controlled, to certain stimuli and not to others, where it is appropriate to continue this response". Perseveration may then be termed an inappropriately continued response to certain motor and sensory stimuli. The definition of rigidity in terms of appropriateness of response to demand for change will be discussed later.

A final comment must be made about the confusion of language use in perseveration studies. Experimenters have often used terms in different ways or described results in words which are similar but not identical to those of their predecessors. Rim (1955) writes of three factors, viz. disposition rigidity, creative effort rigidity, and ideational or cognitive rigidity. Cattell (1949) however, had defined two factors, ideational inertia and disposition rigidity, the latter to be tested by means of creative rigidity tests ! Clearly, the two writers are not using terms to mean the same things, and analysis and comparison become difficult. The interchangeability too of "cognitive or ideational rigidity" is confusing, as ideational perseveration is seen by Eysenck as referring to a name or word occurring in the conscious mind without any apparent reason, while cognitive rigidity is used later to refer to problem solving ability.

3.2 Rigidity

English and English (1958) define rigidity as being "a relative inability to change one's action or attitude when the objective conditions demand it; clinging to a no longer appropriate way of feeling or acting. To be distinguished from perseveration, which is the continuation of a response actually going on, whereas rigidity is resistance to undertaking a new kind of response". We shall later examine many of the tests of rigidity in the light of this definition.

/The study ...

The study of rigidity flowed from the study of perseveration with many of the instruments for the study of perseveration being adopted wholesale, such as Cattell's hidden figures and flicker fusion. However, where perseverationists, on the whole, had given up the idea of perseveration being a unitary function, the rigidity experimenters tried to show that rigidity was a unitary personality trait linked with other personality variables such as authoritarianism (Adorno, 1950) and intolerance of ambiguity (Budner, 1962). This broad perception seemed to lead to a great deal of work with tests of preference as well as tests of specific ability. The implicit assumption is apparently that rigidity affects a broad range of behaviours, from the inter-personal to the perceptual, equally, and can therefore be tested as well by sampling preferences as by sampling motor or problem-solving behaviour. This would make of rigidity a source trait[2] manifesting itself in various surface traits.

The most extreme example of the preference type test is that of Breskin (1968) who gave his subjects twenty items consisting of pairs of drawings, and asked them to indicate a preference for one drawing out of each pair. Each pair consisted of a drawing which conformed to the laws of Praegnanz[3] and one which did not. Subjects who preferred the regular, precise drawings were scored as being rigid. Fisher (1950) also used the subjects' preferences to obtain rigidity scores. Those subjects who (for example) said that they liked a large number of different coloured ribbons, who selected a large number of photographs of people as being 'friendly', or who accepted a large number of pictures as being 'like myself' received a high flexibility score. Another implicit assumption of most of the preference tests is that 'Rigidity' and 'Flexibility' are mutually exclusive, and that populations can, therefore, be dichotomized into 'Rigid' and 'Flexible' people.

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[2] According to Cattell (1972) a surface trait is a set of personality characteristics which are correlated but do not form a factor, and are believed to be determined by a single unitary influence, viz. a source trait.

[3] Law of Precision: "the most general law of the organisation of experience or behaviour. It holds that a Gestalt tends, to the extent that conditions permit, to become sharply defined or precise, regular, symmetrical, parsimonious". (English and English, 1958, p.402)

/A group ...

A group of preference tests which evoked a storm of controversy were the Einstellung tests (Fink, 1958). In these problem solving tests (the classical case is Luchins' water-jar test, invcIving the transfer of specified quantities of water between jars of given capacities) the first few problems are solved in the same manner so that the subjects develop an answering set. Then there is a change, and problems are presented which can be solved either in the manner of the previous problems or in a newer, simpler fashion. Subjects who do not change are generally held to be rigid. Conflicting results have been obtained using this test, and Luchins (1949, 1951) and Levitt and Zelen (1953) have strongly attacked its rationale. They point out that on the criterion of speed, subjects who continued using the set method to which they were accustomed performed better than subjects who analysed each problem separately, and changed their method of solution. Therefore, objective conditions did not demand change, indeed, they demanded that the subject should not change. A change of set thus indicates a subject's preference for looking at and solving each problem individually, rather than his ability to respond to a demand for change.

Tests of rigidity which do take the demand for change into account are almost all in the cognitive field, as opposed to the old perseveration tests which emphasised motor and sensory responses. One of the best examples is Berg's (1948) test of card-sorting ability. In this test, subjects are required to sort cards into groups according to one of four possible principles, with the experimenter indicating when the "correct" choice has been made. The "correct" principle changes several times during the test, and subjects must therefore alter their response sets in order to continue making appropriate responses.

The difference between demand and preference tests is unfortunately not the only division in rigidity research up to the present day. The difficulties caused by careless use of terminology, mentioned in the perseveration section, are rife here too. Tests have been constructed to cover a wide area, from pictorial tests of intolerance of ambiguity (Frenkel-Brunswik, 1949) to questionnaires on ethnic prejudice (Rokeach, 1968). Chown, in her literature survey in 1959, lists no less

/than 47 ...

than 47 different rigidity tests, none of which overlap! In a later survey, Leach (1967, p 11) agrees that although "a large amount of effort has been devoted to the study of rigidity during the last forty years ... there is still little agreement as to its identity or components". This specific confusion regarding the status of a rigidity trait appears to mirror the general confusion in the whole field of personality research as to the value of the concept "personality trait" in the sense of "source trait". A brief look at the current state of trait theory might therefore be helpful for this study.

4. PROPOSED FURTHER FLEXIBILITY RESEARCH

We must now attempt to apply the findings of the trait and personality theorists to the study of flexibility. Clearly, to prolong the debate on whether or not there is a unitary trait in this area would be fruitless. Rather, a study should be made of flexible behaviour in different areas, which may not necessarily correlate with one another in one individual. Individual rigidity profiles could then be drawn for subjects, indicating strengths and weaknesses in different areas. If the tester is interested only in one area, it should be possible to administer tests in that area alone. That is, the study should focus on different surface measures of rigidity which may or may not be manifestations of a single source trait.

To start with, a definition of flexibility must be formulated which is not tied to any specific psychological domain. For the purposes of this study, the following definition is proposed: "Flexibility is the ability to change set when circumstances demand it".

By the qualifying clause, 'when circumstances demand it' we mean only when circumstances objectively demand it. Fabian (1957), after some work with the seven-squares test, found that labile responses occurred interchangeably with rigid, but not with flexible responses. He therefore suggested that the rigidity-flexibility-lability spectrum should be conceived of as being circular rather than straight, so that

/lability ...

lability and rigidity would lie next to one another. This hypothesis is borne out by the work of Berg (1948), who found that on a card-sorting test the group with the lowest score (i.e. the least flexible group) produced extremely rigid and/or extremely variable responses. It therefore seems important that flexibility should be seen not only as the opposite of rigidity in the sense of "non-rigidity", but also as "non-lability". A flexibility test therefore, must provide opportunity for subjects not only to alter responses when stimuli are appropriate for change, but also to maintain their responses when the stimuli are inappropriate for change.

Furthermore, if a test situation is to approximate a real-life situation, the subject should be able to choose not only between "right" or "wrong" responses, but among a selection of apparently "right" responses. He must be able to assess the demands of a situation, assign priorities, and act accordingly. The phrase "change set" in the definition may be applied to any field, from the conceptual to the interpersonal, in which the tester wishes to ascertain flexibility. If such a field is carefully and clearly defined, and the score in this field is used to predict performance in a similar field, then many of the risks of cross-situational prediction should be avoided. If situational and extraneous personality variables influence the test situation, they should also be present in the situation in which the subject will later be expected to perform.

This approach sidesteps the issue of the nature of flexibility. It is focussed on the behaviour itself, on whether the subject is adaptable in a situation which is cognitive, perceptual, etc., and not on whether this adaptability is influenced by personality or intellectual variables, or both.

The specific area of behaviour which will be examined in this study is problem-solving. That is, the study will be focussed on how subjects behave in a situation requiring cognitive flexibility.

/This field ...

This field has been chosen partly because it is possible to define the area clearly and measure the behaviour concisely, and partly because of a modern relevance which will be discussed later. In particular, this study will involve research into cross-cultural differences in cognitive flexibility. Before the reasons for expected cultural differences are elaborated on, one further aspect of flexibility must be examined, viz., the possibility of flexibility being improved by training.

5. INCREASING FLEXIBILITY

Most of the work done in this area has focussed on problem solving and tests of intellectual creativity, rather than artistic ability or whole personality. As the rest of this study deals almost exclusively with cognitive flexibility, this section will be devoted to methods of improving cognitive flexibility.

Few studies deal with cognitive flexibility per se, so we will have to extrapolate from other studies, in particular those dealing with creativity. Where creativity studies are aimed at increasing the range of ideas or solutions produced, and/or their originality, it is felt that the same techniques can be fruitfully applied for the improvement of cognitive flexibility.

There are two avenues open to those who would attempt to improve an individual's cognitive flexibility: manipulation of the individual himself, and manipulation of his environment. We will discuss first the effect of environment on flexibility.

Bowden (1970) performed an experiment with scientists in different simulated settings, and found that their creativity decreased or improved according to the setting they were asked to work in and their attitude towards that setting. Thus it was possible for the experimenter to actually manipulate levels of creativity, according to the way the work environment and particularly its demands were perceived. The use of explicit (as opposed to situational) demands for increased creativity will be dealt with later.

/Dellas (1970/71) ...

Dellas (1970/71), describing an atmosphere conducive to maximum creativity, found a significant negative correlation between defensiveness and creativity. This accords with the earlier work of Wolpert (1955), who claimed that a rigidity syndrome could be demonstrated in any individual under very threatening conditions, and Gaier (1952) who found rigidity to be related to anxiety. Rubenowitz (1963) also related fear to increased rigidity. Dellas emphasised that creativity is increased in a psychologically "safe" environment, where the individual does not feel threatened if he deviates from a set pattern of behaviour.

Dealing with another aspect of the environment, Grossman and Eisenman (1971) show that a reduction in situational pressure towards authoritarianism increases creativity and vice versa. This viewpoint is supported by Maruyama (1970, quoted in Bowden, 1974, p 98) who found that a psychologically secure atmosphere was "fostered by the absence of excessively hierarchised authority relationships". Bowden himself (1974, p 98) found that "the suppressive boss, who feels his position threatened by the bright new ideas that his younger, often better academically educated subordinates want to bring forward" was regarded as a major obstacle to creativity among Nigerian administrative personnel. Working on a creativity training project with these administrative personnel, Bowden also concluded that culture and school education had inculcated authoritarian values in them which inhibited creative performance.

Most of the findings mentioned above are tentative. It would nevertheless seem realistic to say, at this stage, that flexible behaviour is more likely to take place in a relaxed, non-threatening environment where great emphasis is not placed on hierarchical and authoritarian values.

Despite the quantity of research devoted to techniques of training for creativity, findings in this area are also tentative and sometimes contradictory. Ray (1967) cites contradictory findings from several experiments based on the work of Maltzman, who defined originality as "uncommonness", and trained subjects to produce more original responses on a free association test by giving them many free association trials and asking for different responses on each trial. Other experimenters found that no increase in originality could be achieved by this technique.

/Other training ...

Other training methods met with more success. Simply instructing subjects to be original or creative, improved their scores on objective tests. Ray (1967) quotes experiments by Maltzman, Bogart and Breger (1958) and Rosenbaum, Arenson and Panman (1964) where originality was increased simply by telling subjects to produce original responses. Bourne, Ekstrand and Dominowski (1971) quote findings by Maske and Davis (1968), where instruction produced more original responses on the Uses test, and by Guilford and Wilson (1957), whose instructed subjects gave more "clever" plot titles than subjects who had not been told to be clever. Levy (1968) found that verbal reinforcement ("yes", "good") during original behaviour would increase that behaviour, and that describing the role of an original person would also elicit original behaviour from subjects. Bourne, Ekstrand and Dominowski (1971) come to the conclusion that it is easy to increase originality, but difficult to increase creativity, as most original ideas are impractical. They state that originality training can facilitate performance on problems for which that particular training method is appropriate, but not problems requiring different approaches.

Khatena (1970, 1971) achieved success in training college adults by means of five creative thinking strategies. These strategies were: breaking away from the obvious and common-place, transposition, analogy, restructuring, and synthesis. The subjects were taught to manipulate both verbal and non-verbal stimuli, and the training led to an improvement in giving infrequent or original responses to tests. Dellas (1970/71) found it possible to increase flexibility and originality by training subjects to associate elements from two disparate sensory modalities, viz. visual experiences and affective experiences. Roweton (1969/70) also increased flexibility in subjects by giving them a long detailed list of possible changes for a problem object. The subjects' creativity scores were improved by giving them pre-training in verbal free association as well as a short list of possible object changes. The subjects showed improved scores for a product improvement test, but training brought about no significant change on the Unusual Uses test scores. This seems to provide further evidence for the fact that it should be possible to increase flexibility in a narrow field, with little transfer to wider areas of creativity.

/6. ...

6. CULTURAL DETERMINANTS OF COGNITIVE FLEXIBILITY

Having discussed why this project is concerned specifically with cognitive flexibility, further clarification is considered necessary at this point to explain why cognitive flexibility is expected to differ among individuals from different cultural backgrounds.

The effects of environmental influences on human behaviour and attributes is a topic which involves all branches of the social sciences. The two disciplines most relevant to the present discussion are anthropology and psychology, including of course, subdivisions of these fields such as cognitive anthropology and social psychology. Often researchers from these two areas have adopted totally different methodological approaches to the study of the problem, with the anthropologists concentrating on "culture" and its influence on the general personality types predominant within that culture, while the psychologists have emphasised "environment" and its effect on the individual. In this study we will deal first with broad relationships between culture and personality, and second with the narrower area of culture and cognition.

6.1 Culture and Personality

In defining culture, Bohannan (1971. p 3) states that "... man communicates through and lives by culture. In his perception of the world, and in his communication of it to others of his kind, man must use sounds and images and material things that are meaningful to him and to the person with whom he communicates. These meanings, made overt in language, metaphors, things,and behaviour, are summed up in the idea of "culture". The relationship between this milieu and the person functioning within it must be two-way, with individual behaviour simultaneously modifying and being modified by the prevailing culture. In this study we will examine only one of these processes, viz. the function of culture in channeling the behaviour and shaping the personality of the individual.

/It would ...

It would be simplistic to look for straightforward cause-effect relationships between a people and their culture - the influences on personality are subtle and complex - and no two individuals react in identical fashion to the stimuli a culture provides. One of the first determinants of cultural practices is simply the ecology within which the culture exists. Whiting (1963, p 4) describes its influence as follows: "The ecology of the area determines the maintenance systems which include basic economy and the most elementary variables of social structure ... these basic economic conditions determine in part the arrangements of people ... and household composition. These in turn set the parameters for child-rearing practices". Within these parameters, of course, a wealth of traditions and other social factors develop, which determine the way the children are ultimately reared. (For descriptions of culturally-determined child-rearing practices, see Whiting and Child, 1953).

Socialisation, and specifically ways of child-rearing, appears to be the major factor in culture which influences personality development. Psycho-analytic theory emphasises the importance for later personality formation of the child's early experiences, particularly weaning, toilet-training, etc. But Kluckhohn (1957) reminds us that child rearing patterns do not cause adult personalities, but that children and adults interact with and within their institutions to form the cultural milieu in which both groups live. "Child-rearing practices" must therefore not be studied in isolation but we must observe and try to comprehend the total life of the child: "the over-all pattern of personality can be understood only in terms of total childhood experience". (Kluckhohn, 1957, p 154).

Learning theory provides us with another insight into the way cultures mould personalities, (Honigmann, 1967; De Vos and Hippler, 1969). Firstly, the system of rewards and punishments within a culture must shape behaviour within that culture, and secondly, the culture will provide opportunities for children to learn valued behaviours while certain other behaviours will be lacking because neither incentive nor opportunity to acquire them is available to the child.

/Finally, ...

Finally, culture influences behaviour by providing a filter for the environment in which the child lives. The artifacts of a culture modify the natural environment, and its belief and value systems explain, interpret and provide an often culture-specific meaning for the experiences the child has and the people and objects he encounters.

Within these general cultural influences, however, the individual child, within his own family group, still reacts in an idiosyncratic fashion. Linton (1936, p 471) warns that "any attempt to establish valid correlations between culture and personality types must take into account ... the diversity of experience among individuals reared within the frame of a single culture and society".

There is therefore a risk involved in taking a heterogeneous group from one culture and expecting to find significant differences on behavioural and personality indices between that group and another heterogeneous group from a different culture. In some instances the differences within cultures may be more significant than those between cultures. In the earlier studies by anthropologists such as Malinowski and Mead, which dealt with geographically isolated non-Western cultures that appeared to be fairly homogeneous, this was not a major problem (although Hsu (1954) claims that these studies were over-simplified, and ignored important individual differences). The study of the inter-relationship of culture and personality in complex Western populations is more difficult. Benedict (1935, p 4) writes "in retrospect it may be possible to characterise adequately a great and complex whole like Western civilisation but ... at the present time the attempt to interpret the Western world in terms of any one selected trait results in confusion".

One study which managed to analyse the effects of childhood environment and child-rearing on personality development in a Western culture, is worth mentioning here. Bettelheim (1969) studied the children on an Israeli kibbutz, analysing, within a psycho-analytic framework, the ways in which the children's experiences and environment are consciously and unconsciously manipulated to produce, with varying degrees of success,

/a personality ...

a personality type amenable to kibbutz life. The isolation of a group with common cultural practices and beliefs, as in the kibbutz, is unusual. When comparing samples from two large and diverse cultural groups, care should be exercised that the subjects in a sample have similar experiences at least in some areas (education, for example, or socio-economic class). This question will be referred to later, when discussing subjects for this study.

While still in the domain of culture, environment and personality, before moving on to a discussion of culture and cognition, two important studies of environment and rigidity must be mentioned. Rokeach (1948) was the first to see a link between ethnocentrism and general mental rigidity, but the major early work in this field comes from Frenkel-Brunswick, (in Adorno, 1950), who linked ethnocentrism, rigidity and intolerance of ambiguity. As part of her contribution to the work on the authoritarian personality, Frenkel-Brunswick described the childhood environment of the person who is likely to grow up displaying some authoritarian characteristics. She showed how excessive conformity to societal norms and other external values which he does not understand, prevent the child from internalising values and lead him to repress feelings which do not thus conform. This leads to a rigid and superficial approach in later life.

Another large-scale study which related child-rearing practices to, among other things, general flexibility, was that of Witkin (1962). He divided his subjects into two groups on the basis of cognitive style. One group, described as field independent, was regarded as being able to think and perceive in a differentiated (or articulated) and presumably flexible fashion. The field dependent group he described as perceiving and thinking in a global, less analytic, and supposedly more rigid fashion. The mothers of the second group were characterised as being both inwardly inconsistent and outwardly conforming in their child-rearing practices. They tended to oppose self-assertion in their children, and prevented their children mastering their environments and learning to assume responsible and adult roles. The mothers of the

/field-independent ...

field-independent group aided the development of a separate self-concept, both physically (in the earlier stages) and in terms of values, etc., (in the later stages), and assisted the development of differentiation[4] in their children.

Although Witkin's classifications were developed to examine and explain inter-individual differences within a Western culture, different workers have also applied them cross-culturally. Hovey, (1971) has devised a classification of 14 African societies on a global-articulated continuum, determining also which factors in those cultures play a large part in developing cognitive style. Particularly important are community organisation variables. Articulated communities evidence "a lack of localised clan structures and a proclivity towards marriage outside the blood group" (p 103), while global groups were kin-homogenous and endogamous. Factors relating to infancy and childhood were also found to be important. The cognitive style tended to be articulated where children were hardly indulged at all, there was high-pressure towards their developing"self-reliant achievement behaviour", and their anxiety over non-performance was high (p 103).

6.2 Culture and Cognition

Having shown how culture and environment can influence the general areas of personality and behaviour, we will now discuss the more specific aspect of the effect of culture on cognition. Alternatively stated, the discussion will focus on the differences in performance of cognitive tasks that may be expected between individuals raised in different cultures.

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[4] Witkin uses the term 'differentiation' in the sense of separation of different psychological functions (Witkin, Berry, 1975). The general system of the differentiated individual is separated into many subsystems, tending to a greater specificity of functioning within many different areas.

/Triandis (1964) ...

Triandis (1964, p 2) describes cognition as "the subfield of psychology that is concerned with the laws determining how organisms know the world around them". This field, he says, includes "perception, recognition, retention, imagination, meaning, associations, and attitudes ... concept formation and problem solving". The two major areas of cognition which have been analysed for cultural influences are language and perception. These two aspects are not free of influence from one another; the words available in a vocabulary to describe what is perceived are considered to affect perception (Whorf, 1956), and what is perceived as important may affect development of descriptive vocabulary.

Tajfel (1969) suggests that there are three reasons why "cultural variables" may affect cognition. The first, functional salience, refers to the fact that in different physical (ecological) environments, different discriminatory abilities become more or less important to the individual. Familiarity refers to the fact that "individuals living in a culture may be exposed to types of human artifacts unfamiliar to those living in another culture" (p 359). The third reason for difference lies in systems of communication which "often mediate between the individual and his surroundings ... focus his attention on some aspects of his environment and deflect it from others, or ... may impose idiosyncratic cultural classifications on the world he lives in". After reviewing the literature relating to the effect on perception of social and cultural variables, Tajfel (p 374) concludes that differences in "marginal" aspects of perception are predictably related to cultural contexts, and determined chiefly by functional salience and familiarity. The most important difference, to Tajfel (p 324) is the fact that "perceptual interpretations of a notation system are not "given", they must be rooted in past experience". This has undeniable implications for education systems and Tajfel pleads for more research in this area.

/Undoubtedly, ...

Undoubtedly, in the area of culture and cognition it is language that has received the most attention. Most of Stephen Tyler's (1969) book on Cognitive Anthropology is devoted to the use of "ethnoscience", described by Greenfield and Bruner (1969, p 90) as a method which "**infers** the mind of the language user from the lexicon he uses". Probably the most important hypothesis which has given rise to both psychological and anthropological work is what De Vos and Hippler (1964) call the Sapir-Whorf hypothesis, a viewpoint of linguistic relativity which places great emphasis on the richness of the lexicon that a language has available to represent a given domain.

Triandis, writing in 1964, comes to the conclusion that the hypothesis was stated too vaguely and too generally, and requires a great deal of modification. In particular, he feels that the importance of linguistic relativity has been over-emphasised, and that relationships seem to be neither very great nor irreversible. Although (p 41) "subjects in different cultures use different categories and different organisations of lexical fields, there is considerable similarity in the ways in which they evaluate key concepts".

Examining the field of culture and cognitive growth, Greenfield and Bruner (1966) suggest that "some environments 'push' cognitive growth better, earlier and longer than others", but that different cultures do not produce cognitive styles which are totally divergent and unrelated.

No discussion of culture and cognition could be complete without reference to education. Partly because the greatest differences, both within and between cultures usually occur between educated and uneducated individuals; partly because almost inevitably education itself is not uniform, but takes on some of the characteristics of the environment within which it operates and becomes as much a part of a society's culture as its language.

/The most ...

The most important study in this field, for our purposes, is by Lovell (1955). He compared two groups of British adolescents with backgrounds of high stimulation and with low stimulation respectively. The term "stimulation" referred to both school and home environment, and reflected "inherited traits, ability to withstand stress and ... make adequate responses to real life situations; early upbringing and environment; cultural background; quality of teaching and school atmosphere generally" (p 208). The stimulated group had had a more helpful and intellectually healthy background and were generally more stable.

While Lovell found that the stimulated and non-stimulated groups were matched for general intelligence, and the non-stimulated group actually scored slightly better on verbal intelligence, he found a substantial difference between the groups on a factor he calls categorisation, which is strongly linked to mental flexibility, and is measured by an ability to divide objects into different categories, a test very similar to Berg's (1948) test of mental flexibility. This factor also had a high loading on Luchins-type tests and sorting tests. Lovell is unable to state whether this flexibility deteriorates early due to lack of stimulation, or whether it never develops in an unstimulating environment. His conclusion is simply that it is mental flexibility in particular, and also the capacity for forming new concepts, which are affected by the adolescents' intellectual and emotional circumstances.

Vernon (1969) stresses particularly the problems of education in developing countries, where school children often come from a background that is not academically oriented. Where a teacher has a class of 30-60 pupils or more, it is, he says, "only the exceptional person whose influence is sufficient to outweight that of home and peer-group". Thus what he calls 'peripheral' skills such as spelling and arithmetic are communicated fairly successfully, but it is very difficult to develop "logical reasoning, flexibility of mind (and) ... initiative".

/7. ...

7. IMPLICATIONS OF PREVIOUS RESEARCH FOR THIS STUDY

As with the work on rigidity, studies in cultural diversity are in a state of some turmoil and controversy (Cole, 1975), and it would be dangerous to draw definitive conclusions on which to base further predictions. Perhaps this is inevitable. No culture is static - it must be continually modified from within by the individuals who maintain it, and from without by external forces over which these individuals have no control. Cultural differences may therefore rapidly be created by or disappear under the impact of some pervasive force such as industrialisation, or slowly modify in response to small scale changes and demands. Furthermore, many of the results obtained by cross-cultural testing must be questioned because of the uncertainty as to exactly what was being tested, and whether the testing instrument was measuring the same attribute in the different populations it was applied to. Cole (1971) is disturbed by the contradictions in the information supplied about the same population by ethnographers and psychologists when the ethnographers describe abilities that appear to be manifested in every-day activities, and the psychologists describe the lack of these abilities on the basis of psychometric tests. An example of this occurs among the Kpelle people who must accurately measure precise amounts of rice for their farming, but cannot estimate the size of different lenghts of stick supplied by psychologists. Cole pleads for more empirical evidence from ethnographers, and psychological tests better suited to the real-life environment of the testees.

A further problem, alluded to in the section on Culture and Personality, is that of the cultural diversity of both Black and White population groups in South Africa. No conlusions can be drawn for either group as to, for example, the effects of child-rearing patterns, because too many different child-rearing patterns are involved. However, it would seem safe to assume that, although the inter-individual differences within one group are great the inter-group differences, based on differing environment and culture, are even more significant. The work already quoted on culture and cognition would appear to make it feasible to anticipate a difference in cognitive flexibility between the two groups. It remains only to determine the magnitude and direction of this difference.

/Kendall (1974) ...

Kendall (1974), discussing findings with the Form Series Test, a non-verbal sequence continuation test, refers to the "extreme difficulty experienced by Africans, even at higher levels of education, to effect a realistic change in their manner of problem-solving" (p 51). He maintains that this does not imply any lack of conceptual or abstract thinking ability, but simply a difficulty in overcoming mental set. He cites (p 54) findings by Laroche, whose African subjects also displayed a stereotyped perseveration induced by a perceptual set. Kendall concludes that "non-verbal rigidity as a feature of the structure of intellect of non-Westerners, should be seen as a future research priority for cross-cultural research" (p 54). This is one of the questions this study hopes to investigate, in relation, at least, to a group of educated Black and White South Africans.

Some support for Kendall's position, with respect to Blacks with at least some high school experience, comes from an examination of the one envirnomental variable which is held fairly constant across the various Black groups, and about which some reliable statistical information is available, viz. education.

The Black teacher-pupil ratio for the years 1969-74 which are most likely to have affected the population under consideration in the present study varied from 1:59,8 to 1:55,7 (Steenkamp and Van Rensburg, 1975). The White ratio for 1968-1973 varies from 1:21,32 to 1:20,84 (Steenkamp and Van Rensburg, 1972). In the light of Vernon's (1972) attitude to large classes in developing countries, mentioned earlier, this magnitude of ratio may retard the development of, among other things, cognitive flexibility. Large classes lead to lack of individual attention, and this, combined with a large number of poorly qualified or

/inadequately ...

inadequately trained teachers[5] and a lack of extra facilities[6] could create, in many Black schools, a less stimulating academic atmosphere similar to that described by Lovell. Following Lovell's thesis, one would then expect to find Blacks scoring lower on cognitive flexibility than on mental ability tests, relative to Whites. The environmental factors mentioned above may also affect general ability, but if our hypothesis is to be proven the difference between the scores of the White and Black groups must be greater on the cognitive flexibility measures than on the measures of general mental ability.

[5] The annual report of the South African Department of Bantu Education, 1974 gives the following figures for teacher qualification.

Degree and diploma:	1 247
Degree only:	1 362
Matric/Senior Certificate with Primary Teachers qualification:	4 902
Matric/Senior Certificate with Secondary Teachers qualification:	833
Qualified with JC:	29 511
Qualified with Std 6:	14 385

[6] The same report states that only 40% of the schools visited during 1974 have libraries or reading-rooms.

8. PROPOSED EXPERIMENT

8.1 Hypotheses

On the basis of the considerations raised in the foregoing discussion, the following hypotheses were framed:

1. That there will be a difference between Blacks and Whites in terms of cognitive flexibility in favour of Whites.

2. The difference between Blacks and Whites in terms of cognitive flexibility will be greater than the difference in terms of cognitive ability.

8.2 Experimental Design

Seven non-verbal tests have been chosen for this experiment. The first is a buffer test to accustom subjects to the test situation. Three are tests of different aspects of cognitive flexibility, and three tests of different aspects of general mental ability. These tests will be discussed in detail in the next section.

For the first hypothesis to be supported, a significant difference must appear between the White and Black scores on the three cognitive flexibility tests, with the Whites attaining the higher scores. If this difference is larger than any differences between White and Black scores on the corresponding three mental ability tests, the second hypothesis will have been supported. If there is a substantial relative difference between Black scores on the cognitive flexibility tests and their mental ability scores, and this difference is significantly larger than the difference in White scores on these two groups of tests, this will also support the view that Blacks have a specific lag in cognitive flexibility relative to general mental ability.

/8.3 ...

8.3 Test Battery

1. The Spatial Orientation test is a test adapted by Crawford-Nutt (1976 (a)) to serve as an easy buffer test to acquaint subjects with testing procedures and instil confidence into them. As all subjects are given cut-out shapes to manipulate to help them find correct solutions, they should experience no difficulty in answering all the items in the test correctly. This test is included purely as a buffer test, and is not scored.

2. The Standard Progressive Matrices is a well known reasoning test developed by J C Raven in 1936 as a test of observation and clear thinking. It is a pattern-completion test which studies have shown to be one of the most reliable tests of intellectual capacity in different cultural groups. It is included in this battery as a measure of general mental ability.

3. In the Gottschaldt Figures test the subject is required to determine which simple figure has been hidden or embedded in each of the more complex patterns which constitute the test items (NIPR, 1956). This test has been included as a test of analytic ability.

4. The Elements Test has been adapted from the Common Elements Test drawn up by Schmidt (1970, 1971). In Schmidt's test, based on the Gottschaldt Figures Test, subjects are required to find which hidden elements are common to pairs of complex patterns. The figures from his test have been used for this study, but have not been paired. Subjects must simply find the elements hidden in each figure. The Elements Test is assumed to require a more flexible approach than the Gottschaldt Figures, because the subject must look for more than one element in each figure. Having found one element, he must then change his Gestalt, or mental set, in order to see which other element is, or elements are, embedded.

/5. ...

5. The Squares Test F is an adaptation by Verster (1975) of a test called Match Problems V, described by French, Ekstrom and Price (1963) as a measure of figural adaptive flexibility. The subject is presented in each item with four identical patterns of squares from which he must remove a given number of lines, leaving behind a pattern of completed squares. It is considered that the subject must exhibit some flexibility in order to produce four different solutions to each problem.

6. The Squares Test A is also an adaption of Squares Test (Verster, 1975), along the lines of Guilford's Match Problems II cited by French, Ekstrom and Price (1963). Both the number of lines to be removed and the number of squares to be left are given, and as only one solution is required the subject must adopt a convergent rather than a flexible approach. The test has been included as a test of figural reasoning ability.

7. The Random Sequences Test, the use of which in this context is fairly new, must be explained in greater detail. Most researchers(Tune, 1964; Rath, 1966; Wagenaar, 1972) agree that human subjects are incapable of producing a random sequence when instructed to do so, and that there are significant individual differences in the degree of non-randomness of series produced on instruction. Weiss (1964, 1965) suggests that in order to maintain a random sequence, the subject must suppress or otherwise inhibit paying attention to each response after it occurs. When this inhibition does not occur, and the previous response serves (or several previous responses serve) as stimulus/i for the next response, Weiss considers that the subject will produce runs or some other form of non-random sequence. Certainly, if the random sequence must be formed from stimuli which normally, in the subject's experience, form an ordered sequence (in the case of this study, the numbers 0-9), then the subject must continually inhibit the automatic impulse to order the stimuli. One might argue that the more flexible subject would find it easier to go against this tendency towards natural ordering, and adopt a new, random approach. A more perseverative, and therefore less random approach would also be expected from a more rigid thinker.

/Mittenecker ...

Mittenecker (1953, 1958, 1960) used randomisation tests in work with abnormal subjects. He found that neurotics, when asked to produce random sequences, showed great precision and rigidity, and exhibited a tendency to produce many same-sequence repetitions and move very small distances in the sequence. This link between personality rigidity and non-randomisation is supported by the work of Kuethe and Ericksen (1957), who found that an increase in anxiety (often linked to rigidity) and muscle-tension led to an increase in response stereotypy. Rath (1966) suggested that subjects who expect the world to be ordered and repetitious will not make good randomisers..

In the present study, therefore, subjects will be asked to produce sequences of random numbers, using the numbers 0 to 9, and it is expected that the more flexible subjects will produce sequences that are more nearly random according to statistical criteria of randomness than the sequences of the subjects who exhibit greater cognitive rigidity.

8.4 Method

Test Instructions.

Pons (1974) and Crawford-Nutt (1975) designed special instructions for the administration of the Ravens' Progressive matrices to Black subjects. Using these instructions, they found that Blacks achieved the same level of performance as Whites who were given standard instructions. To try and eliminate the error caused by Black groups not fully understanding instructions, Crawford-Nutt's Ravens instructions have been slightly modified, to be used for all groups taking part in this experiment. The instructions for the other tests have been drawn up in the same fashion, making use of demonstration posters, and individual examples which must be completed by each subject to ensure that he has grasped what he must do. Language used in instructions has also been simplified and modified (see Greenfield and Bruner, 1966).

/9. ...

9. IMPLICATIONS OF THIS STUDY FOR FURTHER RESEARCH

If the hypotheses in this study are found to be supported, they will have important implications for both cognitive research and research into industrial training. Some of our current "culture-fair" intelligence tests will have to be re-examined, to determine to what extent the cross-cultural differences in intelligence they reflect are a function of differences in cognitive flexibility rather than general intellectual ability.

The industrial training implications are particularly important in South Africa today, now that high-level positions in business and industry are opening up to Blacks. When a man is doing low-level, repetitious, mechanical work, lack of flexibility does not affect his competence or efficiency. However, once he moves up to a level of responsibility, where he must act autonomously and take decisions for himself and others, a certain amount of flexibility in his approach is essential. Otherwise, he will not be able to remain sensitive to the different and sometimes contradictory aspects of complex issues, and produce new solutions and methods of solution to the continually changing problems he must find answers for.

It is therefore imperative that if these differences in cognitive flexibility exist, studies should be carried out to determine the best methods of modifying or overcoming them. Section 4 of this study cites some previous experiments which will be helpful to researchers attempting to find ways of improving flexibility. This previous work shows particularly positive results when dealing with the increase of flexibility in specific areas (Rowton, 1969/70; Bourne, Ekstrand and Dominowski, 1971). It should therefore be possible to clearly delineate specific areas in the industrial setting in which flexibility should be improved, and then recommend environmental changes and training techniques or programmes which could help to achieve this end.

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