

ROLE OF COGNITIVE STYLE
IN CHILDREN'S PERFORMANCE
ON PIAGETIAN TASKS

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Jean Van Arsdel
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THE ROLE OF COGNITIVE STYLE IN CHILDREN'S PERFORMANCE

ON PIAGETIAN TASKS

JEAN VAN ARSDEL

Recently interest has focussed on Witkin's notion of cognitive style (Goodeneough 1978, Donaldson 1982, Messick 1982). Witkin's development of differentiation theory arose from studies concerning the way people orientate their bodies in space and is closely related to the individual's perceptual ability. Field-dependence/field-independence theory is primarily concerned with how people deal with information about the world rather than with how much or how well they do so (Goodenough 1978).

Links (Case and Pascual-Leone 1975, Satterly 1979, Huteau 1980) were cited between the work of Piaget and Witkin. Goodenough (1978) wrote that the field-dependence dimension could be identified in problem-solving situations that seemed to require re-structuring. Some of the best illustrations of re-structuring problems come from the work of Piaget.

As perceptual demands and materials of Piagetian conservation tasks and characteristics of Witkin's field-dependence/field-independence notion seemed well related it was hypothesised that a relationship might exist between children's performances on Piagetian tasks and their responses to Witkin measures of cognitive style.

The study was of a longitudinal design. Four consecutive testing situations at three month intervals aimed to compare children's (N = 65) performance on a battery of six Piagetian conservation tasks (two each of length, area and horizontal/vertical frames of reference) with these same six - seven year old children's scores for two Witkin measures of field-dependence, the Children's Embedded Figures Test (CEFT) and the Draw-a-Figure Test (DAF).

As field-dependent subjects are thought to respond to, and process more easily, information presented them in a social or personal manner, one Piagetian task of each of the three areas, length, area and horizontal/vertical frames of reference, was presented in a 'social' manner while the other was administered in an 'impersonal' or abstract manner - reported by Witkin et al (1974) as more easily accomplished by field-independent persons.

Results of the study gave some limited support to the hypothesis that a relationship might exist between children's performances on Piagetian tasks and their responses to Witkin's Children's Embedded Figures Test. It was also apparent that a majority of children, whether field-dependent or field-independent, were more successful in accomplishing the Piagetian tasks presented in a 'social' manner than they were at accomplishing those presented in an 'impersonal' fashion. Further, the two Witkin measures of cognitive style (CEFT and DAF) did not correlate. Vernon (1972), Bowd (1975) and Satterly (1976) also have not found agreement between these two Witkin measures of field-dependence.

The implications of the study call attention to the complexity of factors which contribute to the teaching/learning situation and of the need for further work relating style or method of presentation to the content of the material.

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CHAPTER I

INTRODUCTION AND STATEMENT OF PROBLEM

"Every teacher must know that every method is only a step, on which he must stand in order to go further; he must know that if he himself will not do it, another will assimilate that method and will, on its basis, go farther, and that as the business of teaching is an art, completeness and perfection are not obtainable, while development and perfectibility are endless."

From TOLSTOY ON EDUCATION, University of Chicago Press, 1967, page 58 - 59.

This study has evolved from two earlier pieces of work concerning the development of young children's mathematical concepts (Van Arsdel 1972, 1978). The first was an investigation of three types of training upon reception class children's efforts to reverse arrangements of objects manually.

The 1972 study hypothesised that three groups of children given three different types of mathematical experience relating to conservation of number, would show varying degrees of progress in their ability to perform matching, counting, sequencing and reversing tasks on two parallel toy wash lines (adapted from Piaget and Inhelder, 1956). It was anticipated that the children given 'Classification and Seriation' experiences, linked with language appropriate to these mathematical experiences, would amke the greatest gains when the tasks were presented at a later date. It was not anticipated that the children would retain this acquired ability over a period of time. Nor were the children given 'Reversibility' training expected to improve in their ability to accomplish the initial tasks. A pre-test (the washing line) was given each of the thirty-three children in the sample. The three different types of training were then given to each of the three groups of eleven children; Group A. Reversibility experiences; Group B, Classification and Seriation; Group C, Classification and Seriation linked with language appropriate to the experiences. Training sessions (15/20 minute periods) were given individually to each child for six consecutive weeks.

A post-test (the washing line task) was then administered. The hypothesis* was refuted as the greatest progress was made by the children who were given the training in Reversibility experiences.

* It was hypothesized that children in the Reversibility Training Group would not show as great a gain in performance on the post-test as the children receiving the Classification and Seriation Training with language.

the next highest overall gains were made by the Classification and Seriation with accompanying Language group. Very little progress was made by the group given training in Classification and Seriation. The training sessions appeared to produce different effects upon each of the three groups and resulted in progress being made by the groups in different areas. A second post-test (reversing toy books on two parallel shelves of a toy bookcase) was given four weeks after the first.

The children in the Reversibility group retained the ability to reverse the series; they generalised the method to new materials (the bookcase task) and were able to reverse the miniature books on one shelf when the model shelf of books above was screened from their view. As the books were marked with Roman numerals, were all the same size and shape although of different colours, there were fewer perceptual clues to help the children in this reversibility task than there were in the washing line task. These findings were not in line with the then current literature. The children were of mean age 5 years 3 months. The study was of six months duration. Results were analysed by the Wilcoxon Matched-Pairs Signed Ranks Test (as appropriate for the type of data obtained) and the results of this test suggest the probability that Training Method A (Reversibility) and Method C (Classification and Seriation with Language) were effective (at the .01 level of significance). Method B (Classification and Seriation) was significant at the .02 level.

The second investigation was conducted over a period of four years (Van Arsdel 1978) and concerned children's acquisition of mathematical concepts of distance, length, area and horizontal/vertical co-ordinates. The children ($N = 30$, mean age 8 years 8 months at the end of the study) were administered a battery of

fourteen Piagetian tasks. Individual children's performances were measured and assessed by means of the battery; profiles of the development of the children's mathematical ideas were plotted for each child in the sample and for the group as a whole, to compare stage formations and to observe stability of concept attainment.

It was hypothesised that children might not perform consistently on specific tasks; that there would be no significant change (advance or decline) in the performance of individual children from one testing to another and further that children would not acquire certain tasks related to operational understanding of Euclidean space in an invariant order.

The battery of tasks was arranged in a 'simple to complex' order (Piaget et al, 1948) and administered to each individual subject six times at three monthly intervals. After a nine month interval, the battery was administered a seventh time.

The results of this study were analysed by means of the Binomial Test. Some results (H_0 : There is no difference in the number of children who ADVANCE and DECLINE in performance on the battery of tasks) were significant, (Testing 1 - 7 at .01 level), while analyses of the raw data grouped from one testing to the next and grouped into two sections, School A and School B, from which the sample was chosen, were not significant. Overall, however, the study supported opinion that the notion of developmental stage is in no way as rigid and structured as it is assumed to be. Children advanced in their overall performance on the tasks of the Piagetian battery; then declined. Sometimes the same child would perform successfully on a task at one testing, and at the next testing fail to complete the same task. Some children did not achieve the tasks in the order predicted by Piagetian literature nor did they clearly demonstrate the 'breaks'

defined as necessary for the stages.

Questions and queries arose concerning these results and of the usefulness of the Piagetian tasks as assessment measures. Responses of individual children in both studies had been seen to fluctuate, to vary according to manner of presentation, type of materials and equipment used in the task and to relate to the children's emotional attitudes and personalities. Thus, while the present study was conceived as an extended investigation of the mathematical concept of horizontal/vertical co-ordinates (Euclidean space), the main objective is to determine a reasonable explanation for the wide variations and fluctuations in performances on inter-group tasks and for the lack of stability of concept attainment which the children in the previous studies exhibited.

Many factors may have contributed to these differences observed in the children's performances in the first two studies, but a close examination of the tasks suggested that spatial ability might be an especially significant factor. The Piagetian assessment tasks rely heavily upon the child's ability to perceive spatial relationships of the materials used in the tasks, or on the child's ability to represent a situation by drawing a diagram. For example, assessment of conservation of length tasks requires observations of endpoints of lines and strips of paper; area tasks hinge on comparison of plane geometric shapes placed in a variety of positions. Assessment of horizontal/vertical frames of reference demand drawing a line to represent the position of the water level in a jar. It seemed also that the child's emotional state was influencing performance. Specific instances were noted where a child's very positive and assured replies were greatly altered following the death of her mother; another child's scores appeared to fluctuate in relation to

the festivities of the season as she was not permitted by her parents to participate in the school's Christmas and Easter events. The transfer from one school and teacher to another (in three cases) seemed another factor in performance changes.

A third factor which appeared to be influencing task efficiency was the child's personality. The steady, placid, and persevering child was ever ready to consider the task carefully, was prepared to concentrate and search for a suitable solution to the question. The volatile, effervescent child, always eager to participate, might make one lightning effort towards a response, with little reflection or consistency, and be content with his or her answer. There was a wide range of personalities between these two examples and an accompanying range of responses. These personality variations reflected the individual child's own personal style or method of response in the testing situation.

In the studies and literature related to both Witkin's theory of psychological differentiation and the Piagetian theory, it appears that perception and spatial ability are important factors.

The theory of psychological differentiation developed from an observation that people differ in the way they orient themselves in space. Further, the way in which each person orients himself in space is an expression of a more general preferred mode of perceiving (Witkin et al, 1974). Another characteristic of the theory is that it seeks particularly to bring together cognitive and personality aspects of development, to show interrelationships between the two areas. (Witkin, Lewis, Hertzman, Machover, Meissner and Wapner 1954; Witkin, Dyk, Faterson, Goodenough, Karp, 1974). Recent attempts have been made as well to link psychological observations (used to classify persons as field-dependent-independent) to a neurophysical level.

(Oltman, Ehrlichman and Cox 1977; Zoccolotti and Oltman 1978).

Witkin et al (1962/1974) report that a study by Beller (1958) has shown that field dependency correlated positively with greater attention to those on whom the subject was dependent. In Beller's study measures of field dependency were based on repeated ratings of children in nursery school situations by participant observers. Observations were made of where these children directed their attention - literally, where they looked - under highly structured (a meal session), moderately structured (a work situation), and relatively unstructured (a free-play situation) conditions. It was found that the more dependent the child the more he focused his gaze on the human environment, particularly the teacher, and the less oriented he was to the physical environment.

The results of Beller's and other studies (De Varis 1955, Crutchfield et al 1958) suggest that people with a global field approach (field-dependent) are particularly attentive to others, especially to facial characteristics and expressions which provide ready clues to another person's moods and attitudes. Field-independent persons, unlike people with a global field approach, appear to experience others in terms of deeper attributes, reflecting their more developed awareness and greater ability to maintain a distance which allows for more objective evaluation of people. Field-independent persons also seem less alert to the facial characteristics of others.

This dimension of social orientation is considered to have important educational implications for classroom teaching. Namely, because of their social orientation, field-dependent children are thought to be particularly adept at learning and remembering

materials that have a social content (Witkin et al 1977) while field-independent children have more internalised frames of reference and pay attention to material of a more abstract, analytical nature.

Throughout the 70s Satterly and colleagues have investigated various aspects of cognitive style using British subjects. Satterly and Brimer (1971) cite Beard's (1965) study of analytic and synthetic thinking as having provided clear evidence of distinct differences in modes of organisation as well as offering support for the existence of 'global grasping' which is held by these two researchers as being analogous to the characteristic which they have been investigating and term 'analytic power'. They report that while the analytic mode is similar to Witkin's concept of field-independence, the former, unlike field-dependence, is not considered as a passive acceptance of information. In Beard's study, they claim, the developmentally less mature, synthetic style is held to be an active attempt to understand by means of a whole-form appraisal. On the other hand, the analytic style is linked with a part isolating examination and a making of a variety of formulations before decision taking.

The purpose of Satterly and Brimer's study was to discover which mode, global or synthetic, had positive attribute (that is an active attempt to achieve functionally valid meaning through a speedy whole-form appraisal), and to try to demonstrate that the ability to make a speedy whole form appraisal might lead to successful adaptation. They devised for this study a 'style of thinking' test which consisted of thirty groups of pictures, four to each group, from which the child was asked to identify a principle by which three of the pictures could be considered as similar, also to report which of the four could not be classified with the other three. They administered this test to a sample of 490 boys and 483 girls, aged ten to eleven years.

Results were analysed using a four-way factor system and tentatively show that children (age 10 - 11 years) exhibit a preference for contrasting styles of cognitive¹ functioning and these differences are associated with differences in perception. The preferences which they observed did not exhibit positive intellectual values only for the analytic modes. However, Satterly and Brimer (1971) believe that analytic set can be developed - and if such a preference for the analytic set were permitted 'unlimited exercise' then ultimately this would lead to inhibition of contrasting styles and differences in intellectual ability might arise.

They quoted Witkin et al (1962) as describing the typically global (field-dependent) subject as being 'passive'; 'ineffective in solving problems which require the isolation of essential elements'; 'relying on external sources for definitions of his attitudes, judgments and sentiments'. Satterly and Brimer then remark :

" . . . it is small wonder that despite declarations to the contrary by Witkin et al and Kagan, the analytic should so frequently be regarded as the superior type of child, for he is nearly always more effective in a wide range of tasks".
page 295

During the intervening years, Witkin and his colleagues have come to define the dimensions of cognitive style with increasing precision. Yet they have maintained consistently that the notion of field dependence/field independence is concerned with form rather than content of cognitive ability and that these dimensions are bi-polar

¹Discussing cognitive style in terms of 'analytic power' and analytic preference, Satterly and Brimer remark that measures of field independence should be considered tests of analytic power, but figure sorting and similar tasks are tests of analytic preference. This distinction in their opinion makes it clear that field dependent behaviour is almost totally devoid of characteristics which would serve its exponent well in most adaptive requirements.

in nature. Intelligence and most other human abilities are measured on unipolar scales. To have more of the ability is better than to have less of it (Goodenough in London & Exner 1978). In contrast to dimensions of cognitive style, each pole has adaptive value under some specific condition, for example, in perception of the vertical and horizontal axes of space; ability to restructure cognitive fields may lead to particularly effective performance in certain perceptual and problem-solving situations. Further, states Goodenough, in many social situations it is reasonable to expect that there will be situations in which a relatively field-dependent mode of functioning may be more adaptive. For example, in many social situations, one expects that an orientation toward other people may lead to relatively successful interpersonal behaviour.

Cognitive styles, spatial ability and school achievement were studied by Satterly (1976) who again chose his sample from ten to eleven-year olds. In this study tests of cognitive style (the Group EFT, Gottschaldt Simple Figures Test, the Preference for Analytic Style Test devised by Satterly and Brimer (1971), Intelligence and School Achievement tests, plus two Piagetian style tasks, one of spatial judgement, the other of haptic perception) were administered to a group of 201 boys. Satterly chose a sample of males only, the rationale for this being that numerous studies have demonstrated sex differences in factorial patterns which emerge from batteries of cognitive and achievement tests (Bieri et al, 1958; Jackson et al, 1964). Sigel (1965) is cited by Satterly as attributing these differences in socialising experiences of males and females which have a little understood impact on cognitive operations but whose effects are, nevertheless, obscured when analysis of a mixed sample is carried

out.² The results of this study show the EFT as moderately correlated with intelligence, mathematics and haptic perception. Further, the EFT showed some correlation with the spatial (Piagetian) tests, attained significance ($p > .01$) and were roughly of the same order as were the results of the two verbal tests. Satterly concludes from his results that the correlation of the EFT with spatial and achievement tests is "in part attributable to its overlap with intelligence". However, he believes, as well, that the analysis also offers support for the separability of the EFT as an index of field-independence from verbal and spatial tests. He found that after differences in intelligence were controlled, correlations still appeared between the EFT, mathematics and haptic (Piagetian task of recognition of objects by feeling them) perception tests.

Satterly hypothesises that the order in which he administered to his subjects the battery of tasks (Gottschaldt Simple Figures Test was administered just prior to the EFT) may have established a set or preference for the mode of solution, successful in the Simple Figures Test, to be carried over into performance on the EFT.

Summing up his work, he remarks that the study is in partial agreement with Vernon's (1972) research which showed that among children considerable overlap in variance existed between field-independence and verbal intelligence. Yet, Satterly maintains that despite this overlap his study offers support for the existence of a small factor of cognitive style, as held by Witkin et al, which is distinct from intelligence and spatial ability.

² This assumption might have been better served by drawing the sample from a population of both males and females. Three analyses could have been made of males, of females and of the two groups combined. Results could have been compared.

The analysis, in his view, offers support for the notion 'that cognitive style characteristics do affect the responses of children to certain school subjects (albeit even only in minor ways) when end products, as distinct from strategies of learning, are investigated'.

He suggests that further studies are required in order to decide whether or not cognitive style is a useful variable in understanding interactions of the learning situation and whether it can replace more traditional measures of recording individual differences in school achievement.

Satterly and Telfer (1979) utilised the learning theory of Ausubel and related this to the cognitive style theory of Witkin to design a research study concerned with the interaction of field independence and an 'advance organiser' in learning and retention. One hundred and eighty children aged 14 - 15 years were stratified into three levels of field-dependence and randomly assigned to twelve teaching groups. Further, the twelve groups (fifteen children each) were allocated to one of three treatments; lessons, lessons plus advance organiser; lessons plus advance organiser plus specific reference to its organising properties. Two lessons on meaning, analyses and construction of words were taught and the groups were compared in recall and transfer. As predicted, and in line with Witkin's usual stated characteristics of field-dependent subjects, this group of pupils achieved the greatest gains from lessons where the organiser was used with specific reference to its organising properties. Satterly and Telfer (1979) concluded from this work that the interaction of cognitive style with the advance organiser demonstrated that in the complex task of processing material which must be made meaningful if it is to be transferred and retrieved, children learn more easily when they are made consciously aware of 'super-

ordination - sub-ordination' processes - especially in cases with specific pupils who lack the facility for the articulation of input that is characteristic of field-dependent subjects.

Using a methodology and statistical analysis similar to his previous research, Satterly (1979) studied the covariation of cognitive styles, intelligence and achievement. Subjects were, as in his 1971 and 1976 studies, ten to eleven-year olds. A battery of tests was administered to four hundred and thirty pupils and scores on test and re-test (three weeks later) were obtained. As no significant differences appeared between boys and girls on any of the tests, a hierarchical factor analysis was undertaken on the whole sample on a matrix of correlations between three measures of cognitive style (analytic-synthetic test, field dependence/field independence, levelling-sharpening) and achievement in mathematics, geography and English.

Satterly believes that this study suggests field independence shares a small amount of variance with achievement after control for general ability has been made. This in his view provides some support for the independence of cognitive style from general intelligence.

Roberge and Flexer (1979) challenged this view of Satterly's (1979) and maintained that his conclusions were 'clouded by the fact that, in both of his analyses, the loadings of the achievement tests on the field independence factor were of the same magnitude as those for the embedded figures test'. Roberge and Flexner attempted this 're-examination' of Satterly (1979) by administering the EFT, Lorge-Thorndike Intelligence Test and Metropolitan Achievement tests to four hundred and fifty pupils randomly selected from classes in a suburban public (U.S.A.) school, aged 11 - 13+ years. They presented a table of correlations and claim their figures reveal a sex difference favouring

girls on the intelligence test as well as significant positive relationships among scores on all of the standardised tests. They claim that there is little evidence of a field-independence factor distinct from general intelligence which could be used to make predictions that cannot be made from standardised tests of intelligence and school achievement.

However, Roberge and Flexner's study was done with American children of a different age group (eleven to thirteen year olds as compared with Satterly's ten to eleven year old sample), using different test instruments and in an American suburban school setting. Although it is not clear in Satterly's work as regards the background of his sample, the differences listed above suggest that the studies are not as comparable as Roberge and Flexner assume. Hence results should not be straightforwardly contrasted either.

These studies of Satterly and his colleagues were interesting but inconclusive concerning the role of cognitive style as related to school learning, retention and achievement. Three of the studies were conducted with children aged ten to eleven years - a crucial period in the development of visual/spatial abilities as well as in the development of cognitive style (Witkin et al 1962/1974). One study (Satterly 1976) used only male subjects. The designs of these investigations were of a 'statistical, positive type' and the reader had limited information given him as regards the context of the situation in which the test instruments had been used.

Cohen and Manion, (1980), describe the historical development of the 'scientific method of positivism' and remark that so successful has been the application of its principles to the problems of natural phenomena, and so breath-taking have been the outcomes in terms of material and technological progress, that it was felt that comparable

achievements would eventually distinguish the work of social scientists if this same approach to problem-solving were to be applied to the world of social phenomena. Cohen and Manion quote Heather (1976) and define the term 'positivism' as 'a broadly defined movement in the history of man's intellectual development, the distinguishing feature of which is the attempt to apply to the affairs of man the methods and principles of the natural sciences'.

Recently much attention has been given to the perceptual demands and the role of materials used in the Piagetian tasks (Bryant 1982). Bryant tells us that Piaget was happy to admit that children might solve a problem presented to them in one kind of material a long time before they managed the same moves with other kinds of material as well. Piaget even honoured this sort of unevenness with a label, horizontal décalage. .

Discussing obstacles to the acceptance of Piaget's claim for developmental cognitive stage theory, Flavell (1982) remarks that it is difficult to equate for diagnostic sensitivity the tasks we use to assess stage-specific mental organisation. The task that tests for the presence of one item may be harder and less sensitive than the task that tests for the presence of another item. Because of this assessment problem, it is very difficult to find out just how synchronous or asynchronous the acquisition of the same-stage items really are.

Further, Smedslund (1977) questions the representativeness of the Piagetian tasks. He feels strongly that these tasks are unrelated to the molar features of the child's environment. It is Smedslund's view that performance and interest in school work and in theoretical tasks of the kind favoured by Piaget are linked in various ways with the child's family and cultural background, but are also strikingly unrelated to the degree of sophistication with which he behaves in his

world outside the classroom.

Light et al (1979) state that one of the unfortunate consequences of the demarcation which has grown up between the study of social and cognitive aspects of development is that cognitive testing situations are rarely considered from an interactional point of view. Conservation measures devised by Piaget, in their opinion, depending as they do on the interchange between tester and child, merit critical examination as social encounters.

Donaldson (1982) discusses and mentions the possibility of explaining children's failures on conservation tasks in terms of Witkin's field dependency theory.

Odom writes (in Sigel and Brainerd, 1978) that cognitive-change research is concerned with the general area of human problem solving. This approach contains no clear or distinct theoretical role for perceptual development and its consequent effects on the perceptual characteristics of task information. It appears then that there is an implicit assumption that all information in a problem-solving task is perceived identically at all developmental levels. Hence age-related performance differences are considered to result from different cognitive structures that evaluate the same information.

Odom argues that information contained in a problem-solving task must be perceived before it can be cognitively evaluated. He also states that what happens to the relation between perception and cognition in the course of development is not clear in cognitive-change positions. In his opinion understanding of the nature of the perceptual system and the characteristics of the information it detects may therefore be necessary to understanding of the nature of cognitive evaluation.

This understanding of the function and role of the perceptual

system is also necessary before conclusions can be made about developmental changes in cognitive structures in reference to Piagetian conservation tasks. Further, Odom (1978) states that he has adopted certain ideas of Gibson (1969) concerning the role of perception. First, relations (dimensions of difference, invariants of events) serve as basic information for the perceptual system; second, these are present in the external environment and are not mediated products of cognitive structures, images, stored associations or inferences; and third, they are discovered in increasing numbers by the perceptual system as development proceeds.

Gibson (1969) herself notes that the role of perception as related specifically to either Piagetian or Witkin's theories is not clear. Of Witkin's work with the Rod and Frame test she writes that :

"Witkin et al describe the subject who is free of error in these tasks as 'field-independent', meaning that he has the ability to differentiate himself from the environment. I think it might be better described as ability to differentiate gravitational cues - vestibular, kinaesthetic and skin pressure - from visual-directional stimulation, a highly analytical performance, as the subjects testified. It is also a highly artificial discrimination, for the two kinds of information do not normally conflict."

It is Gibson's view that Piaget had not (in 1969) committed himself to one theory of perceptual learning. According to Gibson, perception for Piaget involves assimilation of sensory input to a schema and often, following upon this, accommodation of the schema to the specific object. Thus, acquisition of schemata must be the fundamental process of perceptual learning. Perception is also probabilistic and subject to distortion, although the thought processes (at least at maturity) are not.

Gibson states that in her own view perception is active and adaptive; it is self-regulated and progresses towards reduction of uncertainty in processing stimulus information. It is not a process

of association, but one of filtering and abstraction. She strongly believes, as well, that there are developmental trends (but not stages) in perceptual functioning - progressive specificity, optimisation of attention, and progressive economy in information pickup. But she admits much remains unanswered, as how the distinctive features are discovered, or how attention functions to filter out the irrelevant and preserve the critical information.

Gibson (1969) calls for developmental studies of perceptual activity, with a hope of discovering generalisations that will reveal laws of behaviour and its adaptation to ongoing events. She suggests we must look for a progressive sequence which spans the activity from birth to maturity.

Witkin et al (1974, 1977) suggest that their research needs to be extended especially with subjects of the age range below ten years.

These variables, namely the perceptual demands and materials of the Piagetian tasks and the child's cognitive style appeared related to characteristics of Witkin's theory of psychological differentiation. There seemed the linkage, as well, between the emotional factor of dependency upon adults, observed in the first two studies, to another Witkin notion concerned with social orientation.

Further, the work of Witkin and his colleagues (1974, 1977) suggested a way in which individual children's modes of functioning might be assessed. The two studies described earlier (Van Arsdel 1972, 1978) gave a background of children's responses and performances on Piagetian tasks.

Thus the variables which apparently affected children's performances in the earlier studies, namely, spatial ability, emotional dependency and personality style, suggested that cognitive style might provide a framework for determining the causes of the child-

ren's uneven performances on the Piagetian tasks. The very heavy dependency on spatial awareness in the Piagetian tasks particularly strengthened the possibility that the work of Witkin and his colleagues might fruitfully be related to Piagetian-type conservation studies.

It was then hypothesised for this present study that a relationship might be found to exist between children's performances on Piagetian tasks and their responses to Witkin measures of cognitive style with subsidiary variable related to the style of presentation of the Piagetian tasks. The aim of the study is seen as providing clarification of information concerning the development of field-dependence/field-independence characteristics in children in the early years age range and of their responses to the appropriate Witkin measures of cognitive style (Children's Embedded Figures Test and Draw-a-Figure Test) as well as to establish whether or not a relationship exists between these measures of cognitive style and the children's performances on Piagetian conservation tasks.

CHAPTER II

PSYCHOLOGICAL DIFFERENTIATION THEORY

"Cognitive styles are concerned with the form rather than the content of cognitive activity. They are pervasive, stable dimensions of individual differences in the processes of perception, thinking, problem solving, learning and so on. They are primarily concerned with how we deal with information about the world rather than with how much or how well we do so.

From "Field Dependence" by D. R. Goodenough in DIMENSIONS OF PERSONALITY, Edited by H. London and J. Exner, Jr., John Wiley, 1978, page 166.

Background and Historical development of Psychological Differentiation Theory

The concept of cognitive styles, that is the different ways in which individuals process information and the relationships between such processes and other aspects of the functioning of the organism, has been of particular interest to recent researchers (Pervin 1978, Donaldson 1982).

One such view of stylistic differences in cognitive functioning is that of Witkin's psychological differentiation. Witkin and his colleagues have been developing their theory for some thirty years (Goodenough 1978), attempting to weld thought processes and mental functioning to attributes of personality. These writers (Witkin et al 1974, 1977) hold that the concept of differentiation - widely used in both biology and psychology, can be traced to theories of Werner (1948) and Lewin (1935).

Witkin's theory of field-dependence (global cognitive style) and field-independence (analytical cognitive style) began with an interest in perception. In order to answer the questions: "How do we know whether our body or another object in the environment is straight?" and "Are visual cues from the field or sensory cues from the body of most importance?", the Rod-and-Frame test was devised. In this test the subject sits in a darkened room observing a luminous frame which surrounds a movable luminous rod. The experimenter tilts the frame to a variety of angles, and the subject's task is to bring the movable rod to a position he perceives as upright. To make the rod vertical, the subject must disregard the tilt of the field (frame) and make use of the cues from his body position. The research on how visual field cues and bodily sensation cues affect the perception of the upright led to significant group findings, but it also appeared that there was

great variation among individuals (Witkin and Asch 1948). Along with the Rod-and-Frame Test, were developed the Tilting-Room/Tilting-Chair Test (similar to Rod-and-Frame Test) and a pencil and paper test, the Embedded Figures Test, which requires the subject to find a simple figure or shape within a larger complex figure. The subject is first shown the simple figure alone, then shown the complex figure, and is asked to locate the simple shape within the complex one.

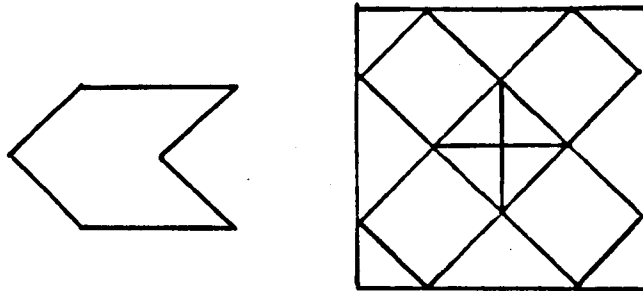


Figure 1

Sample of simple and complex figures similar to those used in the Embedded-Figures Test.

This test does not involve the use of body posture or body position, but it does measure the ability of the individual to separate an object from the context in which it occurs, assumedly tapping some spatial ability.

Witkin and his colleagues report a clear, consistent relation between the use of 'postural' cues in the space orientation tests and the ability to find a geometrical figure hidden in a complex figure (Witkin et al, 1974). The common factor in both of these tests is allied to the essential operation in perception, that of the formation of figure/ground relationships. Figure/ground relationships do not exist in the outside world but are created by the mind's selective organisation (Bloomer 1976). A figure in one situation can become a

ground in another, certain relationships exist between a figure and its background. If a figure is perceptually bright, it is seen with more intensity and as standing out from the background.

Witkin's work concerning field-dependence/independence led to the development of the Children's Embedded Figures Test by Karp and Konstadt (Witkin, Oltman, Raskin and Karp, 1971). An earlier version of this test was designed by Goodenough and Eagle (1963) - Children's Embedded Figures, but was bulky and difficult to administer. The revised version overcame these drawbacks (bulkiness, expensive construction from plywood) yet incorporates many of the features of the Goodenough-Eagle early test.

It should be clear, then, that the common denominator underlying individual differences in performances on the various Witkin tasks is the extent to which the person perceives part of a field as discrete from the surrounding field as a whole, rather than embedded in the field; or the extent to which the organisation of the prevailing field determines perception of its components; or, to put it in everyday terminology, the extent to which the person perceives analytically. At one extreme end of the performance range perception is strongly dominated by the prevailing field (field-dependent) and at the other end of the range perception is experienced as more or less separate from the surrounding field (field-independent); (as discussed earlier, page 9). As the scores from any test of field-dependence/field-independence instrument form a continuous distribution, the terms reflect a tendency, in varying degrees of strength, towards one mode of perception or the other. There is no implication that there exist two distinct types of human beings.

As research studies accumulated, Witkin began to refine the construct field-dependence/field-independence and to define it in terms of

an ability to deal with a given field analytically or to perceive a part of a field independently of its surroundings.

Intellectual Development and Differentiation Theory

Initially, Witkin and his colleagues were examining the ways in which people dealt with an immediately present stimulus configuration - that is how they perceived. It emerged however, that the styles they first identified in perception also were apparent when the person was dealing with symbolic representations as in thinking and problem solving. The individual categorised as field-dependent is likely to have difficulty with the type of problems (and Witkin et al, 1977, emphasise only this one type) where the solution depends on taking some critical element out of the context in which it is presented and restructuring the problem material so that the item is then used in a different context. Witkin et al (1977) cite some unpublished work of Harris to support this claim. Harris (1959) used two of the problem-solving tasks which Duncker (1945) employed in his classical studies of functional fixity. An example of such a problem is a situation in which the subject is asked to construct a stand or shelf consisting of a board resting on two supports. The experimenter, in fact, makes available the items required for such a structure; in the experimental room there are, among other objects, a board, one support, and a pair of pliers. The support is nailed to the board by the experimenter in such a way that if the subject is to use the support as part of the stand he must first remove the nail. To carry out this task the subject has to use the pliers in the conventional function. However, to construct the shelf the pliers also have to be used as the second support for the shelf. Obviously, for the pliers to be used as a support, they must be taken out of the conventional functional context and

conceived of in the less commonplace context of serving as a support. What is at issue, as in the perceptual tasks considered earlier, is the degree of adherence on the part of the subject to a predominant context. Harris found, to a striking degree, people who were categorised as field independent in laboratory tests of perception more easily overcame the predominant context in the pliers problem.

The scope of the differentiation dimension was further enlarged when results of field-dependent and field-independent subjects' performances on the Rorschach inkblots test were examined. The majority of studies performed on this design indicate that relatively field-independent persons are more likely to impose structure spontaneously on the stimulus material which lacks it. Relatively field-dependent persons were more likely to leave the material as it was (Moore, Gleser and Warm, 1970; Nebelkopf and Dreyer, 1970; Witkin et al, 1962/1974).

This difference in ability toward imposing structure when it is lacking has been found in studies with verbal materials as well (Bruce, 1965; Kleine, 1967; Stasz, 1974). Stasz (1974) studied field-dependent and field-independent high school social-studies teachers' and pupils' abilities to impose psychological structure upon ten general anthropological concepts, such as 'culture', 'society', and 'civilisation'. Both before and after minicourse instruction field-dependent teachers and pupils made fewer distinctions among concepts. For field-dependent persons, concepts clustered into a large, loosely organised group which included most of these concepts. For field-independent persons, concepts clustered into small, tight groups with less overlap across groups.

The tendencies to rely on self or field as primary referents are characteristics of the field-dependent and field-independent cognitive

styles.

The main perceptual tests used to assess the degree of field-dependence reflect the subject's reliance on internal or external referents.. This becomes evident when the ways in which the subjects perform on the tasks is analysed. In the Tilting-Room/Tilting-Chair test, the person seated within a small tilted room is required to adjust his body to the upright from an initially tilted position. In carrying out this task, people at one extreme adjust the body close to the upright, regardless of the orientation of the surrounding room, indicating that the body is experienced as discrete from field and that information from within the body itself provides the main referent for judging body position. Other people at the opposite end of the continuum tilt the body far forward towards the axes of the tilted room around them, indicating that the body is not experienced separately from its surroundings and that the external field is used as the main referent for judging body position. In another assessment measure of field dependence/field independence, the rod-and-frame test, the subject is required to bring a tilted rod, centred within a tilted frame, to the upright position. Here, as in the tilting-room/tilting-chair situation, some people tend to use the external field as the main referent for judging the position of the rod, aligning the rod with the tilted frame in order to perceive the rod as straight; others, using the experienced position of the upright body as referent, bring the rod close to the vertical.

The evidence (Witkin et al, 1977) linking structuring tendencies to analytical tendencies suggested that the individual differences with which they were dealing might best be conceived as an articulated-global continuum, analyses and structuring thus being complementary aspects of articulation. The person who experiences in an

articulated fashion tends to perceive items as discrete from their background, when the field is organised, and to impose structure on a field, and so perceive it as organised, when the field has little inherent structure. In contrast, it may be said that experience is more global when it accords with the overall character of the prevailing field as given, and involves less intervention of mediators, such as analysis and structuring. The articulated-global concept is applicable to the processing of information both from an immediately present stimulus configuration, as in perception, or from symbolic material, as in intellectual functioning.

Social Influence and Differentiation Theory

Differences in interpersonal behaviour between relatively field-dependent and field-independent persons have been examined by Witkin and his colleagues using a variety of approaches. Clear evidence has been provided from this research in support of the general hypothesis that social-influence techniques have a particularly pronounced effect on field-dependent persons. The effect which such materials have on other approaches is not clear. In general the evidence suggests that field-dependent people make more use of information provided by another when the situation is ambiguous and the other is seen as a source of information that will help remove the ambiguity; field-independent people seem to function with a greater degree of separateness under such conditions. On the other hand, when the situation is well structured or when there is reason to believe that the other is not a useful source of information for resolving the ambiguity, the field-dependent and field-independent people are no different in their response to external social references. Nor is there evidence that field-dependent people are emotionally dependent or that they seek

approval or attention from others.

Linton was one of the earliest to conduct research relevant to social-influence techniques. He found (1952, 1955) that the extent of subjects' field dependence was significantly related to other people's opinions with whom they were involved in a group situation. Linton also found that a persuasive written communication had a greater effect on attitude-change among field-dependent than field-independent people. Studies which have followed have not confirmed this finding with consistency. Most studies have not found field-independent subjects to be less influenced by arguments attributed to an authoritative source (Doktor and Hamilton, 1973; D. C. Glass et al, 1969; Laird and Bergkas, 1975). What has been found with consistency is that a relation between field dependence and use of external referents is found only under conditions in which subjects interact with actual (or bogus) members of a group.

Shulman (1975) studied social influence in relation to cognitive style and opinion change. Group members were asked to reach a consensus on issues about which they had initially disagreed. In his study Shulman examined group decisions about hiring applicants for radio announcing jobs. Bogus selection committees were asked to find a unanimous decision to either accept or reject each of several applicants on the basis of a taped audition and a brief description of the applicant. The groups were composed of one or two subjects and a set of 'helpers' who outnumbered the subjects. One of the applicants was well qualified for the job and at the audition elicited a favourable response from almost all the subjects. He was said to have a facial deformity, however, and the 'helpers' gave prearranged arguments to reject the applicant on this basis. Thus, the subjects were cast in a minority position and were required to resolve their conflict with a

vocal majority. It was found that groups who could not reach a consensus opinion on this applicant tended to have field-independent subjects who refused to join the majority.

Still another study (Oltman et al, 1975) examined conflict resolution in groups that were homogeneous or heterogeneous with respect to the cognitive style of their members. Subjects were college women assigned to two-person groups of three kinds : a) both members were field-dependent, b) both members were field-independent, or c) one member was field-dependent and the other was field independent. Each pair was assigned a task of reaching a compromise agreement on a set of choice-dilemma problems about which they had initially disagreed. Groups that were homogeneously field-independent more often failed to resolve their conflict (35% of the problems discussed) than did groups with one field-dependent member (18%) or two field-dependent members (5%). Moreover in heterogeneous groups the conflict was more often resolved by shifts of opinion on the part of the field-dependent partner than the field-independent. Thus these results suggest that field-independent people tend to be unwilling or unable to contribute effectively to conflict resolution by accommodating their views to those of others.

The weight of the evidence of the studies tends to confirm Linton's (1952, 1955) conclusion that in interacting social groups, field-dependent persons use external social referents to a greater extent than do field-independent. The generality of this conclusion must be qualified by the circumstance that in the studies all the information made available to the subjects for forming their judgments was not very clear. Thus the additional information contained in the views expressed by the others may have been helpful to the judgmental process. Taking the views of others under these conditions,

as field-dependent persons tend to do, seems quite reasonable. The greater resource of field-dependent persons to views of others may be understood as seeking information for use in structuring an ambiguous situation, which, as held by differentiation theory, they are less likely to structure on their own. The lesser response of field-independent persons to external social referents under conditions of ambiguity, on the other hand, may reflect a greater tendency to provide their own structure to situations which lack this.

To the extent that ambiguity plays an important moderating role in the relation between field dependence and social influence, we may expect variations in the degree of social structure to have a greater effect on field-dependent than on field-independent people.

Experiments (Culver, Cohen, Silverman, and Shmavonian, 1964) in which subjects were given relatively specific directions about what to expect during deprivation, but in which instructions for other subjects were ambiguous, (with the experimenter providing little feedback throughout) showed that heart rates tended to be higher in the non-informed than in the informed condition among field-dependent subjects, whereas the opposite tendency was observed among field-independent subjects. The results were marginally significant, but they suggest that field-dependent people may be less relaxed when they do not know what is expected of them.

Witkin and Goodenough (1977) summarise research related to field-dependence and interpersonal behaviour. They claim segregation of self from non-self as one of the main features of their theory and explain this notion as boundaries having been formed between inner and outer, particular attributes are identified as one's own and recognised as being distinct from those of others. That which lies within and constitutes the self is articulated. Differences in degree of

self-non-self segregation lead to differentiation in the extent to which self, or alternatively, the field outside is likely to be used as a referent for behaviour. This has obvious implications for interpersonal behaviour.

Goodenough (1978) suggests that the dimension (field-dependence-independence) reflects the degree to which people function autonomously of the world around them. People at one extreme of the dimension are likely to have internal frames of reference available to them that they use in articulating incoming information. People located at this extreme are said to be field-independent. People at the opposite extreme are likely to use external frames of reference and are less active in processing incoming information. They are said to be field-dependent.

Experience of one's own self as separate and distinct from that of others, and with it, reliance on internal referents, are likely to make for autonomy in social relations. In contrast, a less delineated self and primary reliance on external referents limit personal autonomy. Whether internal or external referents are given greater emphasis affects, in turn, the individual's orientation toward the main source of external referents - other people. Thus, continue Witkin and Goodenough (1977), we may expect reliance on external referents to be associated with a 'turning-toward-people' orientation as a characteristic social stance. Such an orientation is likely to foster attention to information provided by other people and their activities, interest in involvement with others, and competence in social relations.

Socialisation and Cognitive Style

Socialisation factors are also reported to play an important role in the development of field independence. A variety of studies (Seder,

1957; Sholtz, 1973; Johnston, 1974; Witkin, Price-William, Bertini, Christiansen, Oltman, Ramirez and van Meel, 1974; Jones, 1975 in London and Exner, 1978) give evidence of the common sense hypothesis that when socialisation practices encourage separation from parental control, then development is toward greater field independence. When the course of development is either governed by a tightly organised, strictly enforced set of rules and prescriptions for behaviour, or when parental authority and protective functions inhibit separation, then greater field-dependence results. (Seder 1957).

Early studies of socialisation and cognitive style were based on interviews with mothers of ten year old boys concerning child-rearing attitudes and practices in their families. These early studies identified gross features of family experience (Goodenough 1978). Mothers were assessed as either field-dependent or field-independent by means of a global impression gleaned from the records of a series of interviews. Criteria of classification were the mother's own level of development with respect to sense of separate identity, impulse control, and capacity for articulated experience. Two hypotheses were tested. First, the degree of differentiation of the mother herself was part of the basis on which the overall global ratings of IID (interaction inhibiting differentiation) and IFD (interaction fostering differentiation) rested; second, the more undifferentiated children are likely to have more undifferentiated mothers. This latter hypothesis seemed commonsense; for instance, a mother who has not developed her own sense of identity, as a person separate from others, would be less likely to permit her child to separate from her or to develop as an individual. If a mother's own experience is not articulated she cannot help her child achieve articulation. Her own failure to use internalised frames of reference would not permit her to communicate to the

child a clear consistent, and meaningful view of himself and others (Witkin et al, 1962/74).

It was found that the interview could predict with some accuracy which were mothers of field-dependent children and which were field-independent on the basis of a cluster of indicators. Mothers of field-dependent children tended to inhibit separation. For example, some mothers' physical care of the child seemed to continue long after the usual time reported by other mothers; they seemed to limit the child's activities through anxieties for, or ties to, the child, and they did not permit the child to assume responsibilities for himself. Strict training practice that stressed conformity to adult norms was another condition indicative of mothers of field-dependent children. In all types of families, intense maternal involvement could be associated with field-dependent children.

A variety of research approaches have been used since the interview; methods of data gathering about child rearing and field-dependent children have given way to other methods. For example, child-rearing attitudes and practices as reported by parents of field-dependent and field-independent children have been examined; reports of these same practices given by the children themselves (usually retrospective reports collected when the children are matures) have been compared with those given by their parents; observations have been made of parent-child interactions in trivial or laboratory situations on the assumption that enduring modes of interaction are being observed (Goodenough, 1978).

The most common method of assessing parental behaviour at the present time is the use of field-dependent/field-independent subjects as sources of information. The information obtained in this way has understandably been lacking in detail. It is however, relatively easy

to collect since all required data is contributed by one family member. This approach, because of its economic simplicity, has often been used as well in field studies of non-western cultural groups. Results have been interesting because similar conclusions have been drawn from a variety of cultures. Generally these studies have shown that field-independent persons report their parents as relatively permissive. Field-dependent on the other hand, report an emphasis on parental authority in their families.

A study mentioned earlier (page 32) followed the interview technique and studied mothers of ten year old field-dependent and field-independent boys and girls who were matched for intelligence (Seder, 1957). The interview was designed to collect answers to a set of questions in order to determine how mothers were raising their children. Some of the findings reported by Seder were that during childhood, field-dependent children (particularly boys) were found to share their parents' bedroom and even their bed more often than field-independent children. Field-dependent parents were more often found to punish harshly acts of disrespect for, or aggression against, parental authority, whereas parents of field-independent children more often tolerated disrespect but punished babyish or passive behaviour in their children. Mothers of field-dependent children often intervened to settle disputes with peers, whereas field-independent children were encouraged to fight their own battles. No difference was found in the age at which toilet training began, but mothers reported that punishment for failure was harsher and training completed earlier for field-dependent than for field-independent children. Standards were more often set by parents for their field-dependent children, while the field-independent were more often allowed to participate in setting the standards. Seder's general conclusion was that parents of field-

independent children are more permissive, democratic, and encouraging to independent behaviour.

Cross-cultural research findings - as mentioned earlier - have also given additional evidence that domination by the mother in child rearing is associated with a more field-dependent cognitive style, at least for males. Witkin and Berry (1975) cite studies of Vernon (1965a), MacArthur (1971) and Baran (1971) to support their statement. They maintain that child-rearing practices which foster the development of greater or more limited differentiation tend to be similar across cultures. Witkin and Berry stress, however, that in all the studies reviewed, it was the subjects themselves, rather than their parents, who provided the data on child rearing practices. The data then reflect the subject's own perception of how they were raised. Witkin, Dyk et al (1962/1974) did rate parental practices made from interviews with mothers and found this data congruent with their ratings of the son's views of the practices reported by their mothers. Studies of the child's viewpoint reflected in the Thematic Apperception Test stories and in interviews conducted by different staff members were carried out independently of the studies made of the mothers. The role of the fathers was considered as well.

Witkin and his colleagues report that they anticipated differences between relatively more differentiated and relatively less differentiated children in the views they held of parental role and parental attitudes. It seemed likely, in their opinion, that parents showing the kinds of characteristics observed among mothers judged as IFD (interaction fostering differentiation) would tend to be viewed by their children as essentially supportive; on the other hand, parents with characteristics common to mothers judged as IID (interaction inhibiting differentiation) would more likely be experienced as non-supportive.

Parental support would be expressed in the TAT stories in a variety of ways, for example, in giving guidance and help, imparting standards for growth; in showing positive attitudes and acceptance; in acting in a reasonable way, and for the child's own good. Lack of parental support would also be expressed as for example, in inability or unwillingness to give guidance, help and standards for growth; in attitudes of complaint and non-acceptance; in the exercise of authority in an arbitrary and severe fashion, and with little regard for the child's own good.

These authors recognised that what a child said about his parents in the TAT stories or in interview need not always express the real views and sentiments which he held. His account might at times represent a "wish fulfilment" rather than things as they were; or, specifically in the interview, might be coloured by the child's efforts to present as benign a picture as possible. Results of this study were as anticipated. Children with a more global field approach portrayed parents in a relatively nonsupporting relationship towards themselves and children with a more analytical approach in a relatively supportive relation.

Social Structure and Cross Cultural Studies

Psychologists have considered cross-cultural data on field dependence and argue persuasively that field-dependent and field-independent modes of functioning may be related to the types of social structure characterising a particular group of people. Contrasts in social organisation between 'loose' and 'tight', and in socialisation practices between 'permissive' and 'strict' may be seen as plausible adaptive consequences of the ecological and economic differences between migratory hunting-gathering and sedentary agricultural-

pastoral life-styles (Barry et al, 1959; Berry, 1966; Witkin and Berry, 1975). Not only does the hunter lead a relatively isolated life, but the activities involved in the search for game may place a premium on field-independent, cognitive restructuring skills, particularly in the relatively homogeneous environmental field that often characterises the hunter's world. Witkin and Berry (1975) suggest that the ecological demands placed upon persons pursuing a hunting and gathering subsistence economic life style require the ability to extract key information from the surrounding context for the location of game and the ability to integrate these bits of information into a continuously fluctuating awareness of the hunter's location in space for the eventual return home.

On the other hand, the requirements of life in subsistence-level sedentary agricultural-pastoral cultures suggest that field-dependent modes of functioning may be more suitable. Adherence to group norms may be more valuable to group survival than autonomous individual functioning. Social sensitivity and attentiveness to others may become more adaptive than cognitive restructuring skills. Berry's (1966) work provides support for this opinion and other studies have compared migratory hunting gathering groups and sedentary agricultural-pastoral groups to study degree of field-dependence. Arunta aborigines, migratory game hunters of the Central Australian semi-desert lands, have been found to be more field-independent than the African Temne (Dawson 1969). Dawson had previously (1967a, 1967b) studied two Sierra Leone groups, the Temne and Mende, in order to implicate social conformity in developments of differentiation. Two groups living in Hong Kong, the Tanka, termed boat-people because the family lives on a boat and spends much of its time fishing at sea, tended to be more field-independent than the agricultural Hakka (Dawson 1970).

Of two Amerindian tribes, the Algonkian Cree of northeastern Canada who live in migratory family bands in winter and fishing in summer, were less field-dependent than the Tsimshian Indians of northeastern Canada who found food supplies of salmon and shellfish readily caught in nearby coastal waters. The Tsimshian tribe were considered representative of a sedentary food accumulation economy although not agricultural in the usual sense (Witkin and Berry, 1975).

Goodenough (1978) links the view that culture evolves from relatively field-independent hunting-fishing people to relatively field-dependent agricultural peoples, to socialisation and child-rearing practices and suggests that these later processes could be responsible for observed changes in degree of field dependence in today's population.

In summary, Goodenough (1978), page 165, suggests four main propositions as basic to the theory :

- 1) People are self-consistent in mode of field approach across a wide variety of situations.
- 2) As regards the conceptualisation of the construct, the dimension of cognitive styles (field-dependent/field-independent) are concerned with FORM rather than the CONTENT of cognitive activity.
- 3) As regards the origins of the cognitive style in ontogenetic development, it is proposed that socialisation factors (child rearing patterns) have an important effect on the extent to which a field-independent mode of functioning emerges.
- 4) There has been a shift in cognitive styles in the cultural evolution of mankind, as a natural consequence of the cultural evolution in socialisation practices from the relatively permissive child-rearing that tends to be found among hunting-gathering societies to the relatively strict child rearing that tends to be found among agricultural-pastoral societies.

By the late 1970's Witkin and his colleagues had thus extended the main construct of their theory, (that is the notion of field-dependence-independence, Witkin and Goodenough, 1977) and currently propose the model in which the most general dimension of cognitive

functioning identified is a dimension of individual differences in extent of autonomy of external referents. This quality is seen by them to conform in several ways with the concept of style (manner of moving toward a goal) rather than with the concept of ability (competence in goal attainment). Because the labels field-dependent and field-independent came, in the early 50s and 60s, into wide usage in connection with this line of work, they chose to transfer these labels to the higher-order dimension of extent of autonomy of general referents from its lower level-line location as it had been used in their earlier conceptual scheme as a perceptual disembedding ability (Witkin and Goodenough, 1977).

The notion, then, of 'global versus analytical' style of cognitive functioning has grown from a very large body of research and has developed into the 'differentiation hypothesis'. Style of cognitive functioning is taken to refer to the process of information exchange between the individual and his environment. A person with a 'global' style of cognitive functioning tends to submit to the dominant organisation of a field and to experience items as fused with their backgrounds. The person considered to perceive in the 'analytical' style of cognitive functioning experiences items as separate or discrete from their backgrounds and is able to overcome the influence of an embedding context.

Differences in processing information hold over a variety of situations, they hold over time, and differences in perceptual orientation are found to be associated with broad differences in personality organisation.

Educational Implications of Field-dependence/Field-independence

Research studies relating cognitive style - particularly the construct field-dependence/field-independence-to educational practices -- has developed at an ever increasing rate over the last three decades. This research is still, however, in its early stages. (Witkin, Moore, Goodenough and Cox, 1977) Nevertheless, sufficient evidence has been gathered to identify four areas in which attention to cognitive style has potential benefit for issues of education. These areas are how students learn, how teachers teach, how teachers and students interact, and how students make their educational-vocational choices and perform in the areas of their choice.

The first three have relevance for this study and it is these areas which will be considered.

How Students Learn

A collection of studies show that relatively field-dependent people are particularly interested in and relatively attentive to social aspects of their environment. They have in effect a sensitive 'radar' system, and studies have shown their interest in and ability to recognise human faces, (Crutchfield, Woodworth, and Albrecht, 1958; De Varis, 1962, in Goodenough 1976), to attend more to verbal messages with a social content, even when the messages are on the periphery of attention (Goodenough, 1976). Field-dependent persons are drawn to people, in the sense of liking to be with them. This 'with people' stance is discernible even in their use of interpersonal space (Witkin et al, 1977). Other studies of field-dependent persons have shown them to be better liked (Dingman 1972, Oltman et al, 1975), seen by others as warm, tactful, considerate, socially outgoing and affectionate (Crutchfield et al, 1958; Weissenburg and Gruenfield, 1966), known

and to know more people (Oltman et al 1975). These qualities, in total, seem to suggest that field-dependent persons, those considered to have a 'global' cognitive style, have greater skill in getting along with others.

One illustrative study (Ruble and Nakamura, 1972) examined cognitive style in learning social materials. Eight and nine year old children were given three concept attainment problems. On each trial of each problem their task was to identify the correct figure among three shown to them. In the first, 'large size' was correct, but the experimenter provided an additional redundant clue, social in nature, by looking at the figure which was correct. In the second problem, the social clue alone was relevant; and in the third problem, size alone was the correct clue. Field-dependent children showed better learning than field-independent children on the second problem, which featured the social clue alone. On the other hand, field-independent children were better on the third problem, which did not involve social cues at all.

Thus while field-dependent children are adept at learning and remembering materials that have a social content, field-independent children achieve lower results with such materials through lack of attention, rather than lack of ability. Teachers, it is therefore suggested, can bring field-independent children's performance to the same level as field-dependent by calling social material into focal attention (Witkin et al, 1977).

Conversely, field-independent persons, those considered to function in an 'articulated' style, tend to have a more impersonal orientation. They have been found (by means of a personality inventory, Pemberton 1952) to be 'not sensitive' to social under-currents; have been reported by Crutchfield et al (1958) as 'cold

and distant' with others, 'individualistic'. They are shown more likely to be interested in the abstract and theoretical, more likely to be aware of needs, feelings, attributes which they experience as their own and as distinct from others. Succinctly, there is a difference in the sense of separate identity between relatively field-dependent and field-independent people which has consequences for the nature of the social roles they are likely to assume in a particular situation.

Experimental evidence is available that field-independent students tend to learn more than field-dependent persons under conditions of extrinsic motivation (Fitz 1971, Steinfeld, 1973). This difference disappears when external rewards are material in nature or in the form of praise (Ferrell 1971, Steinfeld 1973).

Steinfeld's study illustrates these findings. Eight and eleven year-old children were given directions to play an experimental game, "Marble-in-the-hole". There were two holes into which the child could drop the marbles. First, the child's preference for one hole or the other was observed; the non-preferred hole was reinforced, and the effect of the reinforcement on the percentage of marbles dropped into this hole was determined. Three types of reinforcement, 1) abstract (flashing light), 2) material (tokens which could be redeemed for small toys), 3) social (praise from the experimenter) were used and compared. Field-independent children performed better when the first type of 'abstract' (flashing light) reinforcement was used. Field-dependent children performed as well as field-independent when the second (material) and third (social) types of reinforcement were used.

There are findings which support the opinion that field-dependent students have greater need for external structuring. These students profit from being given a 'plan' by which they can work. Field-

independent students profit less from such a teaching approach and appear more likely to find mediators of their own design in dealing with a learning task. Field-dependent persons rely on characteristics of the learning task itself and their lesser use of structure may handicap them in some classroom situations where materials to be learned are not clearly organised.

Brumby's (1982) detailed study gives a description of subjects' functioning which relates to this finding. She attempted to categorise the cognitive style in which an individual student most easily solved a problem as well as looking to see whether or not the student could operate in more than one style. Three qualitative, unfamiliar problems were designed to explore differences in cognitive styles in a biological context. Witkin's field independence or articulated style was considered by this researcher as an 'analytic' type while a 'holist' style was considered similar to Witkin's field-dependent or 'global' style of functioning.

The study required first year university biology students ($N = 48$) to answer the problems in writing as well as in an individual interview situation which was tape-recorded.

Three groups of students were identified: those who consistently used only one style of perception (either analytic or holist) throughout the three problems and those who used a combination of the two styles.

Results showed that forty-two per cent used a single analytic style of perception while eight per cent explained tasks in a purely holist style. Fifty per cent showed varying ability to use both styles of perception in different problems.

How Teachers Teach

There is some limited evidence that the characteristics of cognitive style most relevant to teaching stem from sense of separate identity. The extent to which the teacher either assumes responsibility for directing the teaching situation or to share this responsibility with the students has been related to degree of field-independence/field-dependence of the teacher.

Wu (1968) and Moore's (1973) research are reported as supporting the view that field-independent teachers prefer teaching situations that are impersonal in nature and oriented toward the more cognitive aspects of teaching. Field-dependent teachers, on the other hand, favour teaching situations that allow interaction with students, choosing class discussion as a better and more effective teaching approach. This discussion approach emphasises social interaction, and at the same time gives students more of a role in structuring the classroom situation. Wu (1968) reported social studies student teachers - who were relatively more field-dependent - ranked discussion as more important to the practice of good teaching than either lecture or discovery approaches. These latter two methods were the choice of more field-independent teachers. It should be noted that both lecture and discovery approaches demand that the teacher organise much of the learning situation, either through facilitation and guidance of student learning or through information.

Moore (1973) studied patterns of verbal teaching behaviour by use of a simulation game devised to investigate differences in teachers' use of rules, relations and examples in explaining chemistry subject matter and questioning students on the content. His results showed that the more field-independent teachers tended to use questions as instructional tools far more frequently than the field-

dependent teachers. Field-independent teachers tended to use questions to introduce topics and follow student answers. Field-dependent teachers used questions primarily to check on student learning following instructions. Since verbal intervention was restricted and student responses very limited, discovery techniques could not be employed by the teachers. The kind of questioning approach used by the more field-independent group may be seen as the main avenue for teachers to attempt translation of a discovery approach within the context of the game.

Emmerich's (undated) findings reported by Witkin et al (1977) as being carried out in conjunction with their social studies teachers' project mentioned earlier, are held to be supportive of the view that field dependent teachers consider class discussion an effective teaching technique. Emmerich also reported that field-dependent teachers (but not field-independent) felt encouragement of students to set up a group standard to be a useful teaching practice. In this same research, teacher's statements concerning effective teaching techniques suggest that field-dependent teachers were more student-centred in their approach. Students, on the other hand, reported field-independent teachers more frequently emphasised teacher's standards.

Differences in teachers' preferred use of kinds of re-inforcement were also noted by Emmerich. Field-independent teachers considered negative evaluation (expressing displeasure when a student performed below capacity) to be an effective teaching technique. That both corrective feedback and negative evaluation should be emphasised by field-independent, but not by field-dependent teachers is consistent with evidence that field-dependent persons are less likely to express hostility towards others. This difference has been interpreted in terms (as mentioned earlier) of the greater sense of separate identity

of field-independent persons while the field-independent people rely on others for self-definition making it a problem for them to antagonise others (Witkin et al, 1977).

Students of field-independent teachers see them as encouraging students to apply principles (reflecting perhaps the greater interest in the abstract and theoretical) while field-dependent teachers were often seen as teaching facts.

The evidence reported thus far as regards preferred teaching techniques and styles has all been obtained under simulated teaching conditions. Witkin et al (1977) write that only two studies of actual teaching behaviour in classrooms have been attempted. Engelhardt (1973) used Hall's Instrument for Analysis of Science Teaching to observe elementary student teachers in a mini-course setting, but no relationship was found between field-dependence/field-independence and intensity of teaching, style of teaching (student centred or teacher centred), or consistency of teaching style. In the second study, Ohnmacht (1967a) also found no relation between field-dependence/field-independence and direct or indirect teaching, as defined by Flanders Interaction Analysis summary scores. As in Engelhardt (1973), the relation of cognitive style to particular types of teaching behaviour (praise, criticism, use of student ideas, questioning, lecturing) is not reported.

In summary, then, little is yet known about differences in actual classroom teaching behaviour of more field-dependent and more field-independent teachers.

The evidence, however, concerning the different ways in which students learn places an onus on the teacher to consider approaches in which relatively field-dependent and field-independent students learn concepts, and to adapt teaching procedures to suit and serve both

groups, as well as helping students to diversify their own learning strategies (Witkin et al, 1977).

How Teachers and Students Interact

The evidence gathered to date (Witkin et al, 1977) has established match or mismatch in cognitive styles as a factor in teacher-student interaction. To have established that such a relationship does exist, is 'to have opened the door only a crack'. Many basic questions must be answered by research before we can state definitely any practical implications for the class-room situation.

Messick (1982) writes that the problem of the match between features of the instruction and functional characteristics of the learner should be of primary concern to educationalists at all levels.

Messick argues :

In discussing ability structures, I have gone out of my way to emphasise that these cognitive or intellectual abilities develop gradually and experientially through processes of learning and transfer, although I recognise that individual differences in this learning and development may be partly or even largely genetically based, as Eysenck (1982) avows. I stress the developing nature of these abilities in response to education and experience because schooling, especially in the early years, may be instrumental in enhancing their development and effective utilisation as opposed to merely building upon them as given (J. McV. Hunt, 1961, 1980). Thus unless one would like to argue that any of us has fully attained the limits of our genotype, there appears to be ample room to reap the benefits of learning, even for students at the low end of ability distributions - and given the restricted nature of instruction in much of special education, perhaps especially for those at the low end (Furneaux, 1982; Heller, Holtzman and Messick, 1982).

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The distinction is made by Messick (1982) between cognitive styles and cognitive strategies - the former being spontaneously applied without conscious consideration or choice in a wide variety of situations and the latter reflecting decisions among alternative approaches as a function of task requirements, problem content, and

situational constraints. Moreover, cognitive strategies are often selected, organised and controlled in part as a function of larger-scale, more general cognitive styles. In comparison with styles, which tend to be stable and relatively pervasive across diverse areas, strategies are likely to be more amenable to change through instruction and training. It is possible that individuals not only learn to use a variety of problem-solving and learning strategies that are compatible with their cognitive styles, but that they also learn to shift to less congenial strategies that are more effective for a particular task.

With reference to Witkin's theory of cognitive style, Messick (1982) notes that integration simultaneously may not be logically possible as many style dimensions may not represent true bipolarities, but rather contrasts that place one network of interacting characteristics against a disparate network. In spite of this, Messick maintains that the functional attainment of multiple modes of thinking, whether across poles of a single stylistic dimension or across different dimensions of style, requires the development of flexibility in thinking and in the selective utilisation of multiple cognitive structures. He notes Entwistle's (1982) conclusion that a major initiative should be taken at the school level to prevent inappropriate learning strategies becoming habitual before pupils move on to higher education or into employment.

Messick extends Entwistle's conclusion and suggests that learning habits which become habitual are inappropriate at any level. He sees the educational goal as the development and enhancement of flexibility in modes of thinking - to the degree possible in order that cognitive styles might be converted into cognitive strategies, which could then be selectively and appropriately applied in learning and performance as a function of the task requirement - thus reducing to some extent the

restrictiveness and preemptiveness of habitual thinking.

Witkin et al (1977) report that few studies have been undertaken in relation to interaction of teacher and pupil as regards cognitive style. The works of DiStefano (1970) and James (1973) suggest that teacher-student match in cognitive style makes for greater interpersonal attraction than mismatch. Teachers also gave higher evaluation ratings to students similar to themselves in cognitive style. It may be that teachers do better with students similar to themselves in cognitive style and students may learn more effectively when taught by teachers matched to them.

Caution must be exercised, for although matching for cognitive styles appears to create a classroom atmosphere conducive to learning, it is equally possible that negative results could arise from matching. For some kinds of learning content a contrast in style between teacher and students may be more stimulating than similarity. Heterogeneity makes for diversity of viewpoints and may make the classroom more lively. If this is the case, homogeneous classes may be ill-advised. Also, while the interpersonal effects of the discussion approach used by relatively field-dependent teachers may be helpful to learning by field-dependent students, that very approach at the same time minimises those "external structure" characteristics emanating from the teacher which field-dependent students seem to need for effective learning. It must also be considered that relatively field-independent teachers are likely to use negative, or punishment, reinforcement in the classroom but it is the more field-dependent student who is particularly responsive to this method which depending upon circumstances may have a positive or negative effect on learning. Whether the criticism has a positive or adverse effect on learning depends upon the manner in which the criticism is administered. Either way, this type of

external reinforcement is reported by Duvall, 1970; Ferrell, 1971; Konstadt and Forman, 1965; Randolph, 1971 (in Witkin et al, 1977) as having a particularly potent effect on field-dependent persons.

Teachers' adaptation will be a realistic goal if we are able first, to identify particular teaching strategies which teachers may use, either spontaneously or with training, when teaching students whose cognitive styles have been identified as well. For the educator, the development of greater diversity in behaviours within individuals seems as important an objective as the recognition and the utilisation of diversity among individuals.

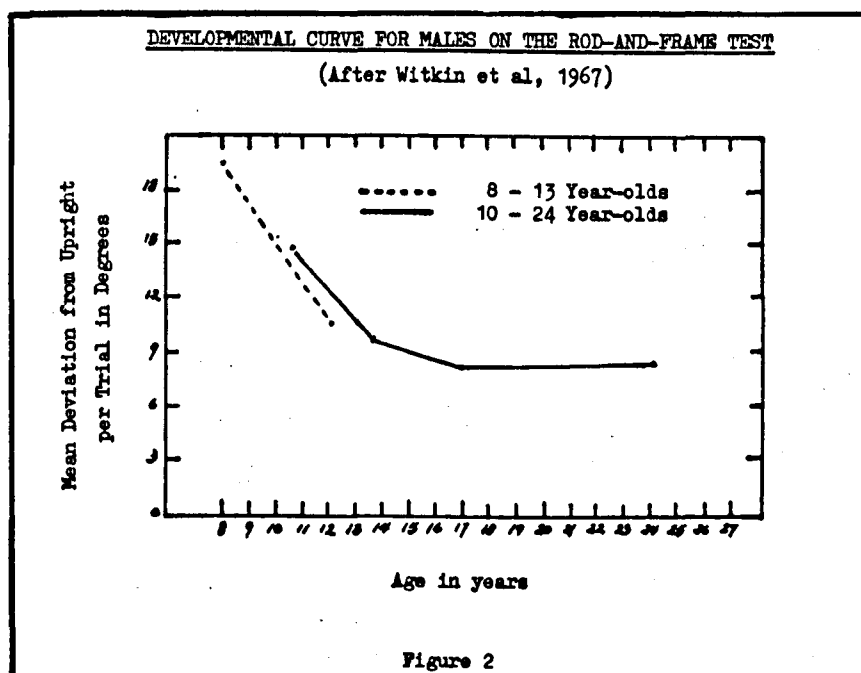
Development Aspects of Field-dependence/field-independence

The differentiation concept is generally applied in a developmental context. In early development a child experiences himself and his environment mainly as a more or less amorphous continuum. In the course of his development, differentiation is the movement away from the initial inevitable state of unity with his mother toward some degree of separation. The child develops a growing sense of what he is like and how he is different from and similar to others. The outcome of this self-development is referred to as the achievement of a sense of separate identity. (Witkin et al 1974). The self becomes more differentiated as it develops.

Little work with standard tests of field-dependence has been reported for young children (below age eight). Some studies recently have become available but are not extensive. Bibliographies of Witkin-type research (as collated and published by Witkin et al through 1978) cite a number of researchers who have used either the present CEFT or an earlier form of this test to measure field-dependence/field-independence with children as young as four years.

Goodenough (1978) suggests that while standard tests of field-dependence cannot be given to the very young child, later field-dependent/field-independence development may be predicted with some accuracy from behaviour observed at these early ages. Ratings of two and a half year old children on degree of autonomous play and attention-seeking behaviour were related to performances on tests of field-dependence later administered to these children when they were six years of age (Wender, Pedersen and Waldrop, 1967).

Goodenough (1978) reports that children change from state of field-dependence toward a greater field-independence during the course of development and he summarises the results of two longitudinal studies in Rod-and-Frame test performance among boys (Witkin, Goodenough and Karp, 1967). The boys in this study were initially tested at eight years of age and retested at age thirteen. In another study the boys were seen at ten years of age and retested at age fourteen, seventeen and twenty-four. The data from these studies show a continuous decrease in the effect of the visual field from eight to about seventeen years of age, with little change thereafter. This is illustrated in the following graph.



Summary of Chapter II Psychological Differentiation Theory

This section reviewing literature on differentiation theory has reported and focused on a limited number of issues which Witkin and his colleagues have been studying. Goodenough (1978) remarks that literature on field-dependence is voluminous and the theory rests on a wide variety of data sources. It is this writer's opinion that there is as well, wide variation in the quality of the data sources and findings should be interpreted with caution.

The areas of historical development of differentiation theory, the relationship to intellectual development, social influences, socialization factors, social structure, evidence from cross-cultural studies and finally the educational implications of field dependence/field-independence have been presented as these areas are a specifically relevant basis for this present study.

The initial work of Witkin and Asch (1948) related to perception of the upright and extended to spatial ability will be referred to when considering the spatial demands of the Piagetian conservation tasks. Witkin's notion that field-dependent subjects are more oriented toward external referents and are associated with a 'turning-toward-people' stance has also been utilized in the study. Field-dependent people are reported as paying more attention to information which is of a social nature, that is, information provided by other people, while field-independent (Witkin and Goodenough 1977) are more likely to rely on their own set of internal referents which they use in processing information. This idea of format of information presentation as it relates to cognitive style is touched upon in this investigation.

However, attention will mainly be focussed on children's performance on Piagetian tasks in respect of their identified cognitive styles as being either field-dependent or field-independent.

CHAPTER III

Piagetian Research

"There is nothing that Piaget wanted to do more than revise his theories . . . Piaget could not bear the idea of being accused of having a system . . . he never wanted unconditional surrender to his ideas. He was open to dialogue . . . "

From IN MEMORIAM by Gilbert Voyat in American Journal of Psychology, December 1981, Vol. 94, page 648.

New Perspectives of Piagetian Research

Readers familiar with Piagetian research will recognise shared commonalities with some characteristics of Witkin's field-dependence/field-independence theory which have been discussed in the previous section. For example, both notions are considered to be developmental; both notions are discussed in reference to the subject's ability to 'restructure' the situation which is presented; and in both theories the 'social' influences (as they affect the subject's personal learning style and the learning situation) have been extensively investigated. In the Witkin theory, the source of information and manner of information presentation is considered an important factor in the teaching/learning process. Currently, Piagetian research is increasingly attending to the kinds of materials, and the style of questioning as well as the use which is being made of these in the interaction between the tester/teacher and the subject/learner in the administration of the Piagetian conservation tasks.

In recent Piagetian literature it is this context of the testing/learning situation which has caught the interest of researchers and it is this same aspect which has been investigated in the administration of the Piagetian tasks of this study. Piaget's death in 1980 renewed interest in his ideas and called forth even further debate of his more controversial points.

Recent studies appear then to have been organised from newer perspectives, (as Boden's 1982 work concerning a model of equilibration) and as it has been suggested above, the causes of intellectual development may be social in nature. This suggestion has relevance for this study as social aspects of the administration of the Piagetian tasks (as indicated above) were a factor of the

research design. Bryant (1982) remarks :

"This is indeed an interesting possibility, especially since one of Piaget's main, though often underestimated interests was in children's social development and understanding of social rules . . . This casual side of Piaget's theory, despite a considerable body of research, remains untested. Yet, there is no reason, in principle, why it should not be tested adequately".

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The factors involved or influencing the learning/teaching/testing situation and the role of the adult/teacher/researcher have especially come under scrutiny (Mervis and Mervis, 1982; Miller 1982). The type of materials and ways in which children have been questioned or directed to use these have also come to be investigated systematically (Donaldson and McGarrigle, 1974; Meadows, 1977; Light et al, 1979; Donaldson, 1982; Miller, 1982). There has also been a move (particularly as regards the study of spatial concepts) to train or introduce the child to actual physical aspects of the situation (Cohen and Cohen, 1982; Gelman, 1982) as part of the test procedure. Gelman provided three and four year-old children with 5-7 minute training sessions (using small blue turtles) as preparation for a conservation experiment. The children were shown two rows of equal (4 - 4) or unequal (4 - 3) numbers of items placed horizontally in one-to-one correspondence. The child was first asked to count the number of items in one of the rows. That row was then covered by the experimenter's hands and the child was asked 'How many are there under my hands?' This was repeated for the remaining row. The child was then asked to judge whether the uncovered rows contained the 'same number or a different number' of items. All the children answered these questions correctly.

Next, the child watched as the length of one row was transformed and then was asked to judge whether the specific number of items in that row had changed. For example, after lengthening or shortening one of the rows, the experimenter pointed to the altered (or un-

altered row) and asked 'Are there still four (three) there?'. If the child's response was 'Yes' a comparable question was asked for the remaining row. The child was then asked to judge whether the rows had the same number or a different number of items to explain his judgement. The order of transformation types was randomised. Transformations on unequal trials yielded rows of the same length; equal trials involved rows of different lengths.

The table below shows results of Gelman's study. Summarised, three and four-year-old children benefitted from the brief (5 - 7 minute) training period when the emphasis was on their using specific cardinal values to make judgements of equivalence. Since the children transferred what they learned to small-item and large-item conservation tests and provided explanations as well, two conclusions follow. First they accessed an ability to conserve. Second, although pre-schoolers are biased toward reasoning about specific numerosities, they are not restricted to this avenue alone. Under certain conditions, they can be induced to solve conservation tasks they would fail if they had to count.

CONDITION	AGE OF CHILDREN	
	3 years	4 years
Experimental	75	88
Cardinal-once	0	50
No cardinal	0	25

PERCENTAGE OF CHILDREN WHO CONSERVED WITH EXPLANATIONS
ON AT LEAST ONE SMALL AND ONE LARGE SET-SIZE TEST

Table 1

Cohen and Cohen (1982) attempted to assess the influence of activity on the construction of spatial representations in three activity conditions. Five common objects (chair, wastebasket, desk,

TV table, box) were set out in an otherwise empty classroom and the children (three groups, $N = 96$) either walked through the environment (walk only condition), were asked to perform isolated tasks at four locations (interact only condition), or performed interdependent tasks at the four locations (interact/linked condition). Following the task, the children were then asked to estimate all pair-wise interobject distances of the objects in the room. Not surprisingly, the eleven-year old subjects estimated distances more accurately than the six-year-olds. However, children of the two age groups used in the study who were placed in the interact/link condition were more accurate in their estimates than were children in either of the other groups of both age bands.

Stability versus Variability

Work of Piaget is cited by Nisbet and Entwistle (1982) as they discuss 'changing views on ability' and note that the focus of recent research has been shifted away from the relative stability of individual differences to the importance of the remaining variability. They remark that Piaget tended to dismiss the observed differences, in performances between tasks intended to be equally difficult. Nisbet and Entwistle state that if these differences are considered, it becomes clear that they are affected by the nature of the particular tasks provided. Indeed, the performances from which the existence of stages are inferred are also dependent on the experimental conditions - the form of questions asked, the language used, the rapport between child and experimenter and so on. It is this situation precisely, found in the writer's previous work (Van Arsdel 1978), which has led to the formulation of the present study.

If this is true of Piagetian experiments, ask Nisbet and

Entwistle, should we not also expect similar differences in performance between children at the same overall intellectual level in the tasks set for them by their teachers in their classrooms. In the attempt to answer this question, some of the more recent research on learning has been looking at these differences in performance within the natural learning setting of the school. Further, this attention to variability has produced yet another set of hypothetical constructs - 'approaches to learning', or 'styles of learning' - which stem from the analysis of performance, and at the same time, is creating a tension with traditional assumptions linked to the meaning of ability. Nisbet and Entwistle ask : "How is it possible to allow stability and variability to coexist as apparently contradictory characteristics of the same concept?"

These writers hold that 'ability' is also a hypothetical construct and that any debate about ability is a debate about theories. They quote an earlier statement of Davies and Nisbet (1981) and succinctly trace the development of learning theories :

"In the nineteenth century, a child's failure to learn was seen as a moral lapse, due to carelessness or lack of effort. The psychometrists of the twentieth century introduced a different model, in which learning was determined by the child's quantity of intelligence. In the 1950's another model became popular, explaining difficulties in learning as environmental, in terms of culture or early childhood experiences or social conditions. It is only recently that we have begun to look for an explanation in terms of the actual teaching itself. Is the subject-matter properly ordered and appropriately matched to the learner's stage of development? Do the methods fit the mental equipment which the learner brings to the task?"

Davies and Nisbet, 1981

They note that major developments in theories of learning have been made in the last 20 years or so. Sadly, those directly concerned with schools and teaching still rely on the old models, specifically the idea of a built-in intelligence as the prime deter-

minant of learning. The 'schemata' of contemporary cognitive psychology (firmly established as a 'commonsense' model of intelligence) is used by teachers to explain why some pupils learn more readily.

Politicians use the same model to determine which proportion of an age group should go to university.

Contrary evidence can also be fitted into this framework of cognitive psychology, but as such evidence does not fit easily, it has tended to remain unnoticed.

Piagetian Notions as a Model for Learning Theory

Recently other theories and models of learning have been suggested. Nisbet and Entwistle name the work of Bloom and Bruner; summarise Lovell as distinguishing two main directions of recent research on learning; the Piagetian and the 'skill integrationists' :

"The Piagetian contribution is well known: popular interpretation of Piaget's stages reflect what Lovell calls 'internal age-related restrictions on learning'. This viewpoint is reminiscent of older theories of innate intelligence. The other group represent the environmentalist side of the controversy: humans are active and assign meanings to the tasks they encounter, creating from previous experience schemata and cognitive styles which are crucial to the processes of learning and development . . . To the followers of Ausubel and Gagne, the metaphor for knowledge creation is the production line: assemble the necessary components and the product will appear . . . To the disciples of Piaget, knowledge is an exotic bloom which has its own proper season."

(Davies and Nisbet, 1981, summarising Lovell 1980)

Desforges (1982) outlines briefly the contributions of Piaget to educational theory. He documents recent criticisms of Piaget's work but remarks that what these criticisms amount to is that we are largely ignorant of what children know and their ways of coming to know, especially as these operate in real-time conditions such as classrooms. Desforges maintains Piaget's work is important - as it has given us a general model of the impact of experience on a

learner's mental organisation. Followers of Piagetian theory have constructed a model of learning which now permeates contemporary cognitive psychology. The notion is that learners always invent some form of organisation for experience and that learning is the active assimilation of experience to schemes. If Piaget's work is viewed as an interpretive framework rather than as an educational panacea it might prove to be exceedingly useful.

Commenting upon the process of finding an adequate model of learning, Lunzer (1972) appears to have foreshadowed Desforges' view and asks, "What are the relations between intelligence, learning ability and the development of logical thought?" His reply is that a knowledge of changing patterns of intercorrelations among a wide variety of tasks (learning, problem solving, memory, attention, language) should offer some leads.

But what is really required is an overall model supported by experiment within which what we call learning, intelligence and thinking will be redefined. More than one breakthrough will be needed to achieve such a model. In the meantime the model proposed by Piaget is, in Lunzer's (1972) opinion not a totally inappropriate one, and when it is superseded Piaget's findings will not have been shown spurious. Rather, the perspective, broad though it is, will have been shown as too narrow and imprecise.

It would appear that Piaget himself would endorse such a view - for writing in 'Problems of Genetic Psychology' (1964, Trans. 1967) he begins :

"The object of this study is not only to communicate some of the recent results of our research but also to indicate the spirit in which it was undertaken. We have studied the development of intelligence for over thirty years and the development of perception as a function of age for over ten years. I should like to describe our objectives in undertaking this work.

Studies of child psychology can, of course, be undertaken in order to understand the child himself better or in order to perfect pedagogical methods. These goals, however, are common to all work in genetic psychology, so we shall not dwell on them. Our objective - in addition to the aforementioned aims - is even more ambitious. We believe that all research in scientific psychology must start from principles of development and that the formation of mental mechanisms in the child best explains their nature and the functioning in the adult. It seems to us that the essential goal of child psychology is to construct an expository method for scientific psychology in general; in other words, to furnish the indispensable genetic dimension to the solution of all mental problems."

Piaget himself refrained from making any pedagogical application of his research and in the preface to the work quoted above Elkind spells out clearly the position :

"It would be hard to overemphasise the importance of regarding Piaget as a genetic epistemologist rather than as a psychologist. Each time the writer has attempted to present Piaget's work to psychologists and educators he has had to parry questions about individual differences, motivation and learning. What is disturbing about such questions is that they presuppose that Piaget should be concerned with properly psychological issues. One is reminded at such times of those book reviewers who criticise an author for the book he did not write . . . There is no question, of course, that Piaget's work has many important implications for psychology and for education. But this is not the same as saying that the work itself is essentially psychological or pedagogical . . . The fact that psychology and education can profit so much from Piaget's contribution should not be transformed into the demand that he be a psychologist or an educator."

page vi, Elkind (1967)

Piaget himself gave us good advice when he wrote in 1964 that today's great danger lay in slogans, collective opinions, ready-made trends of thought. 'We have to be able to resist individually, to criticise, to distinguish between what is proven and what is not' (Piaget 1964).

More recently, writing in 1978 in his 'Preface' to DEVELOPMENT OF THOUGHT, Piaget states :

"This work constitutes a complete recast of volume II of Etudes d'épistémologie génétique entitled Logique et équilibre. The models then used clearly proved to be in-

sufficient, and it was important therefore to restudy the problem completely, particularly as this area of investigation dominates every question of the development of knowledge. The central idea is that knowledge proceeds neither solely from the experience of objects nor from an innate programming performed in the subject but from successive constructions, the result of the constant development of new structures. With this hypothesis, we can refer only to those methods required for regulations leading not to static forms of equilibrium but to re-equilibrations which improve the previous structures."

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An idealised historical evolution of the Piagetian system is outlined by Pascual-Leone (1976a) and the research purposes of Inhelder, Sinclair and Bovet are defended by him as well. He states that 'misunderstanding of Geneva's purposes is not uncommon in the North American literature', and the misunderstanding is brought about by the 'methatheoretical, metaphorical, and unexplicit style of Geneva's explanatory (as opposed to descriptive) theorising'.

Pascual-Leone holds that the purely structural Piagetian models were not adequate for explaining cognitive development. However, in the late 60's and 70's - led by Inhelder, Geneva has presented a 'process structural and organismic' model in order to account for the transition rule. Inhelder, Sinclair and Bovet's (1974) work, Apprentissage et structures de la connaissance, is in Pascual-Leone's view, an attempt to study this dynamic process.

He sees serious and urgent technical problems which must be faced and solved by the Genevans.

He outlines only three:

1. Piagetian purely-structural psycho-genetic theory must develop (or borrow) process-structural technical means to represent the step-by-step temporal events (the process) which occur with the child as he deals with the task. If Geneva does not take this step, they will not have much effect upon the future of a psychology

1 (cont)

which is becoming increasingly more and more dominated by process-structural models derived from or influenced by computer science.

2. The valuable meta-theoretical process-structural description of the equilibration process (which is a concept underpinning the whole of Piagetian theory) must be made theoretical if the model is to be useful in practice.
3. Although the most recent work of Inhelder, Sinclair and Bovet is illustrative of new, exploratory research designs, particularly suited to Geneva and developmental studies, it may be necessary to adopt additional appropriate methods of quantitative, psychological structural analysis. There is need for more suitable methods of numerical quantification for information-processing data reduction in order to study more easily the complex structural invariance across the many tasks.

Pascual-Leone is confident that if Geneva (and North American Piagetians) were to follow his suggestions in designing their research studies - the old debate between 'learning and development' would vanish because organismic factors would be found which could account independently for their manifestations.

This writer shares Pascual-Leone's views as regards the technical problems of the Genevan theorists. She has found it most difficult to record and codify the variety of intelligent responses which individual children have given to the same Piagetian task, and it has been equally as difficult to fit these responses into the traditional Piagetian interpretation of cognitive change.

Cross Cultural Perspectives

Writing from the historians' and philosophers' perspectives and citing evidence from a variety of researchers as well as opinion of African lecturers, Buck-Morss (1975) claims that the apparent 'time-lag' discovered in the cross-cultural application of Piagetian tests may result from a socio-economic bias in Piaget's theory. Further,

where education is a major concern of national policy, this issue has an implicit political content.

Buck-Morss outlines the notion of abstract formalism as the principle which structures the social relations of production and commodity exchange within Western industrial capitalism. She quotes Lukacs (1971) who maintains that abstract formalism is related to Kantian dualism, the separation of formal mental operations from the perceptual objects which provide the content of thought. Buck-Morss argues that Piaget's conception of cognition is clearly within the bourgeois idealist tradition of Kant because :

"Piaget stresses the spontaneity of the subject in the cognitive act, claims thought is a form of praxis, and considers formal categories not innate ideas, but universal structures of experience."

She argues as well that the thought processes which Piagetian tests assess are developmental not only in an ontogenetic sense, but in a socio-historical sense also. For if Piaget's theory is accepted as a development of abstract formalism - grounded in Kantian dualism and its theory of dynamic processes of change, then conservation tests applied to children must measure or reflect the culture of the society or group in which they live - specifically, Buck-Morss (1975) maintains that Piaget-tests assess not only a particular culture, but a particular socio-economic culture :

"The more broadly the child can generalise, the more concrete content he can eliminate as he ascends the hierarch of abstraction, the more 'advanced' will be his Piaget test performance. (Such a classificatory structure is precisely the inverse of that which, as Levi-Strauss (1973) observes, has been most fully developed by traditional societies. The latter classify by differentiating rather than generalising, with a degree of complexity which has repeatedly impressed Western ethnographers.) Adorno (1970) has argued that the bourgeois propensity for generalised abstraction reflects the social value of conformism and a fear of the non-identical view, or religion, or race, which leads to social oppression."

What implications could be drawn if one were to accept Buck-Morss' view that the structure of cognition which concerned Piaget (as well as other psychologists studying the development of thought) reflects the structure of industrialised society and further that the actual development of cognition may reflect the demands of assimilating and accommodating to a particular social reality? It would seem possible to argue that the young child - not yet initiated fully into the 'structure of industrialised society' - would be reflecting the cultural reality of his home and family. Further, while there are many common elements in British society, there is wide diversity. It could be argued that the wide variety of child-rearing patterns (especially in the 80's) affected children's development in a variety of ways. Hence, the family's culture might be strongly influencing children's performance on Piagetian tasks. This factor, however, would be difficult to identify, or quantify, with any precision.

Conservation Studies

Central to Piagetian theory is the notion of conservation. Piaget himself uses the term to describe or elucidate other of his central themes, as equilibration, assimilation and accommodation. He writes in 1970 :

"Conservations which provide the best index of the formation of operational structures, are closely connected both with transitivity and the closure of structures. The link with transitivity is obvious, for if one has $A = C$ because $A = B$ and $B = C$, it is because some property is conserved from A to C; and on the other hand, if the subject accepts as necessary the conservations $A = B$ and $B = C$, he will infer from them $A = C$ by the same arguments. These three main types of argument that the child uses at this stage to justify all conservations, are all indicative of combinations characteristic of a self-enclosed structure . . ."

Succinctly, but perhaps with some loss of the importance of the term as Piaget used it, Furth (1969) defines conservation as the

maintenance of a structure as invariant during physical changes of some aspect.

The debate over the Piagetian notion of conservation, writes Bryant (1982) is understandable as conservation-type experiments are Piaget's best known and most important. Further, these have been repeated more often and argued over more strongly than any other of his techniques. The conservation experiment, as it is about the understanding of invariance, asks the simple question whether the child understands the changing of the appearance of a quantity which comes about by spreading out a row of counters, or pouring liquid from a fat container into a thin one.

Genevan researchers (Bovet et al, 1981) hold that children must understand the situation as an adult does, in order to be classified as 'true conservers'.

Donaldson (1982) discusses conservation clearly and elaborates that in Piagetian theory mental systems make conservation possible. The operational systems - as Piaget calls them - are based on and concerned with 'logico-mathematical experience', not with physical experience, nor yet with psychological experience, which include the experience of beauty.

Logio-mathematical experience, in Piagetian theory, is the experience of certain kinds of action, typical examples being the actions of dividing and bringing together again, sorting or arranging in series. Strictly speaking, it is experience we have from early childhood onwards, of our own acts of this kind and of their outcome. These acts, when they have been internalised and organised into systems, become operations, and it is when thought reaches the operational stage that conceptual 'invariants' arise and children become 'conservers' (Donaldson 1982).

Piaget in his early writings (according to Donaldson, 1982) considered children's inability to conserve as 'one manifestation of a pervasive inability to decentre'. Later, although he did not reject his original idea, Piaget (1975) suggests that in the early years of life, positive observations are strongly dominant over negative ones - and this tendency yields an initial imbalance or lack of equilibrium. Piaget maintains that from the psychological viewpoint, negation is essential only when the subject has no need to construct it, that is, when it is imposed from without. For example, a denial of the facts is a reply to a false forecast or a refusal to accept what is unwanted. All negations are constructed by the subject and by no means result from object resistance. This construction, which begins with seven or eight year olds, is slower and more difficult than the more or less direct composition of positive characteristics. Piaget maintains that we do not have to argue about the primacy of affirmatives. We record only positive observations, and the perception of the absence of an object only occurs secondarily and in waiting periods or forecasts which depend on the whole action and extend beyond perception.

Identity Versus Equivalence Conservation

A recent paper by Silverstein, Pearson, Aquinaldo, Freedman, Takayama and Weiss (1982) reported on attempts to determine the distinction between conservation of identity and conservation of equivalence; defining 'equivalence' as the situation when the examiner makes two equal balls of clay and establishes that the child regards these as the same. One ball is then rolled or flattened into a different shape and the child is questioned as to the amount of clay in the ball which remained unchanged in its shape and the amount in the ball which was changed. In 'identity' experiments, the exam-

inner uses only one ball of clay and transforms this in view of the child (or asks the child to perform the transformation himself).

Elkind(1967) is said to have been the first noting the difference between 'equivalence' and 'identity' conservations. He is reported to have observed that while Piaget's work explained and discussed 'identity' conservation tasks, most of his research (at least until that date) had been concerned with 'equivalence' conservation. Elkin reasoned on logical grounds that conservation of 'identity' should appear before 'equivalence', maintaining that it would be easier logically for the child to make a judgement concerning the change in form in relation to the single ball of clay (identity conservation), as this would be a direct thought process, than to make a judgement in relation to the two balls as this would demand a comparison between the two balls (equivalence conservation) as well as the judgement concerning the change in form.

Since 1967 a variety of studies concerning this point have been done and a variety of results reported. The notion can be related to the Piagetian tasks used in this study. The first task of those two tasks concerned with conservation of length, tested 'equivalence' conservation as did both tasks administered to assess conservation of area. It might be suggested that these three tasks demanded a higher level of logical reasoning ability than did the other tasks of the battery which could be categorised as testing for 'identity' conservation.

Silverstein et al (1982) state that their study was originally planned with a dual purpose in view :

- a) to modify one of the few existing standardised tests of conservation (Goldschmid and Bentler's (1968) Concept Assessment Kit - Conservation, CAK - C) so that it could be used to assess the conservation of identity as well as the conservation of equivalence and

- b) using both the original and modified versions of the test, to gather additional evidence on the question of developmental priority.

They wrote candidly of their findings:

"Initially, we were at a loss to account for our results. We had totally unexpected findings across both grade levels (K through 2) and items, with one exception. (Items were 2-D space, Number, Substance, Continuous Quantity, Weight, Discontinuous Quantity). The children's performance on the equivalence version of each of the items' conservation tasks surpassed their performance on the identity version".

They further reported that to their knowledge, no other investigators had obtained results that had gone directly counter to Elkind's conjecture about the developmental priority of identity. Silverstein et al (1982) maintained that they had confidence in their data and finally concluded that the questions of developmental priority cannot be answered quite as readily as is commonly supposed and as they themselves assumed when their study was initiated. Further, they remarked that investigators must concern themselves, more than they have done to date, with the consequences of using fallible data to test hypotheses stated in terms of population parameters.

Role of Language in Conservation Tasks

The conservation studies debate is continued by Donaldson who suggests that studies in the mid 60's concerning the role of language and linguistic training may have been invalid as more recent studies indicate that what the children may be failing to conserve is the meaning of the question - not the meaning of the individual words, but the meaning of the utterance as a whole. She writes of her own studies begun with McGarrigle in 1974. Two rows of toy cars were placed on shelves, one above the other, with or without enclosing garages. There were always four cars in one row and five in the other and always the fifth car projected at the right-hand end of the

row. The position was counter-balanced, however, as the four cars might be placed either on the top or bottom shelf. The row with the four cars was enclosed in four garages, while the row of five were enclosed in six, leaving one garage empty. The children were asked : "Are there more cars on this shelf or more cars on this shelf?" and for each shelf separately "Are all the cars on this shelf?" Each question was asked twice, first with garages present and then after the garages had been removed, or the other way round. Thus the questioning was within the framework of the Piagetian conservation test : a question was asked, an irrelevant change was introduced, the question was asked again. Many children gave different answers to the repeated questions.

Donaldson continues that when children do not conserve number in the standard task, they appear to be confusing number with length. The number remains the same but the length of the row alters and the child is deceived. In this experiment of Donaldson and McGarrigle (1974), however, both number and length of row are unaltered, yet the answer changes. In this experiment, as contrasted with the Piagetian, the non-conserving answer to questions about which row had more was based not on attention to length, but apparently, on attention to fullness. The same tendency was evident in the case of questions about 'all'. The response patterns were, however, more complex and harder to summarise. When the garages were present, 14 out of 21 children (mean age 4 years 4 months) said that the row which was full had 'all the cars', though they denied this for the more numerous row with the empty garage.

What is it then, writes Donaldson (1982) that is being conserved - or not conserved? In the case of more, we may speak of conservation of inequality of length and number, but the case of all is more per-

plexing. Yet the kinds of response given were so similar that we must look for a single unifying account of what is going on. This can be found in the notion that what the children may be failing to conserve is the meaning of the question - not the meaning of individual words but the meaning of the utterance as a whole.

Contextual Aspects of Teaching/Testing Situation

The work of Sinha and Carabine (1981) is cited by Donaldson. Sinha and Carabine suggest that very young children - three years old - are more likely to attend to internal purposes (of the conservation experiments) which amounts to saying that they would be less likely, once caught up in the 'game' of the experiment, to ask themselves why the experimenter had taken the trouble to 'transform' or 'change' the initial situation which was presented to them. Older children, however, might be less wholly absorbed in the fiction and more likely to attend to the purposes which are external to it.

Donaldson remarks that Sinha and Carabine's argument might usefully be extended and the case that, as well as attending to purposes of either kind, children may attend to impersonal, wholly non-purposive, features of task structure. However, Sinha and Carabine may well be right in saying that very young children are less likely to do this than older ones, preferring to concentrate on functional or purpose-based criteria when these are available. Some tasks, it appears, have no internal purpose of any kind - and the classical conservation task is one of these. In this task then, there are two possibilities :

- a) either subjects focus on impersonal features, like level of liquid; or
- b) they focus on external purpose and wonder about the act of 'changing' the transformation, for example, the act of pouring water from one beaker to another, and why the experimenter did it.

Frequently, in administering the conservation tasks to young children, especially to those whom she knew well, this tester observed a wary, questioning reaction on the part of the child, who sometimes looked perplexed, laughed or grinned, and several asked if the question was a 'trick'.

Anderson's (1981) American research on first grade children might be related to Sinha and Carabine's and is described by Desforges as a study in which the impact of instruction on six year olds is being closely monitored. Records are kept of the teacher's task specifications and a log kept of what the child actually does with the task. In a post-interview, the child is asked what he thought the task was all about. First impressions indicate that these young children focus entirely on getting the task done and look for no greater meaning in the work. This is seen to be a direct result of the teacher's instructions and emphasis, as the teachers have been observed stressing only procedural features of the tasks. Inappropriate tasks appear to be frequently assigned to low achievers. The combination of inappropriate tasks and emphasis on content coverage rather than content mastery seems to result in young children themselves defining success as 'completion' rather than understanding.

Something different appears in the case of the high achievers. As they are used to a large measure of success, when they meet a task with which they can't cope, they immediately seek help. Thus they create for themselves opportunities for acquiring meta-cognitive skills. The low achievers, however, see nothing unusual in the tasks set for them, and rather than using the situation as a 'learning opportunity', they develop strategies (such as copying) for completing the task (Anderson 1981).

This strategy observed by Anderson could well be one which the

children in this study adopted when replying to the questions of the Piagetian tasks. Such a strategy could be another factor influencing the response pattern.

Miller (1982) reports conservation studies with American children (K - Grade 1) in which he compared standard Piagetian-type conditions for eliciting responses and modified situations where-in the transformations occurred in a more ecologically natural, less adult-mediated fashion, for example, boats floating apart, cars running downhill, children moving closer together or farther apart. He suggests as a result of his study, that one important determinant of the child's response to conservation problems is the extent to which the perceptual change and subsequent question are embedded in some natural ongoing activity, as opposed to being the sole focus of attention.

Percentage results of two types of conservation problems given the children in three different manners or conditions are shown in the table which follows. Mean age of the 120 kindergarten children assigned randomly to the three conditions was 5 years 6 months.

TYPE OF PROBLEM			
CONDITION	NUMBER	QUANTITY	TOTAL
Accidental (N = 40)	70%	78%	75%
Incidental (N = 40)	93%	80%	86%
Standard (N = 40)	61%	56%	59%

Miller 1982

Table 2

Miller (1982) concluded that when testing/teaching young children the immediate context of the situation is of much importance. This is, in his opinion, an established (though little understood) fact. He maintains that there is a period in children's development when

their ability to express certain types of knowledge (or to avoid certain kinds of errors) depends very much on the context of the situation.

Akin to Miller's work, although conducted shortly after their first 1974 studies cited earlier, was another set of conservation experiments by McGarrigle and Donaldson (1974). McGarrigle suggested that in a conservation test, the manner in which the transformation was carried out should make a difference. He thought the child should be sensitive to the agent and the purpose of the transformation and tested this hypothesis that if a 'naughty teddy bear' disarranged the array in order to 'mess up the game' children would produce more conserving responses than in a standard test.

His hypothesis was confirmed, and the initial study replicated and extended (Light et al, 1979; Dockerrell et al, 1980) although some of the implications of the work have been questioned.

The intervention of the 'naughty teddy' in McGarrigle and Donaldson was described as effecting an accidental transformation, as contrasted with the experiment's intentional act. Light et al (1979) studied conservation of quantity using glass beakers which contained small pasta shells. These shells were to be used to play a competitive game and so both players had to have equal amounts of them. Once the subjects had accepted the initial equality, the experimenter made a pretence of suddenly noticing that one of the beakers had a badly chipped rim and might be dangerous to handle. Looking around the room, he found another beaker which was not the same shape as the first two. After transferring the pasta shells from the chipped beaker into the unchipped one, he was then able to ask in a natural way whether the competitors were satisfied that they still had the same amount and that the game would be 'fair'. Light et al obtained highly signifi-

cant gains in conserving responses as compared with the standard type experiment. Considering only the first questioned child of each pair, only 5 per cent conserved in the standard condition whereas 70 per cent conserved in the incidental condition.

Light and his colleagues still express doubts as to the validity of their results. They argue that, if the tester's action in the standard condition gives the child the implicit message : this transformation is important, then one may equally say that the intervention of 'naughty teddy' (in McGarrigle and Donaldson's) gives the implicit message : this transmission is unimportant. Thus while one procedure may yield false negatives, the other may yield false positives.

In Geneva, Bovet, Parret-Dayan and Deshusses-Addor (1981) replicated Light et al (1979) with a group of 22 subjects, age 4 years 9 months to 6 years 11 months. Thirteen subjects were in the control group while eight were in the experimental. The Genevans discuss McGarrigle and Donaldson's studies done in the 70's and argue that :

"Or, notre hypothèse est que les problématiques en jeu sont différentes et donc que les résultats, quoique d'apparence identique ont un status cognitif différent".

"But, our hypothesis is that as the conditions of the tasks are different and then the results which appear the same, are of a different cognitive stage (or structure)".

Thus researchers of the Genevan School report that their results clearly show the non-operatory status of the subject's answers. In replicating Light et al's (1979) study Bovet et al asked their subjects to justify their response and the majority were able to do so. They argue that McGarrigle and Donaldson (1975) had not respected the intention of Piaget and that for Piaget the problem of conservation consists in the child's being able to reconstruct the transformation in a manner which indicates he is able to cancel operations mentally (as an adult would).

A partial replication, with variations, of the McGarrigle and Donaldson (1975) and Light et al (1979) conservation experiments was undertaken by Hargreaves, Molloy and Pratt (1982).

Noting that :

"One of the central features of the newly emerging field of social cognition is an interest in the social context of cognitive test situations",

Hargreaves et al based the first part of their experiment on McGarrigle and Donaldson's (1975) work in which 4 - 6 year old children's performances on standard tests of number and length conservation were used.

Hargreaves et al determined to replicate McGarrigle and Donaldson's (1975) experiment, introducing an important variation. In order to eliminate any possibility of the child's linking the actions of the disrupting agent with the questions of the tester, two experimenters were used to carry out each part of the accidental condition procedure independently. Hargreaves et al predicted that this would further increase the effectiveness of this condition in producing conservation responses. A further minor variation was interjected in that a glove puppet monkey replaced the teddy bear. Hargreaves et al argued that monkeys are traditionally regarded as being more mischievous than teddy bears, and they hoped this change would add realism to the situation.

The second part of Hargreaves et al's (1982) study involved an experimental condition similar to the 'incidental' condition of Light et al's (1979) research. The transformation was made to appear irrelevant to the main activity of the child. In this condition a second experimenter interrupts the testing session at a suitable point and attempts to remove the test materials, then when the first experimenter asks that they be replaced, the second experimenter does so, but leaves

the materials in a transformed state.

Sixty-four children from two primary schools serving the same (predominately middle-class) geographical area were subjects in the study. They ranged in age from 5.0 to 5.11 years, with a mean of 5.5 years. Each child was tested on conservation of equality and of inequality of number under control conditions, and then under either one of the two experimental conditions, monkey or interruption. Children were randomly assigned to one or the other of these so that age distribution and composition by sex of each group were approximately the same.

Hargreaves et al's findings show that interruption condition was more effective than the monkey condition in producing conservation responses (approximately 88 and 56 per cent of the children respectively). Approximately 41 per cent of the children conserved on their first response under control condition. The figure was higher than the equivalent in the studies of McGarrigle and Donaldson and Light et al. Hargreaves et al suggested that this may have been a reason why the 'success rate' in their interruption condition was even higher than that of Light et al's incidental condition. Hargreaves et al continue that they were surprised to find that their prediction that their monkey condition should be more effective in producing conserving responses than McGarrigle and Donaldson's accidental transformation condition was not confirmed. Discrepancies, they suggested, may be attributed to socio-economic backgrounds of the samples. In spite of these differences, however, their findings are consistent with both studies upon which their research had been patterned - indicating that the overall frequency of conserving responses was greater in both experimental conditions than in the control.

Hargreaves et al further state that their results from the analysis of changes within groups suggest that, with the exception of one group,

most children show a response set; having settled on a particular response in the first condition, they are unlikely to change it in the second.

The broad pattern of their results, they conclude, lends support to the view that pre-operational children are more likely to conserve when the transformation of the task materials is made to seem accidental, or incidental to the main purpose of the interaction. Their exceptional result suggests that conspicuously high "success rates" (using accidental or incidental conditions) may be followed by normal lower rates of conservation responses when the task is repeated on the same children under standard conditions.

Hargreaves et al (1982) suggest that the 'vital question' posed for Piagetian theory is whether or not this leads to the generalisation that many instances of conservation failure in young children reflect some kind of performance deficit, rather than a lack of operational competence.

They state :

"Social and interpersonal aspects of the test situation are fundamental to our understanding of the child's response, and should not be regarded merely as surface phenomena."

(page 78) 234

They call upon Piaget and Inhelder (1969) to support their own view and quote :

"The decentering of cognitive constructions necessary for the development of operations is inseparable from the decentering of affective and social constructions."

page 95

However, Donaldson (1982) remarks that a general conclusion is that the situation is more complicated than Piaget had supposed and that there are common sources of failure in conservation tests which his theory does not envisage.

CHAPTER IV

The Relationship of Notions of Piaget and Witkin

"The degree of correlation between field-independence and performance in operational tests depends on the prevalence of figurative data when they are an obstacle to the solving of the problem."

J. Pascual-Leone as quoted by M Huteau in "Dépendance-indépendance à l'Egard du Champ et Développement de la Pensée Opératoire", 1980, page 7.

"The field-dependence dimension may also be identified in problem-solving situations that seem to require restructuring. In problems of this type the subject is asked questions about a display, the answers to which require him to imagine the display or himself in an orientation or perspective other than the one immediately present in perception Some of the best illustrations of restructuring problems come from the work of Piaget"

From "Field Dependence" by D R Goodenough in DIMENSIONS OF PERSONALITY, Edited by H London and J Exner, Jr., John Wiley, 1978, page 177.

Witkin's theory of cognitive style and Piaget's notion of cognitive development, contends Huteau (1980), may be compared from several perspectives. Firstly, both theories describe the personality as a more or less differentiated system. Secondly, both field-dependence/independence and cognitive ability increase with age and thirdly, both theories give an important place to cognitive conflict.

Goodenough (1978) has written of the Witkin theory that cognitive styles are concerned with the form rather than the content of cognitive activity. They are pervasive, stable dimensions of individual differences in the processes of perception, thinking, problem-solving and learning. They are primarily concerned with how we deal with information about the world rather than with how much or how well we do so. Psychological differentiation theory seeks to bring together both cognitive and personality aspects of development.

It is impossible to understand the following theory of development writes Piaget (1970) if one does not begin by analysing in detail the biological presuppositions from which it stems and the epistemological consequences in which it ends. Indeed, the fundamental postulate that is the basis of the ideas summarised is that the same problems and the same types of explanations can be found in the three following processes :

- "A) The adaptation of an organism to its environment during its growth, together with the interactions and autoregulations which characterise the development of the 'epigenetic system'. (Epigenesis in its embryological sense is always determined both internally and externally).
- B) The adaptation of intelligence in the course of the construction of its own structures, which depends as much on progressive internal coordinations as on information acquired through experience.
- C) The establishment of cognitive, or more generally, epistemological relations, which consist neither of a simple copy of external objects nor of a mere unfolding of structures performed inside the subject, but rather in-

C) (cont.)

volve a set of structures progressively constructed by continuous interaction between the subject and the external world."

Reference has already been made to Witkin and his colleague's findings that field-dependence/field-independence is a function of age. Children are reported to develop from relatively field-dependent to field-independent as they advance in age. (See Figure 2, page 51).

Piaget writes that there exist structures which belong only to the subject, that are built by a step-by-step process. Piaget (1970) states that we must therefore conclude there exist stages of development. To characterise his stages of cognitive development it is necessary to integrate two necessary conditions without introducing any contradictions. The conditions for stages are (a) that they must be defined to guarantee a constant order of succession, and (b) that the definition allow for progressive construction without entailing total preformation. Cognitive stages have a sequential property, that is, they appear in a fixed order of succession because each one of them is necessary for the formation of the following one.

Huteau's third suggestion, that cognitive conflict plays an important role in Witkin's theory, may be explained by considering the early experiments by means of which the theory was developed. Witkin and Asch (1948) were initially interested in perception of the upright with reference to displaced visual fields. Thus subjects were placed in a highly artificial situation (Rod-and-Frame Test) and asked to discriminate between two kinds of information, that is gravitational cues and visual-direction stimulation, which according to Gibson (1969) "do not normally conflict". Further the Embedded Figures Test presents the subject with the task of analysing a field in order to determine the person's ability to overcome an embedding context.

Differentiation refers to the formal, as contrasted to the content aspects of a system and represents one of the two major characteristics of a system, viewed from the standpoint of its formal properties. The other is integration. Development towards greater differentiation involves progress from an initial relatively unstructured state, which has only limited segregation from the environment, to a more structured state, which has relatively definite boundaries, and which is capable of greater specificity of function. Though the development of differentiation and the development of integration proceed together in closely interwoven ways, the achievement of a high level of differentiation carries no necessary implications as to effectiveness of integration, adequacy of adjustment, or degree of maturity, although it is likely to be associated with more complex integrations. (Witkin et al, 1962/74).

Central to Piagetian theory is his notion of equilibration. He writes (1971): equilibration constitutes a very general process. This process amounts, in the main, to putting up active compensations against outside perturbations: such compensations varying, of course, according to the levels and schemata of the subject but always bringing about a reaction to the perturbations that are experienced or anticipated. Operational equilibrium, on the other hand, is essentially characterised by reversibility (inversion or reciprocity) or, more particularly, by a stable form of compensation systems. Obviously, there is a continuity between the equilibrium attained and the process of equilibration itself. Inhelder summarises this concisely : "The states of intellectual development thus represent a constant progression from a less to a more complete equilibrium and manifest therein the organism's steady tendency toward a dynamic integration. This equilibrium is not a static state, but an active system of compen-

sations - not a final conclusion, but a new starting point to higher forms of mental development (Inhelder 1962).

Huteau (1980) maintains that it is possible to hypothesise that there will be a correlation between subjects' performance on Piagetian tests and degree of field-dependence. This correlation will also be a function of the level of difficulty of the Piagetian tasks.

Continuing at length concerning his own studies which combine Piagetian and Witkin theory, Huteau writes that it is his opinion that the children's level of operational development is a function of age and that a 'ceiling' is reached - in both theories - at approximately age fifteen to sixteen years. This age factor, he claims, must be taken into consideration when looking for a correlation.

Huteau (1980) credits Pascual-Leone's theoretical constructs as part of the basis for his own studies. Pascual-Leone holds that the work of Piaget and his Geneva colleagues differs from North American training studies in an important way. The American studies emphasise experimenter intervention in order to optimise performance. The Genevans, on the other hand, simply expose children to a succession of tasks of varying difficulty but common structure, in order to 'render observable the process of spontaneous cognitive-conflict resolution' (Pascual-Leone 1976).

Brown and Desforges (1979) explain that in Pascual-Leone's neo-Piagetian theory :

"The translation of stage incompetence into M space limitation is equally fundamental. The young child is not denied certain higher order mental processes or operations. So long as the certain number of schemes involved in processing a particular operation does not exceed the child's developmentally determined M space limitation then there is no structural reason to deny the possibility or likelihood that the child will possess that operation. A scheme, in Pascual-Leone's view, would only be precluded from a child's repertoire if formal analysis of the acquisition of that scheme showed that acquisition demanded an M space beyond the child's limitations."

Concerning the M space, Pascual Leone (1976b) writes :

"I must first comment on the issue of factors which underlie the growth of the equilibration mechanism from one developmental state to the next. According to Piaget, the growth in power of the equilibration mechanism (manifested in the increment in the size of the fields of centration and of equilibrium) is just a general (that is, structure-of-ensemble) consequence of the structural learning which characterises development. I have suggested, however, that this growth in power may in part be due to the growth of basic cognitive resources other than Piaget's scheme structures, such as the power of mental (M) centration (similar to the STM or working memory of modern empiricist psychologists). In this alternative view, each level of the equilibration mechanism would have a numerical characteristic: the maximum number of schemes (M power) which the mental-centration energy (M) can boost (that is, "hold in mind") simultaneously in any given mental operation".

Further, the distinction made by Pascual-Leone between a functional M space and a structural M space is a way by which individual differences are noted. The notion of field-dependence/field-independence is also implicated here, as field-independent subjects are said to use their M space to capacity ($M_f = M_g$) while field-dependent subjects do not ($M_f \neq M_g$). On this basis differential effects of instructions for subjects of different cognitive styles have been both predicted and supported by a variety of studies.

Specifically, Case and Pascual-Leone (1975) state that from a structural point of view, conservation tasks resemble Witkin's field-dependence situations. They maintained that failure on certain tasks presented to black teenagers (Lawson and Nordland, 1975) even after they had been given conservation 'training', may have been related to the subjects' field-dependence. Lawson and Nordland had hypothesised that the teenagers' failure on the tasks was related to right-hemispheric processing and sensitivity to misleading visual cues, basing their hypothesis on recent neurological studies which suggest that configurational material is processed primarily in the right hemisphere and verbal material in the left hemisphere of the brain.

Further, the degree of lateralisation is also linked to the assumption as Silverman, Adevai and McGough (1965) and Pizzamiglio (1974) are said to have shown that left-handed individuals show a greater degree of cerebral ambilaterality, while right-handed subjects tend primarily to process configural materials in the right-hemisphere and verbal materials in the left. ³

Case and Pascual-Leone (1975) state that field-dependent subjects typically over-react to salient cues, whether these facilitate the correct answer to the task or not. Such subjects also tend to structure the task input in a 'global' rather than an 'analytical' fashion. Thus, a subject's degree of field-dependence is assumed to affect both the subject's 'tendency' to activate schemes which are set off by visual cues and his 'tendency' to use less than his full mental (M) space.

Hence, children who are highly field-dependent, when given conservation tasks can be expected to give wrong answers although they may have already developed necessary skills for answering correctly.

Case and Pascual-Leone remark :

"First of all, the salient visual cues present at the time when the question is asked are clearly misleading: one of the objects almost invariably looks larger than the other. Second of all, an answer based on the salient visual appear-

³ Case and Pascual-Leone (1975) did state that their neo-Piagetian explanation was not incompatible with the hemispheric one of Lawson and Nordland. Work was reported by Oltman, Ehrlechner and Cox (1977) as well as Zoccolotti and Oltman (1978) which gives evidence of the relationship between differentiation and hemispheric lateralisation. Zoccolotti and Oltman by means of tachistoscopic presentation found relatively field-independent 18-30 year old males showed a significantly right-visual field advantage in reaction-time in a letter discrimination task, while relatively field-dependent subjects did not show a significant hemifield difference on either task. The results are interpreted as indicating a link between Witkin's concept of psychological differentiation and differentiation at the neural level, as manifested by specialisation of function of the cerebral hemispheres.

ance of the objects requires less mental-space than the one based on the fact that the objects were equal a few minutes earlier, and that nothing has been added or subtracted. Taken together, these two factors are so compelling, that college students who are highly field-dependent often fail the more difficult conservation tasks (area, weight, and volume), even though their IQ's and GPA's are normal".

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Two other ideas of Pascual-Leone deserve mention. First, his belief that American studies emphasised experimenter intervention in their attempts to maximise children's performance while the Genevan's simply 'expose' the children to a succession of tasks of various levels of difficulty, but of common structure in order that they may observe the process of spontaneous cognitive-conflict resolution.

Second, it may be that Pascual-Leone's discernment of this difference between the Americans and the Genevans led him to formulate the idea of 'learning loops' as an elaboration of the Genevan method. He chose a basic sequence of items $a_1, a_2, a_3 \dots$ so that they shared a common structure, graded from most difficult (a_1) to least difficult (a_3). Then these items were presented to the child in the order a_1, a_2, a_3 . The child might fail on a_1 and a_2 , but succeed on a_3 as it was the easiest, often demanding little knowledge and having strong contextural cues. Successive retesting of a_1 and a_2 , returning frequently to a_3 as necessary, is termed the 'learning loop' and often allows the child to discover correct solutions to the more difficult items (Pascual-Leone, 1976a).

Huteau (1980) reviews a variety of studies in which operational cognitive development and field-dependence/independence have been contrasted and attempts to answer two questions, which are really the same, but approached from different perspectives :

- 1) Can Piagetian theory enrich our knowledge of field-dependence/field-independence? Namely, does it give us a better understanding of the nature of individual differences which characterise cognitive style?

- 2) Can Witkin's theory, while extending its field of application, contribute to refining the definition of cognitive development by introducing a dimension of individual difference which allows better understanding of the development phenomena?

Huteau maintains that it is possible to give a 'positive' answer to these questions.

The work of Fleck (1972) is cited in which Piagetian conservation tests of number, substance, weight, continuous and discontinuous quantities and two-D space were given to children of three age groups (Nursery, First and Second Grades). These children were also administered the Embedded Figures Test and classified as either field-dependent or field-independent, according to the 'median' performance on the CEFT. Fleck found a significant correlation between conservation scores and field-independence scores.

Dolecki (1976) using only four conservation tests, substance, weight, number and two-D space, found a very high correlation between scores on the Piagetian tests and the CEFT scores when he administered these to children in their first year at school. However, two-thirds of his sample were given instructions of 15 minutes duration, daily for the entire year using Project SEE, a perceptual, analytic training programme designed for kindergarten and first-grade children. Another group were given the same training for a two year period. Significant one-year and two-year training effects were found on conservation and CEFT performance both before and after covariance adjustments were made for a number of entry-level variables including reading readiness skills.

Citing other studies, Lawson and Wellman (1977), Forsberg (1973), Finley et al (1977), Bowd (1977), as well as his own work, Huteau states :

"De l'ensemble de ces travaux, il ressort assez clairement

que les sujets indépendants du champ accèdent aux conservations plus tôt que les sujets dépendants du champ. Tout se passe comme si le fait d'être relativement dépendant du champ constituait un frein à la manifestation d'une conduite de conservation."

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"From the sum total of these works, it emerges quite clearly that field-independent subjects acquire conservation earlier than field-dependent subjects. It seems as if the fact of being relatively field-dependent acts as a brake on the acquisition of conservation".

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Huteau remarks that the most systematic studies concerning horizontal/vertical co-ordinates have been done by Pascual-Leone (1969) and remarks that by changing conditions under which the task was administered (using either an actual bottle or graphic representation against a neutral background of horizontal or vertical lines). Pascual-Leone manipulated the figural factors by choice of experimental conditions and his results show that these factors are, at least in part, responsible for differences in efficiency between field-dependent and field-independent subjects. Field-independent subjects were able to represent H/V co-ordinates more accurately than field-dependent subjects. This finding held for adult groups as well as for samples of children. In the studies using adult subjects field-independency was evaluated by administering the Rod-and-Frame-Test (RFT), the Drawing-of-a-Man (DAF) and the WAIS Analytical Index (cubes and assembling of objects). As with children, the results of the tests were totalled to yield an overall index of cognitive style.⁴

Citing the work of Denforth and Hodges (1975) and of Pascual-Leone (1969), Huteau remarks that children's difficulties with the water-in-

⁴ This index differs, however, from that described by Witkin et al (1962/1974) in which they report combining coefficients of stability for perceptual tests scores of the BAT, RFT and EFT to form an INDEX plus additional tests, Rorschach, TAT, figure-drawing test and miniature-toys-play test as the means by which they assessed for cognitive style.

the-jar task (horizontal co-ordinates) are related to both perception and cognitive abilities (as they are in the process of constructing their horizontal/vertical reference system), whereas difficulties of adults are more likely to be essentially related to perception. (It is not clear as to why Huteau felt adults' failures would be related to perception. Modgil (1976) reports some rather confusing research results in relation to study of systems of reference. Piaget and Inhelder claim that horizontality and verticality are synchronous while this view is challenged by Beard (1964). Mackay, Brazendale and Wilson (1972) studied the development of the concept in children ages seven, eight and nine years. They reported that children may be seen as developing one concept prior to another, depending on the tests selected. A further finding reported by this team was that the children in their study did not reach a level in the development of these concepts as expected by Piaget of nine-year-olds.

The study of the concepts of horizontality and verticality is also reported by Modgil (1976) when College students were used as subjects. Rebelsky (1964) reported that some college students who should be expected to have mastered the concept of horizontality, had not. Further studies of Thomas, Jamison and Hummel, (1973) suggest that College students may in fact have difficulty learning this concept. They reported two experiments with College women who were judged not to know water is horizontal did not learn on tasks specifically designed to elicit self-discovery of the concept. Certainly, they wrote, it would be expected that the subjects had mastered the necessary concrete operations and had received sufficient relevant experience through training. The fact that acquisition of the water-level principle may be especially difficult for some persons yet very easy for others, and the fact that there were very large and signifi-

cant differences between the proportions of judged naive college men and judged naive college women, may suggest the involvement of some biological mechanism (Thomas and Jamison (1975), Page 43).

Outlining studies of Pysh (1970) and Mitchelmore (1974) in which children of several age groups were asked to draw telegraph poles along a winding road in perspective, Huteau writes that the more field-independent subjects drew the vertical better, but the relationship between this ability and field-independency was not always significant.

Having examined an extensive body of research relating cognitive style and Piagetian measures of cognitive development, Huteau (1980) suggests that it is possible to draw a general conclusion that field-independent subjects succeed better than field-dependent in those conservation tasks and other Piagetian tasks which depend upon spatial representations. This general rule does not always hold, however, for Piagetian tasks involving logic of classes and relationships.

Pascual-Leone's (1969) study of logical classifications in relation to degree of field-independence is discussed by Huteau. Pascual-Leone presented nine-year-old subjects with tokens of different shapes and colours (5 blue circles and 2 red and 2 blue squares) and asked the children if 'all the circles are blue' or 'are some blue ones circles?'. Pascual-Leone's results were correlated with a general degree of field-independence, but the correlation was not very high. Further, four tests of field-dependence/independence were used and significance was not shown for two of the four measures, (that is, the RFT and DAF). Non-significant correlations were also reported (according to Huteau) at different scholastic levels, between performances in logic of classes and relations by Grippin et al (1973) and Finley et al (1977). Huteau reports on a study of logic of relationships which he carried out in conjunction with Rajchenbach (1978) in which seriation of set

squares was studied with subjects age from six to seven years old.

There was no significant difference between those who produced correct seriations and those who failed in tests of cognitive style (DAF and CEFT).

The relationship between performance on Piagetian tasks and cognitive style is more clearly seen in studies where a battery or range of Piagetian tasks are administered to the same subjects. It also seems evident that the Piagetian distinction between figurative knowledge (that which focuses on the external, figural aspect of an event in a static manner, closely tied to a particular accommodation as illustrated in perception, imitation, image or memory) is conceivable only within a framework of operative knowing (Furth 1969). Further this operativity (as contrasted with figurative knowledge) implies the action aspect of intelligence at all periods, including sensory-motor intelligence. Operativity is the essential, generalisable structuring aspect of intelligence insofar as knowing means constructing, transforming, incorporating (Furth 1969). These aspects of knowing may be analogous to the characteristics of field-dependence/field independence.

Thus Huteau (1980) suggests it might be claimed that there is not a general development within the child, but rather, regional developments which are not necessarily synchronised. Field-dependent subjects would appear to 'lag behind' in all areas of cognitive development which depend heavily upon, or were related to domains in which the figurative and operational modes of knowing are in conflict. In areas where the figurative and operational modes of knowing are not in conflict, there should be little, if any, difference between field-dependent and field-independent children's performances. There is, in Huteau's opinion, little sense in (or basis for) assigning children to

a general level of development.

Further, it is his view that there may be a second interpretation. There does exist a general level of development, but the situations used to assess such development are not adequate as the observable performances are not solely determined by the children's level of competence, but by a whole series of factors, one of which is the subject's cognitive style.

Bowd (1975) discusses notions of Piagetian 'egocentrism' as 'an embeddedness of one's own view' (Piaget, 1969) and a general lack of differentiation (Piaget, 1969). Bowd notes the similarity of the terms in these definitions when compared with Witkin's definitions of cognitive style.

Bowd decided to investigate these two characteristics of 'egocentrism' and 'field dependence' as they appear to share a concern with the overall structuring of perception. He anticipated a relationship between measures of field-dependence and perceptual egocentrism. Further he aimed to discover whether perceptual aspects of egocentrism could be related to intelligence.

Bowd accepted on the authority of other investigations (Goodenough and Karp, 1961; Elitcher, 1967) that there existed a relationship between field-dependence and intelligence for several age and ability groups, but little evidence had been documented for the early childhood years. Thus he administered tests of inductive reasoning (Raven's Progressive Matrices, Piagetian type egocentrism tests in which the child chooses pictures of objects in relation to physical position of another person); and the Witkin CEFT and DAF were administered to fifty-three children aged five to six years.

Bowd (1975) reports that both field-dependence measures showed a moderately high correlation with the Raven's Matrices test of inductive

reasoning. The Piagetian tasks, however, did not correlate significantly with the reasoning test although it did so with field-dependence. Field-dependency and perceptual egocentrism showed a linear relationship. Details of Bowd's findings will be further discussed in relation to the findings of this writer's results.

Summary of Review of Literature

Witkin and his colleagues have been developing their theory of differentiation or cognitive style for some thirty years, attempting to relate thought processes and mental operations to the individual's personality traits.

The manner in which persons perceive has been greatly extended by research and various studies to embrace a style of cognitive functioning in reference to the process of information exchange between the individual and his environment. A person with a 'global' or field-dependent style of cognitive functioning tends to submit to the dominant organisation of a field and to experience items as fused with their backgrounds. The person considered to perceive in the 'analytical' or field-independent style of cognitive functioning experiences items as separate or distinct from their backgrounds and is able to overcome the influence of the embedding context.

Witkin and his colleagues (1977) claim people are self-consistent in mode of field approach across a wide variety of situations and that their theory has implication and application as regards socialisation factors, education and culture. Much of the work they cite has arisen from cross-sectional and cross-cultural studies which vary greatly in design and purpose. For example, Bauman, 1951; Faterson and Witkin, 1970; Witkin, Goodenough and Karp, 1967, report studies as evidence that people are likely to be stable in their preferred mode of perceiving even over many years. Witkin and Berry (1975) claim results of

recent cross-cultural studies show that sex differences in field-dependence/independence may be uncommon in mobile, hunting societies and prevalent in sedentary, agricultural societies. Okonji (1972) reports that he is aware of the limitations of Witkin's formulations and the conflicting nature of the evidence it has yielded. Yet he supports the theory as the one currently best able to identify the effects of child rearing practices on cognitive development (Lloyd 1972).

Piagetian research - both for and against the Genevan position - appears to have been given a new impetus in recent years. Critics are as vociferous as ever (Boden, 1982, Brainerd, 1978; Brown and Desforges, 1982). The Genevans (Bovet, Parrat-Dayana and Deshusses-Addor, 1981; Inhelder, Sinclair and Bovet, 1974) continue to maintain that North American researchers have misinterpreted Piaget's aim and purpose which was always to study the way in which children acquired knowledge. Pascual-Leone has devised his own neo-Piagetian theory and appears to take a middle stance, criticising and defending the Genevans simultaneously, as well as highlighting the discrepancies of other North American educationalists in comparison with the work of the Piagetians.

Buck-Morss's (1975) historical, philosophical argument concerning the views of Piaget could well be applied to work of a variety of researchers. Her opinion that Piaget's theory expresses a socio-economic bias may influence work of future researchers and might be cited as a reason why early Piagetian studies have been difficult to replicate as there has been so much change in life styles and environments of subjects used in early studies as compared with today's subjects.

The recent Anglo-Saxon approach to Piagetian research seems to be taking a more optimistic and productive outlook. Perhaps, it has been possible to view both the Genevan and American work from their island perspective. It appears, as well, that there is a respectful dialogue among workers - a sharing - as well as co-operative planning of studies

from a number of centres in the United Kingdom. The contributions of Bryant (1982), Donaldson (1978, 1982), Nisbet and Entwistle (1982), to cite but a few contributors, seem to be adding a new dimension to their studies, that of context of situation. Their results lead one to wonder if their methods and attempts to understand children were applied as well to the adult world, yet another interesting avenue might arise. There are still wide variations in results, but the general consensus as expressed by Desforges (1982), is that Piaget's theory will have to do as a framework until something better comes along.

As well as formulating his neo-Piagetian framework, Pascual-Leone (1969) suggested a relationship between the theories of Witkin and Piaget. Huteau (1980) has recently researched the similarity between the two theories, suggesting that they correspond especially in two ways: in form, as in both conceptions personality is described as a more or less differentiated system; and in function, as the ability to overcome the figurative (perceptual) aspects of problems is important in each of the theories and is seen to develop with age. It is this correspondence of the two theories which is being investigated in this study. The first four Piagetian tasks (Length and Area Conservation) were chosen as they appear to demand of the children the ability to overcome the figurative aspects of the materials which are used in the test situation. A detailed analysis, description and explanation of the tasks follows in Chapter V.

Huteau reports as a result of his own studies that there is a relationship between field-dependence and Piagetian conservation tasks which require re-structuring, but not with Piagetian tasks concerned with logic of classes and relations and some combinatorial tasks. Bowd's (1975, 1977) studies produced conflicting results.

Another common feature is that both are fraught with methodological problems, especially if the early experiments which are given as evidence

to support the theories' claims are viewed in the light of some issues recently raised concerning the context of research methods and techniques.

Cautions have been given as to unqualified acceptance of either Witkin's or Piaget's early studies. However, there is still sound basis for proposing a relationship between Piagetian tests of conservation which are dependent for successful accomplishment on spatial ability and Witkin and his colleagues' studies of field-dependence/independence.

Recent work of Donaldson (1978, 1982) and her co-workers concerning the presentation of Piagetian tasks to young children seems also to suggest that the form or style in which the Piagetian tasks are administered may be linked to an aspect of the Witkin theory which holds that field-dependent persons process information of a social nature more easily than do field-independent persons.

Further, it appears that only a small amount of work has been done attempting to link the two theories with children of the five to seven plus age group.

Thus it was considered that a relationship may exist between young children's performance on Piagetian tasks and their response to measures of cognitive style.

General Statement of Hypotheses.

1. Children who are assessed as 'field-independent' functioning, by means of Witkin et al (1971) CHILDREN'S EMBEDDED FIGURES TEST, will score higher overall on Piagetian tasks than children assessed as 'field-dependent'.
2. In further administrations of the Piagetian battery, children initially classified as 'field-independent' by means of Witkin et al (1971) CHILDREN'S EMBEDDED FIGURES TEST, will show fewer regressions on their Piagetian test scores than 'field-dependent' children will exhibit.
3. As the three units of the Piagetian tasks have been organised into a 'personal' and 'impersonal' method of presentation, it is further anticipated that there may be a relationship between scores of 'field-independent' children and the 'impersonal' method of presentation. 'Field-dependent' children may score higher on tasks which are presented in a 'personal' or social manner.

CHAPTER V

METHODOLOGY

" . . . In our opinion, every method is good, and at the same time, one sided; each of them is convenient for a certain pupil and for a certain language and nation".

From TOLSTOY ON EDUCATION
University of Chicago Press,
1967, page 52.

Pilot Study

Two studies of children's mathematical abilities laid a foundation for this present research. The first considered the effect of structural mathematics training upon children's (Mean age: 5 years 3 months) acquisition of conservation of discrete quantity (Van Arsdel 1972, unpublished manuscript). The second investigated the development of the concepts of distance, length, area and horizontal/vertical co-ordinates over a two year period (Van Arsdel 1978, MEd thesis). Results of these studies suggested the development of children's mathematical concepts did not always follow the patterns proposed in Piagetian literature.

In the light of these findings, during February and March, 1979, an initial battery of Piagetian tasks (length, area and horizontal/vertical co-ordinates), standardised tests from the British Ability Scales (Block Design and Matching Letter-like Forms), Frostig Test of Visual Perception and Witkin measures of cognitive style (Children's Embedded Figures Test and Draw-a-Figures Test) were given to a group of fifteen children, aged six to nine years, in a Midlands School. The subjects of this pilot study were chosen from this age band to provide information of the type of response which might be expected across the age range. Film and sound tapes were made of the experimenter administering the tasks to one child.

The tests used in the pilot study required at the minimum one-and-a-half hours per child to administer. Three tests, the Block Design, Matching Letter-like Forms and Frostig's Test of Visual Perception were reported in their manuals as measuring the same or a similar ability. It was necessary to limit administration time of the tasks for two reasons. First, the writer planned to administer all tests herself, and second, children of the age range required for

the study cannot be expected to concentrate for too long a period on such demanding tasks in a one-to-one testing situation.

Results of the pilot tests suggested that the children at the upper age range of the group tested (nine years old) easily achieved the first four of the Piagetian tasks (length and area conservation tasks) and led to the decision that testing begin with children of five plus to six years of age. Frostig's Test of Visual Perception and the British Ability Matching Letter-like Forms tests were both time consuming to administer and were achieved by even the youngest subjects of the pilot group with reasonable ease. Hence it was determined that the Block Design test would be a more useful assessment measure of the children's visual-perceptual abilities as the research design was to be longitudinal.

The analysis of the sound tape highlighted several slight verbal variations in the experimenter's administration of particular tasks within the Piagetian battery. Steps were taken to standardise these presentations. Further, the film helped determine a system for seating the child comfortably as well as ensuring that the materials which the experimenter required for the administration of the tests could be used easily and accurately without distracting the child.

The group of tests used in the pilot study were ultimately condensed to six Piagetian tasks, the British Ability Scales Block Design test (which is reported to measure visual/motor perception as well as giving an indication of level of intellectual maturity), and the Witkin measures of cognitive style.

Main Study

A common factor of spatial ability has been reported by a variety of researchers as being related to both Piagetian and Witkin's theories. Witkin and Goodenough (1977) cite the conservation tasks used by Piaget and Inhelder (1962) as clear examples of restructuring tasks. Witkin and Goodenough hypothesized that such tasks will be easily accomplished by subjects they identify and term as field-independent. They refer, as well, to studies of Pascual-Leone (1969) and Willemssen, Buckholz, Budrow and Geannacopulos (1973) who reported that successful performance on Piaget's water-level problem (representation of horizontal co-ordinates) was also related to RFT performance which is considered a measure of field-dependence. Huteau (1980) has reported a similar relationship between field-dependency and Piagetian conservation tasks.

It is the opinion of Witkin and his colleagues (1977) that the dimension of cognitive style should be considered in relation to the way in which students learn. They propose that relatively field-dependent people are particularly interested in and selectively attentive to social aspects of the environment. They report that such field-dependent persons are better at learning and remembering material with a social content. Messick (1982) updates and concisely states the group's position that cognitive styles also typically embrace personalities and not merely cognitive consistencies, as in the instance of field-independence versus field-dependence, where the field-independent person is characterised as analytical, self-referent, and impersonal in orientation and the field-dependent person as global, socially sensitive, and interpersonal in orientation.

Thus it was hypothesized that a relationship may exist between children's performance on Piagetian tasks and their response to measures of cognitive style. More specifically,

1. Children who are assessed as field-independent functioning, by means of Witkin et al (1971) CHILDREN'S EMBEDDED FIGURES TEST, will score higher overall on Piagetian tasks than children assessed as field-dependent.
2. In further administrations of the Piagetian battery, children initially classified as field-independent by means of Witkin et al (1971) CHILDREN'S EMBEDDED FIGURES TEST, will show fewer regressions on their Piagetian test scores than field-dependent children will exhibit.
3. As the units of the Piagetian tasks have been organised into a personal and impersonal method of presentation, it is further anticipated that there may be a relationship between scores of field-independent children and the impersonal method of presentation. Field-dependent children may score higher on tasks which are presented in a personal or social manner.

Research Design

The study was longitudinal in design and testing of the total sample extended over a three-and-a-half year period. Each subject was observed over a period of eighteen months because of a staggered sequence of testing.

The battery of six Piagetian tasks, Witkin's CEFT (Children's Embedded Figures Test) and DAF (Draw-a-Figures Test) were administered once at three different testings to the first section of the sample ($N_1 = 13$). Two other sections of the sample ($N_2 = 28$, $N_3 = 24$) were administered these tests at intervals of approximately three months, four times. A segment of N_2 ($N_{2L} = 9$) were administered the battery a fifth time to check stability and consistency of earlier results. The British Ability Scale was administered to the N_1 section of the sample at their second testing, while N_2 and N_3 sections were mainly administered the BAS at both the first and third testings.

The total sample numbered sixty-five subjects, thirty-nine boys and twenty-five girls.

Subjects

Two schools were chosen as sources for a random sample of children to ensure that the total sample was composed of individuals from a wide range of backgrounds. The Headteacher of each school selected the class group with which the study could be conducted. Testing of the total sample was organised in a 'staggered sequence', but at the initial testing of each sample the subjects were within age range of five years and ten months and seven years. The mean age for the total sample at the first testing was six years four months. At the first testing all children were classified as second year infants, that is, each child had spent at least two terms in school.

School A

School A was located in a large village approximately seven miles outside Northampton town centre and provided a very stable set of subjects. Twenty-eight children were tested during the spring of 1980 and when the experimenter returned in January 1982 to do a fifth 'spot' check of part of the group, only one child had moved. These children were representative of the usual social and economic English family backgrounds. One child was especially difficult to teach. The teacher, however, took special measures to help this child progress and wanted him to take part in the study. As it is common opinion that primary classes will contain one or two such children, this child's results have been included in the data for this study.

School B

School B was located near the town centre and conversely provided a much more mobile set of subjects. Children moved away from the area to other parts of the county or country. A few went on holiday out of

the country and returned to school after long absences. While many of the children came from homes where father was either a skilled or semi-skilled worker, there were also children whose parents were professionally highly trained.

This school provided the first and third sections of the sample, $N_1 = 13$, $N_3 = 24$. The first section was tested at three to four month intervals from September 1979 to July 1980. The third section was first tested in September 1980. A fourth and final testing was conducted with these children in December 1981/January 1982.

Section two ($N_2 = 28$) was drawn from School A as described above. The following table shows testing dates and mean ages of each section of the sample at the first testing.

MEAN AGE FOR SUBJECTS AND TESTING DATES BY SECTIONS

SECTION	SCHOOL	TESTING 1	TESTING 2	TESTING 3	TESTING 4	TESTING 5
$N_1 = 13$	B					
DATE		Nov/Dec 1979	Feb/Mar 1980	July 1980	-	-
MEAN AGE		6:2	6:5	6:9		
$N_2 = 28$	A					
DATE		June/July 1980	Oct/Nov 1980	Feb/Mar 1980	June/July 1981	January 1982
MEAN AGE		6:8	6:11	7:1	7:4	7:10
$N_3 = 24$	B					
DATE		Feb/Mar 1981	June/July 1981	Sept/Oct 1981	Dec/Jan 81/82	-
MEAN AGE		6:2	6:5	6:8	6:11	

TABLE 3

School A provided reading ages linked to its Composite Reading Scheme and results of the County's 'Screening Children at Five Years of Age Programme' which had been administered to all children during their Reception year in School.

School B provided reading scores and Teacher's Yearly Reports for children in Sections N₁ and N₃.

Procedure

A. Choice and Justification of Assessment Instruments

1) Piagetian Tasks

Six Piagetian-type tasks were chosen from a group of tests used in the earlier study (Van Arsdel 1978). The tasks used in this earlier work were chosen from four areas; that is, tasks reported to assess young children's abilities to conserve distance, length, area and acquisition of horizontal/vertical frames of reference.

As preparation for the present study two hierarchical arrangements were made of the fourteen tasks used in the previous study.

Arrangement 1: Tasks were ordered from least difficult to most difficult by referring to the percentages of children who had successfully completed each of the tasks over the period of the previous study (Van Arsdel 1978).

Arrangement 2: The writer by a) consulting Piagetian literature which describes and reports work with children using these specific tasks, b) analysing the complexity of the tasks and the visual/perceptual demands which successful accomplishment demanded, and c) consulting records of children's individual verbal responses to the tasks, made another ordering of the achievement of the tasks from least to most difficult.

There was much correspondence between the two lists. Two tasks were chosen from three of the mathematical areas which depended upon the child's visual perception of the situation. Percentages of children who had achieved the paired tasks in the earlier study were in close

agreement.

The following six tasks were chosen:

Area 1 Related to Conservation of Length

1. Conservation of length with distortion of shape.
2. Length of lines and coincidence of their extremities.

Area 2 Related to Conservation of Area

1. Conservation of area.
2. Conservation of area outside a closed perimeter.

Area 3 Related to Acquisition of Horizontal/Vertical Frames of Reference.

1. Understanding vertical/horizontal frames of reference:
(Water level in rotating jar).
2. Understanding vertical/horizontal frames of reference:
(House on hill).

Reference was made earlier to the distinction between conservation tests of 'equivalence' and 'identity'. Following Elkind's (1967) definition of the terms, the first of the conservation length tasks above might be considered as 'equivalence' type and hence the less difficult of the two tasks. A careful comparison and analysis of the two tasks of length conservation suggests, however, to this writer, that in actuality the level of difficulty of the length conservation tasks is of a similar nature - although not of an identical difficulty - as the mental steps necessary to successful completion of both tasks appear to be of an equivalent nature.

Piaget, Inhelder and Szeminska (1948) claim 'object constancy' must underline measurement of length. However, qualitative conservation of length will first appear as and when there is coordination of subdivision and order of position. Both tasks used in this study were described by these authors as useful in investigating a child's ability to understand

and coordinate the subdivision of a length of a line (or a strip of paper) in relation to change of position.

The first task, conservation of length with distortion of shape, utilized two paper strips 30 centimetres in length and 8 millimetres in width. The following framework is given to aid the comparison and analysis of the two conservation of length tasks.

<u>Action which Experimenter must elicit from child for each step of task</u>	<u>Child's mental activity necessary to accomplish each step successfully</u>
1. Child is shown two strips and told they have been prepared to same dimensions.	a. Child required to accept and store information.
2. Child is asked to verify that two strips of paper are of identical length.	b. This action demands a straight, simple perceptual judgment or comparison of two strips.
3. Child is asked to choose one strip.	c. An easy task of choosing one item from two which are the same.

The experimenter then cuts the strip not chosen by the child into four pieces and places these pieces in an open box-like formation.

4. Child is asked to compare the uncut strip with the box-like formation constructed by the experimenter.	d. A judgement is necessary on the part of the child which could be made in relation to a variety of factors and which could differ from child to child. The judgement demands that the child retain mentally his/her initial view of the uncut strip or be able to reconstruct in his/her mind in order to
5. Child is asked if the strips are still the 'same'.	e. compare this 'reconstructed' image with the straight strip he/she holds.

The successful completion of these tasks requires an initial act of understanding and storing of information followed by two simple and then two further more complex mental actions on the part of the child.

The second task, length of lines and the coincidence of their extremities, was presented to the children by means of a card upon which two pieces of wool had been glued. One piece of wool was straight (hence the shorter piece of the two) while the other was undulating. Both pieces had identical endpoints.

<u>Action which Experimenter must elicit from child for each step of task.</u>	<u>Child's mental activity necessary to accomplish each step successfully.</u>
1. Child is given explanation concerning two lengths of wool.	a. Child is required to accept and store this verbal information - which contains an element of fantasy.
2. Child is asked to choose a path and a mouse.	b. Choice must be made of two items, (one 'mouse' from two which are the same, and one 'path' from two which differ).
3. Child is asked to place his/her 'mouse' on his/her 'path'.	c. Simple physical act of placing mouse on chosen path which requires ability to follow directions.
4. Child must compare length of two paths and,	d. Child must recognise that the undulating 'path' is longer when stretched out than the straight path. Child must be able mentally to 'stretch' the undulating path.
5. relate this to the mice travelling the paths and determine which mouse would come to the end of the path first.	e. Child must judge that 'mouse' travelling 'straight' path would have a shorter distance and hence arrive first.

This second task appears to require an initial act of receiving and storing information followed by two simpler tasks of choice (as well as the physical act of placing the 'mouse' on the 'path') followed by two more complex acts of mental reasoning.

The first three steps of both tasks one and two make approximately the same demands on the children and are simple mental operations for children of the age used in the study. The fourth step in each of the

two tasks appears the crucial one and demands a more complex comparison and judgement. In task one, the child has in view the second uncut strip and must be able to reconstruct mentally the cut and re-positioned piece used by the experimenter in order to make his/her judgement. After mentally reconstructing the cut strip, the comparison is between two items which are the same.

In task two, the child has before him/her two 'paths' or pieces of wool which he/she has not seen in any other formation. It is necessary that he /she mentally re-position the undulating piece and compare this with the straight piece in order to answer successfully. In all instances the children were required to justify their answers, hence it was possible to ascertain the thought process of each child.

In both tasks one and two, the child is asked initially to process and store information, followed in each task by two further simple mental acts (a perceptual verification and a choice in task one while in task two, two choices are required, one from two identical objects and the other choice from two objects which are not the same). The next step in both tasks requires a mental transposition of the materials presented; that is, in task one the cut strips must mentally be reconstructed to match the uncut strip which the child has in his/her possession, while in task two the undulating wool must be stretched out to its full length in order to be compared to the straight piece of wool also in view. Step four in both tasks requires the child to judge whether the two items (one of which must be transformed mentally) are the same or not. The final step in each situation demands a verbal statement (or physical act of indicating) whether the strips of paper or the paths are the same or different. The mental activity required of the child for the successful accomplishment of the tasks appears similar in demands made as regards mental activity, although not identical.

Some might argue that task two demands a higher level of mental activity than does task one as the child had not previously seen the undulating piece of wool in a straight position. However, it might be counter-argued that having seen (as in task one) that both strips were the same length, the child was (in task one) puzzled and confused by the adult's questions in the situation (Donaldson 1980, 1982). It might also be noted that task two may be classed as 'identity' type conservation situation and hence considered by Elkind (1967) to be less difficult than 'equivalence' type situations.

The second section of Piagetian tasks concerned with conservation of area will be analysed as were those of the length section.

The first task, conservation of area, consisted of showing the child a set of wooden pieces which could be placed in a variety of formations, but which were initially shown in the positions of congruent squares.

<u>Action which Experimenter must elicit from the child for each step of the task.</u>	<u>Child's mental activity necessary to accomplish each step successfully.</u>
1. Child is invited to take from square box two triangular and two rectilinear pieces of wood which can be combined to form two congruent squares. Child is also invited to take out a standard square and his attention is drawn to fact that some pieces are green colour, others crimson.	a. Simple act of recognition, as pieces are named by experimenter, of place shaped objects; combined with physical act of taking from box and placing on the table to make two squares similar to standard square.
2. Child is next directed to place one triangular piece with one rectilinear piece - thus regrouping the two squares which he has constructed. This action is aided by the fact that the child is now putting two pieces of the same colour together.	b. Ability on part of the child is needed to recognize shape and colour as well as to follow directions for re-grouping the shapes.
3. The child is asked to compare this 'new' arrangement with the standard square (in view) and tell if the new formation covers the same amount of space or 'room' as the first.	c. Child must make a perceptual and/or logical judgement of the 'new' area in relation to the standard square still in view.

The successful completion of this task demands mental acts of shape and colour recognition, ability to follow simple directions and regrouping of the pieces manually, as well as a final more complex comparison and judgement of the amount of space covered by both formations. Specifically, this task requires three individual identifications of place shapes, recognition of two colours, ability to re-group these shapes by following directions and the complex final judgement - or summed as six simple mental steps followed by a final complex act of either perceptual or logical judgement. This task might be classified by Elkind's criteria as 'equivalence' type conservation.

Area task two was concerned with conservation of area outside a closed perimeter. The child was first shown two pieces of green card, 'gardens', and further two smaller identical square pieces of brown card which were identified as 'vegetable plots'. One vegetable plot was later cut into smaller rectilinear pieces and re-arranged. The task is considered analytically in the following steps.

<u>Action which Experimenter must elicit from the child for each step of the task.</u>	<u>Child's mental activity necessary to accomplish each step successfully.</u>
1. Child is shown two pieces of green card; asked to pretend that these are 'gardens', one of which is his/hers and the other the experimenter's.	a. Recognition of two plane shapes and two colours; receiving, storing verbal information - which contains an element of 'make-believe'.
2. Child is told that these cards are the same size and is asked to verify.	b. Perceptual judgement demanded to verify or if child wishes, he may manually place one card on top of the other.
3. Further presentation of two smaller brown pieces of card, each placed in a similar position on the larger cards which have been identified as 'gardens'.	c. The child must, receive, process and store verbal information - which contains an element of make-believe.
4. Story of experimenter's 'true' problems of gardening in her	d. Child is required to process and store additional information.

5. The experimenter presents a solution to her problems and illustrates to child by cutting one of the smaller brown pieces of card into three rectangular pieces and re-placing them on her larger piece of card which represents her garden.
6. Child is asked if the arrangement of the vegetable plot shown in the experimenter's garden contains the same amount of space or 'room' as the initial arrangement which is still in view in the child's garden.
7. Finally, the child is asked if the 'green grass' that is, the amount of space left uncovered by the brown card representing the vegetable plot, is the same in both gardens.
- e. Child is further required to process and store information which is related to that given previously.
- f. Child must judge perceptually or logically (or by using a combination of both) as to the amount of space in both his own and the experimenter's gardens. This demands ability to compare and decompose (or recompose) the vegetable plot square.
- g. This judgement demands that the child hold in his/her mind the decision he/she has made concerning the vegetable plot and then deduce by either perceptual or logical reasoning that since both vegetable plots are the same - the same amount must remain of 'green grass' on both his/hers and the experimenter's gardens.

This area task demands that the child recognize two plane shapes, square and rectangle, two colours, and that he/she be able to listen to and process information in the form of a rather detailed 'story'. Finally, he/she is asked to make two complex judgements concerning the amount of space in the two arrangements of the gardens' vegetable plots. This task is more complex than area task one, in that it demands an additional judgement; and is classified according to Elkind's (1967) criteria as 'equivalence' type conservation.

Piaget, Inhelder and Szeminska (1948) write that there is conservation of area as soon as there is operational grouping in the addition and subtraction of areas. Specifically they report that:

"What is most striking about the operational conservation of area is that it appears at the same time as that of distance and length in spite of the specific difficulties of 'composed congruence' when entirely new shapes appear in place of the old. Again the conservation of area results quite simply from the coordination of qualitative operations, and here as in the case of one-dimensional

lengths, their operational synthesis eventually leads to metric operations. The relevant operations are on the one hand subdivision and the addition of parts which enables the subject to conceive of a whole as an invariant total whatever the disposition of parts, and, on the other, operations which govern position and change of position, involving their systemic coordination with reference to fixed sites. The second operation allowed the subject to realize the necessary compensations between newly occupied positions and positions newly vacated, which is a feature of all change of position."

pages 285 and 286

Thus one might argue that from a Piagetian position both area tasks used in the study are of a similar level of difficulty.

Unit three tasks were concerned with horizontal/vertical frames of reference. The skills required of the child for successful completion - especially of the first task, 'Drawing a water line is a representation of a jar at nine different positions' - demands somewhat different skills of the child than did the first four tasks. These two tasks have been analyzed according to the same framework as the first four.

<u>Action which Experimenter must elicit from the child for each step of the task.</u>	<u>Child's mental activity necessary to accomplish each step successfully.</u>
1. Child is shown a covered jar half filled with water. Attention is directed to the 'water-line' as the jar sits in an upright position.	a. The child must receive and process verbal information
2. The child is asked to trace his/her finger along the outside of the jar on the 'water-line'.	b. Manual act of tracing the 'water-line' aids mental understanding and required child follow directions given by the experimenter.
3. Further demonstration is given the child accompanied by verbal instructions as to the change of the position of the water-line as the jar is rotated through 360°.	c. Child must receive and process both verbal and visual information.
4. Specific 'stops' are made at each of the seven positions until the jar reaches its up-right stance.	d. Child must continue to receive and process some verbal - but now mainly visual information.
5. The jar containing the water is hidden and an identical covered jar - without water- is	e. Further processing of verbal and visual information.

presented to the child as well as a prepared booklet of drawings showing the empty jar in nine positions.

6. The empty jar is presented to the child and rotated through each of the nine positions. At each, the child is asked to draw from memory the position of the water-line on the appropriate page in the booklet.
7. The child was shown the empty jar in a total of nine positions.
- f. The child must be able to recall from his/her visual memory - or to reason logically, - the correct place of the water-line and then to reconstruct this information on the drawing of the jar in the booklet.
- g. Thus, the child was required to repeat mental processes in step f for the nine positions of the jar.

In order to complete this task successfully, the child must be able to receive and process visual and verbal information (which information becomes predominately visual toward the end of the task), exercise the ability to follow instructions by performing a manual act of tracing his/her finger on the actual visual water-line, perform the penultimate complex judgement of determining the position of the water-line (after the jar with the water in it has been replaced with an empty jar) and the ultimate act of drawing a line to represent this water-line from memory in the prepared booklet.

The Genevan literature (Piaget and Inhelder, 1956) maintains that successful accomplishment of this conservation task indicates that a child has achieved understanding of horizontal/vertical frames of reference. In actuality the test is concerned with conservation of the horizontal plane. As regards the Elkind (1967) classification, the task might be termed as 'equivalence' type but with certain modifications.

The second of the horizontal/vertical conservation tasks demanded that the child draw a house and trees on a pre-drawn curved line which was meant to represent a hill. The mental demands made upon the child by this task as with the other horizontal/vertical frames of reference measure are of a somewhat different nature and quality than were the skills required for the first four conservation tasks.

<u>Action which Experimenter must elicit from the child for each step of the task.</u>	<u>Child's mental activity necessary to accomplish each step successfully.</u>
1. Child is given paper with pre-drawn curved line and told that this line represents a 'hill'.	a. Child must be able to process and understand verbal information in relation to physical object of paper with line on it.
2. Child is further given coloured pens/pencils and is asked to draw the best possible picture of his/her own house.	b. Child must possess some degree of drawing ability linked to fine manipulative skills as well as <u>wish</u> to draw and show 'clearly' his/her 'house'.
3. The child is further asked to draw a tree next to his/her house on the hill.	c. Child must be able either to recall from observation or already have acquired the ability to represent the placement of upright objects on a curved surface in the correct position. This ability is necessary in the placement of the house as well as in the drawing and placement of the trees.

The task requires that the child process verbal information and act upon directions given him/her by using drawing and manipulative skills. This task appears to demand less of the child as regards mental judgements or perceptual judgements than previous tasks do. The skills required, observational and drawing or fine manipulative, may have developed at very different rates in individual children and may as well be related to the child's early play and drawing experiences at home.

In summary each of the two related tasks in the three units of the Piagetian battery were seen as being of a similar (although not equivalent) level or nature, while growing progressively more difficult and tapping in unit three, a different range of the children's skills and mental abilities.

Another aspect of Witkin's theory of psychological differentiation discussed earlier in the Review of Literature (page 27ff) proposes that field-dependent subjects pay close attention to and retain more easily information which has a 'social' content or bias. This finding is linked to the field-dependent subject's 'global' perception of a field.

Field-independent subjects are reported to process more easily information which has an 'impersonal' orientation and these subjects have been found to be more interested in abstract or theoretical material. The field-independent subject is described as having an 'analytical' style of cognitive functioning and is reported to perceive items as separate from their background or field (Witkin et al 1977). As well as citing their own research on this point, Witkin et al (1977) cite early work of Pemberton (1952) and Ruble and Nakamura (1972) as support for their opinion that field-dependent and field-independent children respond to different types of material in the learning situation.

In order to further study this reported relationship, the six Piagetian tasks chosen for this study were further categorised as 'personal' in style of administration to the child or 'impersonal'. The two styles of perceiving as outlined in the Witkin literature were kept in mind as well as the ordered results of the Piagetian tasks from the previous study. The two tasks from each of the three areas (as reported in Piagetian literature) were assumed to measure conservation of the same concept, they differed, however, in style of presentation and were as follows:

Area 1 Related to Conservation of Length

1. Conservation of length with distortion of shape.
 Style of presentation: impersonal or abstract.
2. Length of lines and coincidence of their extremities.
 Style of presentation, personal or social.

Area 2 Related to Conservation of Area

1. Conservation of Area.

Style of presentation: impersonal or abstract.

2. Conservation of area outside a closed perimeter.

Style of presentation: personal or social.

Area 3 Related to Acquisition of Horizontal/Vertical Frames of Reference.

1. Understanding vertical/horizontal frames of reference:
(Water level in rotating jar)

Style of presentation: impersonal or abstract.

2. Understanding vertical/horizontal frames of reference:
(House on hill)

Style of presentation: personal or social.

Detailed descriptions of each of the six Piagetian tasks and the manner of their administration to the children were typed on separate cards. The cards and relevant sections from Witkin's writings concerning the ways in which field-dependent and field-independent children respond to and process information were presented to a group of experienced teachers. The teachers were asked to sort the six Piagetian tasks into the two categories of 'personal' or 'impersonal' style of presentation. There was unanimity among the group of ten teachers invited to classify the tasks and their classification was in agreement with the writers' as presented above.

2) Children's Embedded Figures Test - CEFT

The CEFT materials were developed by Witkin, Oltman, Raskin and Karp (1971). They consist of cut-out models of two forms (TENT and HOUSE) which are embedded in two series of complex figures. A set of eight plates (four cards for each shape) shows the simple form and three similar, but obviously incorrect forms. The child is presented these along with the cut-out forms of TENT and HOUSE and asked to

choose the correct shape printed on the plates. Next a set of cards showing three incomplete pictures, representing progressing stages of 'embeddedness' of the simple TENT form, are shown the child. Three more complex figures are then shown which were designed to illustrate the procedure to the child: two for the TENT and one for the HOUSE series. This completes the pre-test training which the authors state is necessary to ensure a reliable measure of performance.

The test itself is a series of 25 cards showing complex figures, eleven of which have the TENT figure embedded in them and fourteen which have the HOUSE shape. These are presented to each individual child who is asked to find the 'hidden' shape without reference to the cut-out model used in the pre-test training. There is no time limit set on the test.

3) Draw-a-Figure Test - DAF

Witkin et al (1962/1974) considered that articulated experience is expressed in the person's impressions of his body as well as his impressions of a field. They hypothesized that children with an analytical field approach would tend to have a more articulated body concept than children with a global approach and that the child's awareness of body details would appear in his drawings.

Hence, they adapted a special scale devised by Machover (1953) consisting of a variety of specific items based on graphic features of human figure drawings. The procedure for the present DAF (Witkin et al 1962/1974) is to ask the child to draw a person (generally a picture of himself/herself) and when this drawing is finished, to draw a picture of the opposite sex - mother/father, headmaster/headmistress. These drawings are then scored by two persons, other than the experimenter, who have no contact with the subjects.

The Children's Embedded Figures Test and the Draw-a-Figure Test were considered the most suitable and appropriate assessment measures of field-dependence for use with the very young subjects employed in the study. Witkin et al (1974) discuss and describe the battery of perceptual field dependence tests which they have used, that is, the Rod-and-Frame Test (RFT), the Tilting-Room-Tilting-Chair (TRTC) and the Embedded Figures Test (EFT). The second test, TRTC, was composed of two parts, the Room-Adjustment Test (RAT) and the Body-Adjustment-Test (BAT). Early studies using these two tests, the RAT and BAT, led to the conclusion that the RAT was not measuring the same factor as the other tests of field-dependence. Witkin et al (1974) reported that the RAT provided poorer measures of field-dependence than the other tests and thus they did not use this measure in their index of field-dependence.

In their MANUAL (1971) Witkin, Oltman, Raskin and Karp report that they found an essential communality in the tests of perceptual field-dependence/field-independence. Reflecting this essential communality in their structures, high consistency was found in subjects' mode of performance across the EFT, RFT, and BAT. This same consistency was also observed in the CHEF test which was an early form of the CEFT. Further evidence for a consistent tendency among individuals to perceive in a field-dependent or field-independent fashion was found in numerous studies yielding significant correlations between scores on the EFT and/or RFT and BAT and scores from a host of other situations which may be conceived to involve perceptual illusions and reversible perspective (Gardner, 1957, 1961; Jackson 1955, 1968; Newbegg, 1954, Perez, 1955) (All cited in Witkin, Oltman, Raskin and Karp, 1971)

However, both the RFT and the BAT require use of unwieldy apparatus and if used in this study would have required that the testing of the children be undertaken in a setting other than the familiar site of the school.

As discussed earlier (page 74) young children of the age used in this study are frequently much influenced by their surroundings as well as by the adults supervising them in situations other than their own homes. Removal to a strange environment or use of an unwieldy piece of equipment was not considered viable from the point of parental and school consent or from consideration of the children's ability to be at ease and perform appropriately in the testing situation.

The Embedded Figures Test (EFT) was found to be highly related to the BAT (Body Adjustment Test). The RFT, BAT and EFT all straightforwardly require separation of an item, rod, body or geometric design, from the context or field in which it is embedded. This same characteristic is utilised in the children's version of the Witkin instrument for assessing degree of field-dependency, the CEFT.

In the '60's, Witkin and his group of researchers (Goodenough and Eagle, 1963) developed the Children's Embedded Figures Test (CHEF). This instrument aimed to provide an EFT-like situation suitable for use with young children. The researchers endeavoured to make the task intrinsically interesting to children, to avoid any requirement for sustained attention, to reduce frustration due to failure and to ensure understanding of the task. As in the EFT, the subject was required to locate a simple form embedded in a complex figure. In the CHEF, however, the complex figures were representations of meaningful figures. These figures were used both to make the task more interesting

and to ensure initial perception of the complex figure as an organised whole. Further, in contrast to the EFT, the CHEF provided more of an action than a spectator situation. Each of the complex figures was mounted on a 21 inch square board in the form of a multi-coloured jig-saw puzzle. Knobs were attached to several of the pieces, but only the correct simple form (correct response) was capable of being removed by pulling at the appropriate knob. The subject was seated some distance from the board, for example, across the room. The subject was required to identify the simple form from the constituent pieces and was then allowed to walk to the board and pull the correct knob. The subject's score was the number of correct first choices made.

This CHEF version eliminated many of the procedural difficulties of the adult EFT and RFT and proved as well to yield good reliability and validity results when used with children in the 5 - 9 year age range. Its bulkiness and the expense of its construction made it impractical for wide use. Thus the present children's form of the CEFT which incorporates many of the Goodenough-Eagle CHEF (1963) version but using a number of similar simple forms and complex figures but eliminating the disadvantages - was devised.

As support was given (cited earlier) for a consistency across the assessment instruments and included the CEFT, the Children's version of the Embedded Figures Test and the Draw-a-Figures Test were deemed the most appropriate and viable instruments for measuring field-dependence in this study.

4) British Ability Scale - Block Design (Level and Power) - BAS
The Block Design (Level and Power) test of the British Ability Scales (1978) was chosen as it aims to give a measure of visual/motor ability. As these scales have recently been standardised on a British population, it was anticipated that this test might also serve as a normative measure for comparisons of subjects within the study and with other research.

B. Presentation of Assessment Instruments to Children

1) Setting the Scene

The experimenter aimed to establish a good rapport with each child before the testing began. On the initial visit to the class, the teacher introduced the children to the experimenter who then sat in a corner of the classroom and spoke briefly to small groups of the children, telling them her name, that she was a teacher, the purpose for visiting their classroom, and asked them to help her with her 'work'. The children were also asked to tell the experimenter their names, while she, at the same time, helped them with whatever task was set them by their teacher. Sometimes she asked them to draw a picture of themselves, their home, and a picture of either their father or mother.

A puppet or toy was also introduced at this time and the children were told that whenever Dr. Snodgrass or Mrs. Bunny visited it was a special 'magic' time when whatever response they gave to any of the tasks or games of the experimenter - the answer would be 'correct'. The children were helped to understand that their answers would be considered 'correct' because the experimenter wished to know exactly what they were thinking. The children were also told that there might be times when they would not be able to answer some questions which the experimenter might ask - and to say that they did not know, would, indeed, be a very correct, proper and helpful answer.

Care was also taken to establish the difference between the testing situation when Dr. Snodgrass or Mrs. Bunny visited the school to see them and the 'normal' classroom situation. It was explained that the games or tasks which they did with the experimenter were not related to how well they performed on their reading or writing tasks in the classroom but that the tasks were sometimes related to how well they saw or 'perceived' things. They were told, as well, that two people sometimes looked at the same article and saw something different but that both might be right.

These statements were revised with the child each time he or she came to help the experimenter.

2) Testing Situation

After the initial visit to the classroom and when the experimenter was accepted by the children as a familiar person, a group of two or three were withdrawn to a quiet area outside the classroom. Here one child was individually tested while the other one or two were set quiet tasks of drawing, looking at a picture or story book, in a far corner of the area, so that the child being tested would not be distracted. This pattern was followed so the children might be at ease, relaxed in the company of their peers and not under pressure of an isolated testing situation.

The puppet, Dr. Snodgrass, became a popular aspect of the visits. In School B, the children themselves initiated the practice of carrying Dr. Snodgrass from the room in which they were being tested back to the classroom, passing Dr. Snodgrass on to the next child who was to join the testing group, indicating a relaxed and open approach on behalf of the child to the 'testing' situation.

The individual child being interviewed was positioned to the left of the experimenter so that s/he was not aware that responses were

being timed or recorded. No child was asked to remain with the experimenter for longer than twenty-five minutes at one time. The experimenter was always impressed with the great amount of effort the children expended in accomplishing the tasks, of their great enthusiasm and willingness to co-operate. They were always pleased to help, clamoured to be 'chosen', and never seemed to tire of doing the same tasks. This enthusiastic reception was consistently given the experimenter by the children in the study even when she returned to the school after long periods of absence.

3) Presentation of Piagetian Task Materials.

The six Piagetian (Piaget et al 1948; Piaget and Inhelder 1948) tasks described earlier had been chosen to determine whether or not children could conserve mathematical concepts of length, area and Euclidean space (horizontal/vertical frames of reference). Two similar tasks were selected from each of these three areas. The first task in each area was chosen in order that it might be presented in a clear, but impersonal and abstract manner while the second presentation was in a more personal, social context which could easily be related to the children's school or home situation. Witkin et al (1977) suggest that there are educational implications related to mode of presentation of learning situations and individual's cognitive style.

Area 1 Task 1: Conservation of length with distortion of shape.

Style of presentation: impersonal or abstract.

Procedure: The child was shown two strips of paper which were 30 centimetres in length and about 8 millimetres in width. S/he was asked to verify that the two strips were the same length. Next he was asked to choose a strip for himself and told to give the second strip to the experimenter. The experimenter then cut the second strip into four pieces and placed them in a box-like formation. The child was then asked if the strips of paper were still the same length. He was asked to justify his answer.

Task 2: Length of Lines and Coincidence of their Extremities.

Style of presentation: personal or social

Procedure: The child was presented with a bright green card to which two pieces of wool were glued. One piece of wool was straight; the other was an undulating, snake-shaped thread. The ends of the snake-like piece coincided with those of the straight piece. The two pieces of wool were placed side-by-side on the card, a few centimetres apart, with endpoints in exact alignment. The child was asked to choose the piece of wool he preferred and to 'pretend' it was a 'path'. Next he was shown two bits of plasticene shaped to look like mice - with bits of string for tails. The child was then asked to place a 'mouse' on his chosen 'path'. The experimenter took whichever 'mouse' and 'path' was not selected by the child. The child was asked which 'mouse' would reach the end of his path first and to explain why he thought this would happen. (It was first established that the 'mice' are friends travelling the path at the same speed. An analogy was drawn between the child walking to and from school with his mother or friends and the 'mice' going along their 'paths').

Area 2 Task 1: Conservation of area.

Style of presentation: impersonal or abstract.

Procedure: The child was shown a set of wooden pieces which can be placed in a variety of formations. The top piece of the set was a square of 10 centimetres by 10 centimetres. The child was asked to make two more squares using two pieces of wood to make one square the same size as the pattern. The set allows the child to construct one square with two rectangular halves and another with two triangles. One piece (half) of each formation was painted green, the other half, crimson. The experimenter then asked the child to place the two green halves (one shaped as a rectangle and the other as a triangle) together, and then the two crimson halves. The child was asked what the relationship was as regards the 'space' or 'room' in the new formation as compared with the first arrangement of the three squares. (the original square was always in view for comparison. The child was asked to justify his response.

Task 2: Conservation of Area Outside a Closed Perimeter

Style of presentation: personal or social.

Procedure: The child was shown two pieces of green card and asked to verify that they are of equal size. The cards are said to represent two gardens, one the child's and the other the experimenter's. Two identical, smaller pieces of card (10 centimetres by 10 centimetres) of brown colour were placed on the green 'gardens'. The child was asked to 'pretend' that these were 'vegetable plots'. Next the child was told that the experimenter found it very difficult to work in her vegetable garden. It was difficult to weed, water, transplant, harvest the plants at the centre of the plot. The tester got 'told off' by her mother for leaving her muddy Wellingtons at the kitchen door. The tester's arms were not long enough to reach into the centre of the plot, etc. Next, the tester suggested that a better method of laying out the plot - and a solution to her problem - was to divide the square piece planted with the vegetables in half and then to divide one half of this again. Pieces of card (one rectangular shaped 10 by 5 centimetres and two rectangular pieces 10 by $2\frac{1}{2}$ centimetres) were then replaced on the tester's garden. The child was asked:

- a) Did he and the tester now have the same amount of space for growing vegetables?
- b) Did they have the same amount of green 'grass' around the vegetable plots in each of their gardens?

The child was asked to justify his answer in each case.

Area 3 Task 1: Horizontal/vertical frames of reference.

Drawing water line in representation of jar at nine different positions.

Style of presentation: impersonal or abstract

- Procedure:**
- a) The child was shown a jar about half filled with water. This jar was rotated through 360° and the child's attention directed to the change in the water level at each of the nine 'stopping' positions.
 - b) The jar with water was replaced by an empty jar of the same shape and size; the child was given a booklet with outline sketches of the jar in each of the nine positions. He was asked to draw

the position of the water-level as he looked at the empty jar.

Task 2: Placing of Horizontal and Vertical Lines in Drawings.

Style of Presentation: personal or social.

Procedure: The child was given paper (A4) with a pre-drawn curved line on it to represent a 'hill'. Coloured pens were on the table and the child was asked to draw the best possible picture of his own house for the experimenter to take away with her.

Methods of Scoring Instruments.

A. Scales of Assessing Piagetian Tasks.

Children's responses to the Piagetian-type tasks were evaluated by scales which had been established for the earlier studies. These scales were based upon statements and discussions of children's replies to like tasks in Piagetian writings (Piaget et al, 1948a, 1948b).

Similar scales have been devised by other researchers. Witkin et al (1974) report specific details and rationale for a scale developed to assess their Articulation of Body Concept Test (p 115 ff) as well as a five point scale for assessing children's system of controls and defences (Witkin et al, 1974, p.160). Omari (1975) reported use of a three point scale developed from Piaget and Inhelder's (1967, page 383) sample drawings, which was used to evaluate subjects' responses on the water-in-the-jar task. Silverstein et al (1982) established a three point scale for evaluating Piagetian conservation tasks; while Emler and Valiant (1982) constructed a five-point scale which was used to study children's performances on the 'three mountains' task of Piaget and Inhelder (1956). Shultz, Pardo and Altman (1982) devised a four-point scale which they used to code children's verbal justifications on apparatus (lanes and lights problem) set up to study young children's use of transitive inference in causal chains.

Daniel (1978) writes that ordinal measurement makes it possible for objects to be ranked. Further the differences between rankings are not necessarily equal. As it had early been established that the data resulting from the present study would be of an ordinal type, the use of the scales devised for this study seemed justified.

Scale 1 was used to assess the first four tasks related to conservation of length and area. Scale 2, parts a and b, was devised to evaluate the drawing tasks concerned with acquisition of the horizontal/vertical frames of reference.

Scale 1 Assessing Conservation of Length and Area Tasks

- 0 No response. Task could not be administered because child said s/he could not do it.
- 1 Some response. Although the child attempted the task, his/her response was disorganised, haphazard, with little or no attempt at justification.
- 2 Response given. Child made an attempt to order his response but no justification or check; if justification was given, it was incorrect.
- 3 Response given. Child able to order his response, although he/she wavered in response from positive to negative, or negative to positive; in the end gave a final positive justification.
- 4 Response given in affirmative terms and ordered to some criterion. Could not be shaken from firm positive answer, but could not give an equally firm justification.
- 5 Response given in affirmative, criterion checked and positive justification given.

Scale 2 Assessing Understanding of Horizontal/Vertical
Frames of Reference

- a) Reproduction of water-level in jar as it is rotated 360°.
- 0 No response. Task could not be administered because the child said he could not do it.
 - 1 Although the child attempted to task, he did so in a haphazard manner. The representations of the water-level were placed in approximately the same position in each of the nine figures. The position of the line drawn in the diagram was not correct in relation to the actual water-level in the jar. (1 or 2 positions correct).
 - 2 Child reproduced the 1st, 5th and 9th positions of the water level line on the diagram correctly, but did not draw more than three positions correctly.
 - 3 Child reproduced the 1st, 3rd, 5th, 7th and 9th positions of the water-level line correctly, that is, at least 5 positions were drawn correctly in the diagram.
 - 4 Child reproduced at least seven positions correctly, (Children have most difficulty reproducing the 4th, 6th and 8th positions of the diagram. The 8th is invariably the last position to be reproduced correctly).
 - 5 Reproduced all nine positions of the water-level line correctly in the diagrams.
- b) Drawing House and Trees upon a Mountain.
- 0 No response. Task could not be administered because child said he could not do it.
 - 1 Child drew trees and houses lying flat on the sides of the mountain (the houses appeared to be parallel to the slope of the hill), or else placed them in an arbitrary fashion, using the mountain as a background.
 - 2 Child drew trees and houses perpendicular to slope of mountain at all points.
 - 3 Lines representing trees and houses were placed midway between the perpendicular and vertical slope of the hill.

- 4 Houses and trees may be placed in different manner. The house had only one corner attached to the hill, and was in correct vertical position, while the trees were drawn perpendicular to slope of the hill at their base, but tops 'curved' to correct vertical position.
- 5 Drew lines representing trees and house vertically and joined all to base of mountain slope at appropriate angle.

The use of these scales as assessment measures of the children's performances on the six Piagetian-type tasks gave a maximum score of thirty points.

B. Assessing the Children's Embedded Figures Test.

Witkin, Oltman, Raskin and Karp (1971) discuss the presentation of the CEFT to young subjects and state that the examiner may assist or correct a child who does not arrive at a solution but such assisted items are to be scored as failures.

For children below the age of eight years, testing begins with item T₁. Older children begin with T₆ and are automatically credited with having passed T₁ through T₅. However, if the subject fails three or more of the TENT items T₇ - T₁₁, he loses this automatic credit and is presented with items T₁ through T₅.

Testing is stopped upon completion of the TENT series if the subject fails all items T₇ - T₁₁. If at least one of these five items is passed, testing continues with the HOUSE series.

After the first three training items of both series are presented with the aid of the cut-out shape, the child is not shown the simple embedded form unless he specifically asks to see it. No time limit is imposed on search for finding the simple form.

Responses are scored 1 or 0. A score of 1 is given only when the first choice is correct and verified. The total score equals the number of items passed, 25 being the maximum score.

C. Assessing the Draw-a-Figures Test

Witkin et al (1962/1974) formulated the following five-point scale for assessing the Draw-a-Figures Test. Sample drawings and related scorings are shown in Witkin et al (1962/1974). A score of 1 is ranked as a most detailed and sophisticated effort while a score of 5 is considered a poorer effort.

- 1 Most sophisticated drawings: These manifest high level form (that is, waistline, hips, shoulders, chest and breasts, shaped or clothed limbs, etc.); appendages and details represented in proper relation to body outline, with some sophistication in mode of presentation; appropriate, even imaginative, detailing (that is, successful profiling, as young girl in evening clothes, well-dressed man with cigarette, etc).
- 2 Moderately sophisticated drawings: Drawings which show a definite attempt at role assignment (with regard to age, activity, occupation, etc.) through adequate detailing, shaping, clothing; with continuity of outline (that is, integration of parts) attempted.
- 3 Drawings intermediate in level of sophistication: Drawings in which identification of sex is evident, attempts at shaping and a fair level of integration of parts is manifest and a minimum of detailing is present.
- 4 Moderately primitive drawings: Drawings which essentially still lack features of differentiation through form, identity or detailing; however, these drawings show slightly more complexity in some respects (that is, presence of one body part that is unusual in most primitive drawings, such as neck).
- 5 Most primitive and infantile drawings: These manifest a very low level of form (ovals, rectangles, sticks stuck on to each other); no evidence of role or sex identity (same treatment of male and female with, at most, difference in hair treatment, no facial expression, little shaping or clothing).

A single rating based upon both male and female drawings is assigned each subject. Drawings were assessed by two independent scorers, X and Y both experienced teachers of young children, who had no contact with the subjects. There was almost unanimous agreement between these two scorers. Variations in scoring results were so few that they were considered insignificant. Analysis by both descriptive and statistical methods confirmed this decision to ignore the differences which did occur.

Choice of Statistical Measures and Mode of Analysis

The data for this study were gathered from four longitudinal testings (eleven separate testing situations). A fifth and final testing to corroborate the general trends arising, was conducted with a small sub-group ($N_{2L} = 9$) of children from School A. This final testing is discussed briefly and results are shown in the raw data tables. See pages 132 a, ff., Tables 4 - 8. However, while the data from this fifth testing have not been included in the main analysis, the data do establish and confirm the general pattern of the raw data. The principal reason for administering the Piagetian battery and the CEFT to this small sub-group ($N_{2L} = 9$) was to check for stability and consistency of results. During the main study the test instruments had been administered to the subjects at three month intervals. This fifth testing of the sub-group N_{2L} was done after a time lapse of almost seven months (see Table 3, page 104). Further, the children had transferred the previous September from their Infants School to the local Junior School. These conditions, that is, a different time sequence as regards the administration of the tests and change of school venue and class teacher, precluded the use of this subset of data in the main analysis. (See Chapter IV, page 102).

The raw data arising from the longitudinal testings of the sample are presented in Tables 4 - 8. Tables include:

1. Individual Piagetian Task Scores - Conservation of Length (1 - 2); Area (3 - 4) and Horizontal/Vertical Co-Ordinates (5 - 6) for the Four Testings by School and Sex - Table 4.
2. Individual Piagetian Task Scores - Conservation of Length (1 - 2); Area (3 - 4) and Horizontal/Vertical Co-Ordinates (5 - 6) and the Piagetian Total Task Scores for the Subgroup ($N = 9$) of the Sample for the Fifth Testing - Table 5.
3. Piagetian Task Total Scores and Children's Embedded Figures Test (CEFT) Scores for each Subject of the Sample for the Five Testings by Sex and School - Table 6.

SCHOOL A SUBJECTS	PIAGETIAN SCORES TESTING 1					PIAGETIAN SCORES TESTING 2					PIAGETIAN SCORES TESTING 3					PIAGETIAN SCORES TESTING 4								
BOYS	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
1	1	5	5	3	3	2	5	3	1	4	3	2	5	5	4	5	3	3	5	5	2	5	4	2
2	2	3	2	2	4	3	3	3	3	3	3	3	5	4	4	1	3	5	5	5	2	2	4	5
3	1	3	1	2	4	5	1	5	1	4	3	5	1	3	1	2	4	5	1	2	1	5	3	5
4	5	3	1	2	3	3	3	4	2	2	3	4	1	5	2	1	3	5	1	3	2	4	3	4
5	1	5	1	3	1	2	2	4	2	3	2	2	5	5	1	1	2	4						
6	1	3	1	2	3	4	2	5	1	3	3	4	1	3	1	3	3	3	1	2	3	2	4	4
7	1	5	2	3	4	2	5	1	1	5	3	2	5	5	1	3	3	4	5	3	3	5	4	4
8	3	4	2	2	2	4	5	3	5	3	3	2	5	5	1	5	3	2	5	3	2	4	3	3
9	2	4	2	2	3	2	3	3	1	3	3	2	1	3	1	3	3	2	1	2	1	4	3	5
10	1	1	1	2	3	2	1	4	1	3	2	2	1	5	1	1	2	2	5	3	1	3	3	3
11	1	1	1	1	2	1	0	4	1	1	4	1	0	1	1	1	2	5	1	2	2	2	2	5
12	1	3	2	2	3	2	0	3	1	1	3	5	5	3	1	1	3	4	5	2	2	1	3	3
13	1	1	2	5	3	3	1	3	5	1	3	5	1	5	5	5	3	5	5	2	5	5	4	5
14	1	5	1	2	3	2	1	3	1	1	3	2	1	3	1	1	3	2	1	1	1	1	3	3
GIRLS	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
15	1	2	1	1	3	5	4	5	1	1	5	4	1	5	1	1	4	5	5	5	3	2	3	4
16	1	3	2	1	3	2	1	5	1	1	3	2	1	1	1	1	3	5	1	3	2	1	3	5
17	1	1	1	2	3	2	4	5	1	3	3	4	1	5	1	3	2	3	5	3	1	4	3	3
18	1	5	2	2	2	5	1	5	5	1	4	5	1	3	1	1	5	4	2	2	1	2	3	3
19	1	3	2	2	3	2	1	3	1	1	2	3	1	5	1	1	3	4	5	2	2	2	3	5
20	1	3	1	1	2	2	1	1	0	1	2	4	1	3	1	1	2	3	1	2	2	1	3	3
21	1	3	3	2	3	5	1	5	5	3	4	3	5	5	1	3	3	4	5	5	3	5	4	5
22	1	3	2	3	2	4	1	1	1	5	2	3	1	3	1	1	2	5	1	3	1	2	3	3
23	2	5	2	2	4	2	2	5	3	4	3	4	0	5	5	5	3	2	5	5	1	4	3	3
24	1	5	2	2	3	3	1	4	3	3	2	4	3	5	1	3	3	4	5	3	2	4	3	3
25	1	3	2	2	2	1	3	3	1	1	2	1	4	5	1	1	2	1	1	2	2	2	2	2
26	1	5	1	1	3	4	1	5	1	3	3	2	4	5	1	3	3	5	5	5	2	4	4	5
27	0	1	2	2	3	4	1	3	1	3	4	4	5	0	1	1	3	5	5	5	5	4	3	5
28	0	3	1	1	2	3	1	4	1	1	2	2	1	1	1	2	2	4	1	1	1	1	2	4
SCHOOL B SUBJECTS	PIAGETIAN SCORES TESTING 1					PIAGETIAN SCORES TESTING 2					PIAGETIAN SCORES TESTING 3					PIAGETIAN SCORES TESTING 4								
BOYS	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
29	1	5	1	5	3	2	5	4	3	4	3	3	5	5	5	5	3	1	5	5	3	5	3	2
30	1	5	5	5	4	2	5	5	2	5	5	5												
31	4	5	3	5	3	2	4	5	5	5	5	5	5	3	5	5	4	4	5	2	5	4	1	2
32	5	4	1	4	3	2	1	3	4	2	3	3	5	3	1	1	3	3	5	3	1	1	3	2
33	0	3	1	1	3	2							1	2	3	5	3	3	4	5	1	3	4	3
34	0	3	1	1	4	4	4	4	2	2	3	4	3	5	1	5	4	3	5	5	2	3	4	3
35	1	3	1	1	3	1	4	4	1	3	3	2	4	4	1	3	3	2	5	5	5	5	3	5
36	0	5	1	3	3	2	2	5	3	4	4	2	5	5	1	5	4	2	5	5	3	5	3	5
37	1	3	1	1	4	5	1	4	2	1	3	5	1	2	1	1	5	5	1	3	1	5	4	5
38	5	4	4	1	3	4	2	2	4	2	3	1	5	4	5	3	4	4	1	5	5	5	5	5
39	0	1	1	1	3	4	5	5	2	4	3	4	5	3	1	5	3	3	5	3	1	5	4	4
40	4	3	1	1	3	2	1	4	2	1	3	2	1	5	1	3	3	2	5	5	1	1	3	3
41	4	5	1	1	3	5	4	5	3	5	3	5	5	5	1	5	3	5	5	5	5	5	3	5
42	1	4	1	1	2	2	1	4	2	2	3	4	1	1	1	1	4	3	1	1	1	1	3	3
GIRLS	0	3	1	3	3	5	1	4	2	3	5	4	4	1	1	4	4	4	5	3	1	5	3	4
43	1	3	1	0	2	2	1	4	4	4	2	4	1	4	1	1	2	3	1	5	2	4	2	4
44	1	3	5	1	4	3	5	2	4	5	4	3	4	4	1	5	3	4	5	5	1	5	5	5
45	4	0	5	5	2	4	5	5	5	5	3	5	5	1	5	5	4	3	5	5	4	5	3	5
46	1	4	1	1	5	2	1	1	3	3	4	1	5	1	1	3	5	3	1	1	1	3	4	4
47	1	4	1	1	3	2	1	1	2	1	4	4	1	1	1	1	4	3	1	5	1	1	4	5
48	5	4	4	4	3	2	5	3	5	5	3	1	5	5	5	5	4	2	5	4	5	5	3	3
49	1	1	1	1	3	5	5	5	5	5	3	4	5	5	5	5	3	5	5	5	5	2	5	5
50	0	1	1	1	2	2	1	3	1	1	3	2	1	3	1	1	3	2	1	2	1	1	2	2
51	5	3	1	5	3	2	5	3	5	5	3	2	5	4	1	5	3	2	5	3	1	5	3	2
BOYS	0	0	1	1	3	4	1	1	1	0	4	2	1	1	1	0	4	2	1	1	1	0	3	2
53	0	2	1	1	0	5	1	4	1	1	2	5	5	3	1	1	4	5						
54	2	2	1	1	3	2	5	4	1	5	3	2	2	3	5	5	4	5						
55	2	5	2	5	2	2	1	5	0	0	3	2	2	3	5	5	4	5						
56	4	5	2	1	1	1	1	3	1	1	2	2	1	3	1	1	2	2						
57	1	1	1	1	2	2	1	2	1	5	5	3	1	1	5	2	2	5						
58	3	3	1	2	4	2	1	1	1	3	1	5	1	2	1	3	1	5						
59	2	2	2	1	3	5	5	5	1	3	3	5	5	5	1	5	3	5						
60	3	2	2	3	3	4	1	5	1	5	4	2	5	5	5	5	3	5						
61	2	4	2	0	4	2	1	4	1	2	4	5	1	5	1	2	4	5						
62	0	4	1	0	3	4	5	5	1	4	3	2	5	5	4	5	3	5						
GIRLS	5	4	2	2	3	5	1	5	1	0	2	5	5	3	4	5	3	5						
64	2	0	1	1	3	3	1	3	1	1	3	2	1	3	1	1	3	2						
65																								

INDIVIDUAL PIAGETIAN TASK SCORES - CONSERVATION OF LENGTH (1 - 2); AREA (3 - 4) AND HORIZONTAL/
VERTICAL CO-ORDINATES (5 - 6) FOR THE FOUR TESTINGS BY SCHOOL AND SEX

TABLE 4

INDIVIDUAL PIAGETIAN TASK SCORES - CONSERVATION OF LENGTH (1 - 2);
 AREA (3 - 4) AND HORIZONTAL/VERTICAL CO-ORDINATES (5 - 6) AND THE
 PIAGETIAN TOTAL TASK SCORES FOR THE SUBGROUP (N = 9) OF THE SAMPLE
 FOR THE FIFTH TESTING

School A	Piagetian Individual Scores						Piagetian Total
Tasks	1	2	3	4	5	6	
Subjects							
BOYS							
2	5	4	5	3	4	5	26
4	5	3	4	4	4	3	23
6	5	4	4	5	3	3	24
9	5	3	4	5	3	2	22
10	2	4	1	1	3	4	15
GIRLS							
23	5	5	5	5	4	4	28
24	5	3	1	3	3	4	19
27	5	5	2	2	3	5	22
28	1	3	4	2	3	5	18

TABLE 5

SCHOOL A SUBJECTS	PIAGETIAN TOTALS/TESTINGS					CEFT SCORES/TESTINGS					SCHOOL B SUBJECTS	PIAGETIAN TOTALS/TESTINGS					CEFT SCORES/TESTINGS				
	1	2	3	4	5	1	2	3	4	5		1	2	3	4	5	1	2	3	4	5
BOYS											BOYS										
1	19	18	25	23		11	12	15	15		29	17	22	24	23		19	22	21	25	
2	16	18	22	23	26	20	21	21	24	23	30	22	27				13	20			
3	16	19	16	17		5	10	10	21		31	22	27	26	19		13	8	19	21	
4	17	18	17	17	23	4	8	13	21	20	32	19	16	16	15		12	11	14	21	
5	13	15	18			8	9	11			33	10		17	20		17		13	17	
6	14	18	14	16	24	18	12	22	22	20	34	13	19	21	22		8	16	12	11	
7	17	17	21	24		13	14	21	22		35	10		17	28		16	19	21	24	
8	17	21	21	20		6	6	19	18		36	14	20	22	26		7	13	22	21	
9	15	15	13	16	22	13	13	20	19	17	37	15	16	15	19		6	11	12	22	
10	10	13	12	18	15	9	10	15	19	20	38	21	14	25	26		11	19	23	23	
11	7	11	10	14		7	9	12	11		39	10	23	20	22		14	13	13	23	
12	13	13	17	16		18	7	15	10		40	14	13	15	18		17	16	23	21	
13	15	18	24	26		12	10	14	21		41	19	25	24	28		12	20	20	22	
14	14	11	11	10		7	14	11	20		42	11	16	11	10		15	19	21	23	
GIRLS											GIRLS										
15	13	20	17	22		10	19	15	16		43	15	19	18	21		15	18	22	23	
16	12	13	12	15		4	7	12	12		44	9	19	11	18		6	8	9	16	
17	10	20	15	19		14	11	12	20		45	17	23	21	26		11	11	24	24	
18	17	21	15	13		17	10	12	14		46	20	28	23	27		12	23	20	25	
19	13	11	15	18		11	15	18	16		47	14	13	18	14		15	17	19	20	
20	10	9	11	12		5	17	14	12		48	12	13	11	17		6	12	17	20	
21	17	21	21	27		9	14	23	21		49	22	22	26	25		16	14	20	22	
22	15	13	13	13		21	12	14	21		50	12	27	28	27		4	12	22	22	
23	17	21	20	21	28	12	19	22	24	25	51	7		11	9		9		9	10	
24	14	17	19	20	19	8	15	10	16	19	52	19	23	20	19		10	15	20	18	
25	11	11	14	11		11	9	14	21		BOYS										
26	15	15	21	25		11	7	11	20		53	9	9	8			11	12	12		
27	12	16	15	27	22	3	7	21	18	23	54		14	19			10	12			
28	10	11	11	10	18	7	11	8	15	21	55	11		20			15	25	23		
											56	18	11	24			10	12	18		
											57	14	10	9			6	11	9		
											58	8	17	16			12	18	21		
											59	15	12	18			11	16	18		
											60	15	22	24			21	23	23		
											61	17	18	20			16	8	17		
											62	14	17	18			13	21	23		
											63	12	20	27			9	15	13		
											GIRLS										
											64	21	14	25			10	5	13		
											65	10	11	13			14	9	19		

PIAGETIAN TASK TOTAL SCORES AND CHILDRENS EMBEDDED FIGURES TEST (CEFT) SCORES FOR EACH
SUBJECT OF THE SAMPLE FOR FIVE TESTINGS BY SEX AND SCHOOL

TABLE 6

TESTING SCHOOL A	1 X Y		2 X Y		3 X Y		4 X Y		5 X Y		TESTING SCHOOL B/2	1 X Y		2 X Y		3 X Y		4 X Y	
BOYS											BOYS								
1	5	5	5	5	5	5	4	4			29	5	5	5	5	5	5	5	5
2	4	5	4	4	4	4	3	4	4	4	30	5	4	4	4				
3	5	5	5	5	5	5	5	4			31	4	4	3	4	4	5	4	5
4	4	5	4	4	5	4	5	4	4	5	32	5	5	3	4	5	5	5	5
5	4	4	5	5	5	5	5	5			33	5	5			5	5	5	5
6	4	4	3	3	4	4	4	3	5	5	34	5	5	5	5	5	5	3	4
7	4	4	5	5	5	5	5	4			35	5	5	5	5	5	5	5	5
8	5	5	4	4	5	3	5	5			36	5	5	5	5	5	5	5	5
9	4	4	4	5	5	4	5	5	5	5	37	5	5	5	5	5	5	5	5
10	5	5	5	5	5	5	5	5			38	5	5	4	5	5	5	5	5
11	5	5	5	5	5	5	5	5			39	5	5	5	5	5	5	5	5
12	4	5	4	4	5	5	5	5			40	5	5	5	5	5	5	5	5
13	3	5	4	3	5	5	5	5			41	5	5	5	5	5	5	5	5
14	5	5	5	4	5	5	5	5			GIRLS								
GIRLS											42	4	4	5	5	4	3	5	5
15	4	5	5	3	4	2	4	4			43	5	4	4	4	5	5	5	5
16	4	4	4	4	5	4	3	4			44	5	5	5	5	5	5	5	5
17	5	5	5	5	5	5	5	5			45	4	5	4	5	4	4	5	5
18	4	5	5	4	5	4	5	4			46	4	4	3	4	4	4	4	4
19	5	5	5	5	4	3	5	5			47	4	5	4	4	3	4	3	4
20	5	5	5	5	5	5	5	5			48	5	5	5	5	5	5	5	5
21	3	3	4	4	4	4	4	4			49	5	5	5	4	4	3	4	4
22	5	5	5	4	5	5	5	4			50	5	5	4	5	4	4	5	5
23	3	4	5	4	4	4	4	4	4	5	51	5	5			5	5	5	5
24	4	5	5	4	5	5	5	5	4	5	52	5	5	5	5	5	5	5	5
25	5	5	5	5	5	5	5	5			53	4	5	5	5	3	4		
26	3	4	4	4	3	3	4	4			SCHOOL B/1								
27	3	5	4	5	5	4	4	4	4	4	BOYS								
28	5	5	5	5	5	5	5	5	5	5	54	4	4	4	3	4	5		
											55	3	4			5	5		
											56	3	3	4	5	3	5		
											57	5	5	5	5	5	5		
											58	5	5	4	4	5	5		
											59	5	5	3	4	3	3		
											60	5	4	4	5	3	3		
											61	5	4	4	5	3	3		
											62	4	4	3	4	4	4		
											63	5	4			5	3		
											GIRLS								
											64	4	4	4	4	3	3		
											65	5	5	5	5	4	3		

DRAW-A-FIGURE (DAF) SCORES FOR TOTAL SAMPLE ASSESSED BY TWO INDEPENDENT SCORERS, X AND Y, FOR TESTINGS 1 - 5, BY SEX AND SCHOOL. (KEY: 1 = high score, 5 = low score)

TABLE 7

SCHOOL A SUBJECTS	TESTING 1 - ABILITY & POWER						TESTING 2 - ABILITY & POWER						SCHOOL B SUBJECTS	TESTING 1 - ABILITY & POWER						TESTING 2 - ABILITY & POWER					
	RAW SCORES		AGE ADJUSTED		PERCENTILE		RAW SCORES		AGE ADJUSTED		PERCENTILE			RAW SCORES		AGE ADJUSTED		PERCENTILE		RAW SCORES		AGE ADJUSTED		PERCENTILE	
	ABILITY	POWER	ABILITY	POWER	ABILITY	POWER	ABILITY	POWER	ABILITY	POWER	ABILITY	POWER		ABILITY	POWER	ABILITY	POWER	ABILITY	POWER	ABILITY	POWER	ABILITY	POWER	ABILITY	POWER
BOYS													BOYS												
1	6	3	44	29	85	91	9	7	64	59	91	99	29	10	5	74	44	96	96	11	5	75	44	99	96
2	9	4	64	37	99	97	5	2	39	21	57	61	30	7	6	50	51	85	99						
3	7	5	50	44	92	99	11	7	74	59	96	99	31	5	4	39	37	67	92	7	3	50	29	78	78
4	8	3	57	29	96	91	5	5	39	44	58	96	32	6	3	44	29	76	84	8	2	57	21	86	61
5	6	3	44	29	85	91							33	5	3	39	29	65	84	7	4	50	37	78	90
6	7	3	50	29	92	91							34	6	4	44	37	76	92	6	5	44	44	69	96
7	7	3	50	29	92	91	10	4	74	37	96	90	35	6	4	44	43	76	92	9	3	64	29	95	84
8	2	1	20	10	38	65	10	7	74	59	96	99	36	7	5	50	44	85	97	9	7	64	59	91	99
9	11	3	99	29	99	91	2	0	20	-	18	-	37	4	3	33	29	64	91	8	8	57	68	92	99
10	10	5	74	99	99	99	11	3	74	29	99	78	38	11	7	59	59	99	99	8	5	57	44	92	97
11	1	0	10	-	21	-	8	2	57	21	92	70	39	2	2	20	21	18	62	2	2	20	21	18	61
12	6	2	44	21	85	81	4	1	33	10	43	36	40	5	2	39	21	65	70	7	2	50	21	78	61
13	10	0	74	-	99	-	6	4	44	37	68	90	41	11	4	75	37	99	90	11	7	75	59	99	99
14	6	2	44	21	85	81	7	4	50	37	78	90	42	9	6	64	51	91	99	6	4	44	37	69	90
GIRLS													GIRLS												
15	10	5	74	44	99	99	9	7	64	59	91	99	43	6	5	44	44	85	99	8	2	57	21	86	61
16	5	2	39	21	76	81	6	4	44	37	68	90	44	5	3	39	29	77	91	7	4	50	37	85	92
17	2	0	20	-	38	-	10	4	74	37	96	90	45	6	6	44	51	76	99	8	6	57	51	86	99
18	3	1	27	10	51	65	7	4	50	37	78	90	46	9	5	64	44	95	97	11	4	75	37	97	90
19	6	3	44	29	85	91							47	8	5	57	44	92	97	9	6	64	51	91	99
20	4	2	33	21	64	81	9	7	64	59	91	99	48	6	1	44	10	76	46	8	4	57	37	86	90
21	6	3	44	29	85	91	4	1	33	10	44	36	49	4	3	33	29	53	83	10	3	74	29	96	78
22	7	3	50	29	92	91	5	2	39	21	57	61	50	6	4	44	37	76	92	10	6	74	51	99	99
23	7	2	50	21	92	81	3	1	27	10	30	36	51	3	1	27	10	38	47	2	1	20	10	18	36
24	1	0	10	0	21	0	3	1	27	10	30	36	52	10	4	74	37	99	97	7	6	50	51	85	99
25	2	1	20	10	38	65	7	5	50	44	78	96	53	4	2	33	21	65	81						
26	8	4	57	37	96	97	4	3	33	29	43	78	54	3	3	27	29	66	94						
27	4	3	33	29	64	91	11	5	74	44	96	96	55	6	4	44	37	85	97						
28	2	2	20	21	38	81	3	3	27	29	30	78	56	0	0	0	0	0	0						
							10	5	74	44	96	96	57	4	2	33	21	65	81						
							3	2	27	21	30	61	58	5	1	39	10	65	46						
							5	3	39	29	57	78	59	9	4	64	37	99	97						
							9	7	64	59	91	99	60	7	3	50	29	92	91						
							8	5	57	44	86	96	61	10	3	74	29	99	84						
							3	1	27	10	30	36	62	1	0	10	0	21	0						
													63												
													GIRLS												
													64	3	2	27	21	66	86						
													65	7	2	50	21	92	81						

BRITISH ABILITY SCALE RESULTS (ABILITY & POWER) FOR EACH SUBJECT BY SEX AND SCHOOL FOR TWO TESTINGS

TABLE 8

4. Draw-a-Figure (DAF) Scores for Total Sample Assessed by Two Independent Scorers, X and Y, for Testings 1 - 5, By Sex and School - Table 7.
5. British Ability Scale Results (Ability and Power) for each Subject by Sex and School for the Two Testings Administered - Table 8.

Witkin et al (1974) have consistently presented the results of their studies concerning cognitive style in a dichotomous classification as have other researchers (Huteau 1980, Zoccolotti and Oltman 1978, Ehrlichman and Cox 1977).

Hence, subjects of this study were initially classified by means of the median score of the first administration of the Children's Embedded Figures Test (CEFT) as either:

1. Field-dependent (FD), or
2. Field-independent (FID).

Although one might normally expect a classification into field-dependent and field-independent subjects, an alternate tri-partite system has also been reported. Such a classification has been used to study cognitive style by Satterly (1976), Satterly and Telfer (1979) and Brumby (1982).

In light of the fact that both modes are defensible, it was decided to study the results in both systems.

Subjects of the study were therefore further arranged into three groups of approximately the same number of subjects according to the scores which they achieved on the first administration of the Children's Embedded Figures Test (CEFT) as:

1. Field-dependent subjects (FD), N = 22;
2. Field-dependent/field-independent subjects (FD/FID), N = 21; and
3. Field-independent subjects (FID), N = 22.

The raw data for all subjects of the study were then organised into the FD - FID grouping (dichotomous classification) as well as the FD,

FD/FID and FID grouping (tri-partite classification).

A computer analysis using the STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES^x - USERS' GUIDE, SPSS Inc., McGraw Hill (1983) was carried out on both the 2-way and 3-way classifications of the data.

The SPSS^x system is a comprehensive tool for managing, analyzing and displaying data. It offers a broad range of statistical instruments and accomplishes data modification tasks with a simple, English-like language. The SPSS^x programme gave the opportunity to use statistical instruments which were suited to the type of data which had been gathered as well as to the dichotomous and tri-partite classifications of the sample. Specific statistical measures used were the Kruskal-Wallis One Way Analysis of Variance, the Friedman Two-Way Analysis of Variance, the 't' test and Spearman's Rho. The SPSS^x package also produced scatterdiagrams and histograms of the results.

Haber and Runyon (1973) report that the analysis of variance is a technique of statistical analysis which permits us to overcome the ambiguity involved in assessing significant differences when more than one comparison is made. It allows us to answer the questions: Is there an overall indication that the experimental treatments are producing differences among the means of the various groups? Although the analysis of variance may be used in the two-sample case (in which event it yields precisely the same probability values as the student t-ratio), it is most commonly employed when three or more groups are considered.

Daniel (1978) states that perhaps the most widely used nonparametric technique for testing the null hypothesis that several samples have been drawn from the same or identical samples is the Kruskal-Wallis One-Way Analysis of Variance by Ranks. When only two samples are being considered, the Kruskal-Wallis test is equivalent to the Mann-Whitney. (Mann-Whitney, according to Daniel (1978) seem to have been the first to treat the case of unequal sample sizes, and for very large samples,

the power-efficiency of the Mann-Whitney test approaches 95.5%).

The Kruskal-Wallis test, however, uses more information than the median test and as a consequence is usually more powerful and is preferred when the available data are measured on at least the ordinal scale.

Thus the Kruskal-Wallis One-Way Analysis of Variance was a suitable assessment measure for use with both the dichotomous and the tri-partite classifications of the sample.

Although the SPSS^X programme offers a comprehensive system for analyzing data, in some instances it was necessary to utilize other methods. For example in the situation of the third hypothesis. This hypothesis stated that as three of the six Piagetian tasks were presented in an IMPERSONAL manner and the other three in a SOCIAL manner, a relationship might exist between manner of presentation and cognitive style.

In order to test this hypothesis a factor 'D' was calculated by summing the scores of the three tasks which were presented in the SOCIAL manner and subtracting this total from the summed scores of the tasks presented in the IMPERSONAL manner. That is,

$$(PT_1 + PT_3 + PT_5) - (PT_2 + PT_4 + PT_6) = D.$$

This resulting factor 'D' was then tallied and tabulated in respect of either the dichotomous or tri-partite system of classification of subjects prior to use of either the Kruskal-Wallis or Friedman analysis.

Some slight fluctuations in sample size may appear in the reporting of the data especially in respect of the computer analysis.

These discrepancies were generally caused by a missing value (as the subject was away or ill at the time of testing). The SPSS^X USERS' GUIDE, McGraw Hill (1983) reports adjustments are made within the programme for such cases. They report that by default cases with missing values are included in frequency tables and labeled as missing. Cases with missing values are not included in bar charts, histograms, valid

and cumulative percentages, and statistics. It is possible, however, to include user-missing values as if they were not missing by use of the MISSING subcommand and the INCLUDE keyword. Including missing values in a statistical procedure does not affect the system file or subsequent procedures in the same analysis.

The results of these analyses as they were undertaken for each of the two modes of classification of the sample are given and discussed in the following Chapter V. Further tabular arrangements of the data as they relate to each of the classifications are also presented with the results.

CHAPTER VI

RESULTS

"Everybody is dissatisfied with what is,
and nobody knows that something new is needed
and possible."

From TOLSTOY ON EDUCATION
University of Chicago Press
1967, page 10.

Results

The main hypothesis of this study that there would be a relationship between children's performances on Piagetian conservation tasks and Witkin measures of cognitive style (field-dependence/field-independence) was made explicit by formulation of subhypothesis for each of the three hypothesis stated earlier in Chapter IV, page 97.

The hypothesis were framed and further specified as:

- I Children who are assessed as field-independent functioning by means of Witkin et al (1971) CHILDREN'S EMBEDDED FIGURES TEST, will score higher overall on Piagetian tasks than children assessed as field-dependent (FD).

That is:

- a) Children assessed as field-independent (FID) will achieve higher scores on individual Piagetian tasks than field-dependent (FD) children.
- b) Children assessed as field-independent (FID) will achieve higher scores overall on total Piagetian task scores for each testing than field-dependent (FD) children.
- c) Children assessed as field-independent (FID) will achieve higher scores on the British Ability Scale than field-dependent (FD) children.

- II In further Administrations of the Piagetian battery of tasks children initially classified as field-independent (FID) by means of Witkin et al (1971) CHILDREN'S EMBEDDED FIGURES TEST will show fewer regressions on their Piagetian task scores than will field-dependent (FD) children.

That is:

- a) Children assessed as field-independent (FID) will show fewer regressions on individual Piagetian task scores than field-dependent (FD) children.
- b) Children assessed as field-independent (FID) will show fewer regressions on total Piagetian battery scores from testing to testing than field-dependent (FD) children.

- III As the Piagetian tasks are organised in relation to style of presentation, as either IMPERSONAL or SOCIAL, it is hypothesized that field-independent (FID) subjects may score higher on tasks presented in an IMPERSONAL manner while children classified as field-dependent (FD) may score higher on those tasks presented in a SOCIAL manner.

That is:

- a) Field-independent (FID) children will score higher on IMPERSONAL tasks (3 Piagetian tasks administered in an impersonal manner) than field-dependent (FD) children on IMPERSONAL tasks.
- b) Field-dependent (FD) children will score higher on SOCIAL tasks (3 Piagetian tasks administered in a social manner) than field-independent (FID) children on SOCIAL tasks.

The data arising from the study was then used to examine each of the assumptions in respect of the two classifications of the sample by means of the CHILDREN'S EMBEDDED FIGURES TEST (CEFT) which was collected for each subject of the sample at the first testing.

The median score for each of the four CEFT testings was calculated for the entire sample. This score was 11 for testing one.

Subjects were classified as field-dependent (FD) if they scored below 12 on the CEFT and field-independent (FID) if they scored 12 or higher. The median CEFT score for the second testing was 13, for the third testing was 17 and for the fourth testing was 21.

Daniel (1978) writes that in non-parametric statistical analysis, a parameter of considerable interest is the population median. This parameter, in non-parametric analysis, frequently replaces the population mean as the preferred measure of location of central tendency. This measure of central tendency has been used by researchers in earlier studies of field-independence (Fleck, 1972; Zoccolotti and Oltman, 1978; Huteau, 1980). Thus it was thought appropriate to classify the subjects of this study by means of the median score as either field-dependent (FD) or field-independent (FID) in order to study the relationship between cognitive style and performance on Piagetian conservation tasks.

As a result of the initial administration of the CHILDREN'S EMBEDDED FIGURES TEST, the total sample of 64 subjects was subdivided into the group of 34 subjects scoring 11 and below (median score) on

the CEFT who were categorized as field-dependent (FD) and 30 subjects scoring 12 or above on the CEFT who were classified as field-independent (FID). This classification was adhered to for all further analyses and discussions whenever the dichotomous classification of subjects is considered. Table 9, page 141, shows the division of male subjects into FD and FID categories and also shows total Piagetian and CEFT scores for the five testings. Table 9a, page 142, gives the same information for the girls.

SUBJECTS FD(MEDIAN)	PIAGETIAN TOTALS/TESTINGS					CEFT SCORES/TESTINGS					SUBJECT FID(MEDIAN)	PIAGETIAN TOTALS/TESTINGS					CEFT SCORES/TESTINGS				
	1	2	3	4	5	1	2	3	4	5		1	2	3	4	5	1	2	3	4	5
SCHOOL A											SCHOOL A										
1	19		25	23		11		15	15		1		18					12			
2											2	16	18	22	23	26	20	21	21	24	23
3	16	19	16			5	10	10			3				17				21		
4	17	18	17			4	8	13			4				17	23			21	20	
5	13	15	18			8	9	11			5										
6											6	14	18	14	16	24	18	12	22	22	20
7											7	17	17	21	24		13	14	21	22	
8	17	21		20		6	6	1	18		8			21					19		
9				16	22				19	17	9	15	15	13			13	13	20		
10	10	13	12	18		9	10	15	19		10				15						20
11	7	11	10	14		7	9	12	11		11										
12		13	17	16			7	15	10		12										
13		18	24				10	14			13	13					18				
14	14		11			7		11			14	15			26		12			21	
													11		10			14		20	
SCHOOL B/2											SCHOOL B/2										
29											29	17	22	24	23		19	22	21	25	
30											30	22	27				13	20			
31		27					8				31	22		26	19		13		19	21	
32		16	16				11	14			32	19			15		12			21	
33			17	20				13	17		33	10					17				
34	13		21	22		8		12	11		34		19					16			
35											35	10		17	28		16	19	21	24	
36	14					7					36		20	22	26		16	19	21	24	
37	15	16	15			6	11	12			37				19			13	22	21	
38	21					11					38		14	25	26					22	
39			20					13			39	10	23		22			19	23	23	
40											40	14	13	15	18		14	13		23	
41											41	19	25	24	28		17	16	23	21	
42											42	11	16	11	10		12	20	20	22	
																	15	19	21	23	
SCHOOL B/1											SCHOOL B/1										
53	9		8			11		12			53		9					12			
54		14	19				10	12			54										
55											55	11		20			15	25	23		
56											56		11	24				12	18		
57	18					10					57										
58	14	10	9			6	11	9			58	8	17	16			12	18	21		
59											59			12	18			16	18		
60	15					11					60	15	22	24			21	23	23		
61		18					8				61	17		28			16		17		
62											62	14	17	18			13	21	23		
63	12		27			9		13			63		20					15			

BOYS PIAGETIAN TOTALS AND CEFT SCORES FOR FIVE TESTINGS BY COGNITIVE STYLE AND SCHOOL

(Cognitive Style, FD or FID, classified by use of median score for each testing)

TABLE 9

SUBJECTS FD(MEDIAN)	PIAGETIAN TOTALS/TESTINGS					CEFT SCORES/TESTINGS					SUBJECTS FID(MEDIAN)	PIAGETIAN TOTALS/TESTINGS					CEFT SCORES/TESTINGS				
	1	2	3	4	5	1	2	3	4	5		1	2	3	4	5	1	2	3	4	5
SCHOOL A											SCHOOL A										
15	13		17	22		10		15	16		15		20				19				
16	12	13	12	15		4	7	12	12		16										
17		20	15				11	12			17	10			19		14			20	
18		21	15	13			10	12	14		18	17					17				
19	13			18		11			16		19		11	15			15	18			
20	10		11	12		5		14	12		20		9				17				
21	17					9					21		21	21	27		14	23	21		
22			13					14			22	15	13		13		21	12		21	
23											23	17	21	20	21	28	12	19	22	24	25
24	14		19	20	19	8		10	16	19	24		17				15				
25	11	11	14			11	9	14			25				11				21		
26	15	15	21			11	7	11			26				25				20		
27	12	16		27		3	7		18		27			15		22		21		23	
28	10	11	11	10		7	11	8	15		28					18				21	
SCHOOL B											SCHOOL B										
43						6	8	9	16		43	15	19	18	21		15	18	22	23	
44	9	19	11	18		11	11				44										
45	17	23									45			21	26				24	24	
46											46	20	28	23	27		12	23	20	25	
47											47	14	13	18	14		15	17	19	20	
48	12					6					48		13	11	17			12	17	20	
49											49	22	22	26	25		16	14	20	22	
50	12					4					50		27	28	27			12	22	22	
51			11	9				9	10		51										
52	7			19		9			18		52		23	20				15	20		
64	21	14	25			10	5	13			64										
65		11					9				65	10		13			14		19		

GIRLS PIAGETIAN TOTALS AND CEFT SCORES FOR FIVE TESTINGS BY COGNITIVE STYLE AND SCHOOL

(Cognitive Style, FD or FID, classified by use of median score for each testing)

TABLE 9a

ANALYSIS - TWO-WAY CLASSIFICATION OF SAMPLE
HYPOTHESIS I

The first sub-hypothesis was:

"Children assessed as field-independent (FID) will achieve higher scores overall on individual Piagetian task scores than field-dependent (FD) children."

In order to test this hypothesis the Kruskal-Wallis One-Way Analysis of Variance was applied to the six individual task scores of all subjects for the four testings. This instrument is reported as suitable for assessing significant differences when more than one comparison is made among the means of various groups. It is also appropriate for ordinal data. Results of this analysis are shown in Table 11 on the following page, page 146.

Examination of Table 11 indicates that at the first testing, the Kruskal-Wallis One-Way Analysis of Variance showed a significant difference ($P = 0.0291$) between the mean ranks for the fourth Piagetian task of the battery. This fourth task was concerned with conservation of area (outside a closed perimeter) and the mean rank for the subjects ($N = 33$) classified as field-dependent (FD) was 27.42 while that of the field-independent (FID) subjects ($N = 30$) was 37.03.

In the second testing, two instances of significant difference appear as a result of the Kruskal-Wallis analysis. The first is task 4 (conservation of area) as in the first testing where the mean rank for the field-dependent children was 26.82 and that of the field-independent (FID) 38.07. This result was statistically significant ($P = 0.0133$). The second instance occurred for the fifth Piagetian task (conservation of horizontal/vertical co-ordinates - or water-in-the-jar task) where the mean rank for the task as achieved by the field-dependent (FD) children was 27.65 and that of the field-independent (FID) 37.10 ($P = 0.0276$).

KRUSKAL-WALLIS ONE-WAY ANALYSIS OF VARIANCE - INDIVIDUAL PIAGETIAN TASK
SCORES BY COGNITIVE STYLE FOR FOUR TESTINGS - TWO-WAY CLASSIFICATION

FIRST TESTING N = 63						
Task	Mean	STD	FD (N = 33) Mean Rank	FID (N = 30) Mean Rank	Chi Square	p
1	1.667	1.513	29.00	35.30	2.1526	0.1423
2	3.175	1.476	29.89	34.32	0.9777	0.3228
3	1.730	1.110	30.53	33.62	0.5594	0.4545
4	2.016	1.362	27.42	37.03	4.7589	0.0291*
5	2.921	0.747	28.82	35.50	2.6606	0.1029
6	3.016	1.465	34.18	29.60	1.1030	0.2936
SECOND TESTING N = 63						
1	2.619	2.210	29.66	34.74	1.3800	0.2401
2	3.905	1.729	30.37	33.91	0.6250	0.4292
3	2.492	2.094	28.93	35.60	2.2978	0.1296
4	3.048	2.051	26.82	38.07	6.1338	0.0133*
5	3.413	1.520	27.65	37.10	4.8552	0.0276*
6	3.397	1.836	28.63	35.95	2.6250	0.1052
THIRD TESTING N = 63						
1	2.937	2.078	30.15	34.17	0.8811	0.3479
2	3.556	1.721	32.04	31.95	0.0005	0.9827
3	2.063	1.839	29.01	35.50	3.1090	0.0779
4	2.968	1.926	28.37	36.26	3.2106	0.0732
5	3.238	1.058	29.81	34.57	1.2768	0.2585
6	3.730	1.405	32.38	31.55	0.0345	0.8527
FOURTH TESTING N = 52						
1	3.615	2.198	23.55	29.94	2.9476	0.0860
2	3.692	1.462	27.88	24.90	0.5495	0.4585
3	2.481	1.925	26.70	26.27	0.0112	0.9157
4	3.577	1.903	25.79	27.33	0.1433	0.7050
5	3.404	1.361	25.32	27.88	0.4437	0.5053
6	3.885	1.308	27.95	24.81	0.6041	0.4370

TABLE 10

These significant cases are summarized in the following table:

TWO-WAY CLASSIFICATION OF SAMPLE FID SUBJECTS ACHIEVE SIGNIFICANTLY HIGHER MEAN RANK SCORES ON INDIVIDUAL PIAGETIAN TASKS THAN FD SUBJECTS						
Testing	Task	N	FD - Mean Rank	N	FID - Mean Rank	P
1	4	33	27.42	30	37.03	0.0291*
2	4	33	26.82	30	38.07	0.0133*
2	5	33	27.65	30	37.19	0.0276*

Table 10a

Thus these analyses allowed acceptance of the hypothesis which stated that children assessed as field-independent (FID) would achieve higher scores on individual Piagetian task scores than field-dependent (FD) children for three of the task analyses of the total of twenty-four tasks.

A careful visual observation of the mean rank scores for both the field-dependent (FD) and field-independent (FID) groups (see Table 10, page 144) shows that higher mean rank scores for the individual tasks were achieved by the field-independent (FID) children in eighteen of the twenty-four analyses. However, only three of these comparisons, as stated earlier, were statistically significant.

The field-dependent (FD) children scored higher on the individual tasks than the field-independent (FID) in the other six instances. The field-dependent (FD) children scored higher in the sixth task (conservation of horizontal/vertical co-ordinates - drawing house and trees on hill) of the first testing, the second task (conservation of length - length of lines and coincidence of their extremities) and sixth task (conservation of horizontal/vertical co-ordinates - drawing house and trees on hill) and the second, third (conservation of area) and sixth tasks in the fourth testing. It should be emphasised, however, that in three of these six cases the mean ranks differ by less than one point.

These cases are summarized in the following table:

FD SUBJECTS ACHIEVE HIGHER MEAN RANK SCORES ON INDIVIDUAL PIAGETIAN TASKS THAN FID SUBJECTS - TWO-WAY CLASSIFICATION					
TESTING	TASK	N	MEAN RANK - FD	N	MEAN RANK FID
1	6	33	34.18	30	29.60
3	2	33	32.04	30	31.95
3	6	33	32.38	30	31.55
4	2	27	27.88	22	24.90
4	3	27	26.70	22	26.27
4	6	27	27.95	22	24.81

Table 11

It is interesting to note the pattern of repetition of tasks 6 and 2 over the testings. Reference will be made to this later in the study.

It is felt that the overall pattern of achievement - comparing the rank means of all 24 cases does give limited support to the hypothesis that field-independent (FID) subjects will achieve higher scores on individual Piagetian tasks than will field-dependent (FD) subjects.

The second sub-hypothesis to be considered stated that:

"Children assessed as field-independent (FID) will achieve higher scores overall on total Piagetian task scores for each testing than field-dependent (FD) children."

Support for this hypothesis is evident in the second testing of the sample where the Kruskal-Wallis One-Way Analysis of Variance shows the mean rank for the field-dependent (FD) group as 24.95 (N = 33) and that of the field-independent (FID) as 37.28. The difference between the mean ranks of the two groups is in favour of the FID group and is statistically significant ($p = 0.0064$). A further Kruskal-Wallis analysis of the sample classified by sex as well as cognitive style shows that in

this second testing the difference between mean ranks is significant for the boys section of the sample ($P = 0.0252$) but not for the girls. As cited earlier in the Review of Literature, page 10, Satterly (1976) chose a sample of males only, as numerous studies have demonstrated sex differences in factorial patterns which emerge from batteries of cognitive style and achievement tests (Bieri et al, 1958; Jackson et al; 1964). Conversely, Frank and Davis (1982) have reported on the effect of field-independent match or mismatch on a communication task in which the sample used was 298 female university undergraduates.

KRUSKAL-WALLIS ONE-WAY ANALYSIS OF VARIANCE - PIAGETIAN TOTAL SCORES									
Testing	N	Mean	STD	MEAN N	RANK FD	MEAN N	RANK FID	CHI SQUARE	SIGNI- FICANCE
1	64	14.266	3.76	34	29.37	30	36.05	2.0529	0.1500
2	61	17.033	4.95	33	24.95	28	37.28	7.4430	0.0064 *
3	64	17.841	5.184	36	28.93	28	35.60	2.0879	0.1485
4	50	19.163	5.332	27	24.02	23	26.20	0.2848	0.5936
BOYS									
1	38	14.553	3.725	17	18.97	21	19.93	0.0706	0.7905
2	36	17.028	4.539	18	14.58	18	22.42	5.0120	0.0252 *
3	38	18.553	5.285	18	18.17	20	20.70	0.4949	0.4818
4	26	19.846	4.994	11	12.77	15	14.03	0.1735	0.6770
GIRLS									
1	26	13.846	3.844	17	11.68	9	16.94	2.8234	0.0929
2	25	17.241	5.309	15	11.27	10	15.60	2.1018	0.1471
3	26	17.077	5.043	18	13.00	8	14.63	0.2532	0.6148
4	24	19.000	5.927	16	12.34	8	12.81	0.0236	0.8779

Table 12

Table 12 shows means, mean ranks, Chi Square and significance for

this Kruskal-Wallis analysis of the Piagetian total scores for the four testings. Visual examination of this table shows that the mean rank scores for the field-independent (FID) subjects were higher than those of the field-dependent (FD) subjects in all of the testings, although statistically significant in one testing only. Thus as stated in Hypothesis Ia, some limited support is given to the hypothesis that field-independent subjects may achieve higher scores on the battery of Piagetian tasks than will the field-dependent (FD) subjects.

The third sub-hypothesis stated that:

"Children assessed as field-independent (FID) will achieve higher scores on the British Ability Scale than field-dependent (FD) children."

The scale used in this instance was the British Ability Block Design test. Each child's performance was timed for the individual items of the test. Subjects, however, were allowed as much time as needed to complete a design. Two scores were then given for each item of the test - an untimed score or ABILITY SCORE - BAS 1; and credit was also given if the child achieved the item within the time set for a particular age range, POWER SCORE - BAS 2. These two raw scores were then further adjusted for the specific age of the child. These two sets of adjusted data from the first administration of this instrument were used in the Kruskal-Wallis analysis and results are shown in the table below.

KRUSKAL-WALLIS ONE-WAY ANALYSIS OF VARIANCE - BRITISH ABILITY SCALE TWO-WAY CLASSIFICATION OF SAMPLE							
VARIABLE	N	MEAN	STD	MEAN RANK N = FD	MEAN RANK N = FID	CHI SQUARE	P
BAS 1	63	44.333	17.345	27.67	36.77	3.9525	0.0468 *
BAS 2	63	29.175	16.475	29.52	34.73	1.3181	0.2509

Table 13

This third sub-hypothesis of HYPOTHESIS I is supported at the 0.0468 level of significance by the results shown for the untimed ABILITY score - BAS 1, but not for the timed POWER test - BAS 2. However, the mean rank of the FID section of the sample is higher than that of the FD section for both ABILITY and POWER tests.

HYPOTHESIS II

The second HYPOTHESIS stated that in further administrations of the Piagetian battery, children initially classified as field-independent (FID) by means of Witkin et al (1971) CHILDREN'S EMBEDDED FIGURES TEST (CEFT), will show fewer regressions on their Piagetian test scores than will field-dependent (FD) children. This hypothesis was concerned with the stability and consistency of the children's performance on the Piagetian tasks over the four testings and aimed to investigate if a relationship might exist between these factors of stability and consistency of performance and field-independence.

This hypothesis is further specified as:

"Children assessed as field-independent (FID) will show fewer regressions on individual Piagetian task scores than field-dependent (FD) children."

and,

"Children assessed as field-independent (FID) will show fewer regressions on total Piagetian scores from testing to testing than field-dependent (FD) children."

Table 14 shows the number of regression scores tallied for the individual Piagetian task scores for field-dependent (FD) and for field-independent (FID) subjects over the four testings grouped in the two-way classification.

An examination of these figures over the four testings shows that there are only slight variations in the number of regressions scored by the field-independent (FID) children when compared with those scored

TABLE OF REGRESSIONS - TOTALLED FOR INDIVIDUAL PIAGETIAN TASK SCORES BY COGNITIVE STYLE
AND SEX OVER THE FOUR TESTINGS - TWO-WAY CLASSIFICATION OF SAMPLE

TESTING 1 - 2								TESTING 2 - 3								TESTING 3 - 4							
Task	1	2	3	4	5	6	Totals	1	2	3	4	5	6	Totals	1	2	3	4	5	6	Totals		
FD Boys (N = 18)	6	7	3	3	5	4	28	(N=18)	2	6	5	4	2	1	20	(N=11)	1	5	1	2	3	2	14
FD Girls (N = 17)	1	4	7	3	3	5	23	(N=17)	2	4	6	2	4	3	21	(N=15)	1	6	0	1	3	2	13
FD Totals (N = 35)							51	(N = 35)							41	(N = 26)							27
FID Boys (N = 21)	5	4	7	4	2	1	23	(N=21)	2	6	5	5	3	5	26	(N=16)	0	6	3	4	2	3	18
FID Girls (N = 9)	1	4	1	1	2	5	14	(N= 9)	2	3	3	1	2	4	15	(N= 8)	1	3	2	1	5	2	14
FID TOTALS (N = 30)							37	(N = 30)							41	(N = 24)							32
TOTAL REGRESSIONS - FD Subjects 119								TOTAL REGRESSIONS - FID Subjects 110															

TABLE 14

by the field-dependent (FD), The FID children scored a total of 110 regressions while the FD children scored 119. This result is surprising especially when the sample size of the groups is considered. The FID group contained 30 subjects for testings 1, 2, and 3 and 24 children for testing 4. The field-dependent (FD) group contained 35 subjects for testings 1, 2 and 3; 26 children for testing 4. The size of the sample was reduced to fifty at the fourth testing as it was only possible to administer the battery of test instruments to the first section of the sample ($N_1 = 15$) on three occasions (at the three month interval) before they moved on to another teacher and a different system of class organisation.

Witkin and his colleagues (1974) stated that it is their view that style of cognitive functioning refers to a process of information exchange between the individual and his environment. The person considered to perceive in the analytical or field-independent style experiences items as separate or discrete from their background and is able to overcome the influence of an embedding context. This characteristic of field-independent persons has been related by other researchers (Huteau 1980, Bowd 1977, Case and Pascual-Leone 1975) to Piagetian measures of cognitive development. As a result of these and other studies, it has been suggested that field-independent subjects will succeed better than field-dependent persons on those conservation tasks and other Piagetian tasks which depend upon spatial representations (Huteau 1980).

In light of this research (which has been discussed in more detail in Chapter IV, "The Relationship of Notions of Piaget and Witkin"), it seemed logical to hypothesize that field-independent children would achieve understanding of Piagetian conservation tasks prior to field-dependent children and hence that field-independent (FID) children would maintain a pattern of stability in their responses to the tasks over the four testings in advance of the field-dependent children.

However, as in Hypothesis IIa, a Kruskal-Wallis analysis of the data showed no statistical significant difference in the regression scores (mean rank for FID subjects was 2.83 and for FD subjects 4.16) and this hypothesis cannot be accepted. It would appear in this study that cognitive style is unrelated to children's stability of performance on individual Piagetian conservation tasks.

Hypothesis IIb stated that:

"Children assessed as field-independent (FID) will show fewer regressions on total Piagetian scores from testing to testing than field-dependent (FD) children."

Results similar to those given above for Hypothesis IIa appeared when the regression scores were tallied and analysed. A total of 55 regressions was counted over the four testings of the sample. Thirty-one of these were attributed to the field-dependent (FD) subjects (N = 35) and twenty-four to the field-independent (FID) subjects (N = 30). No statistical significance resulted from a Kruskal-Wallis analysis (mean rank for FID subjects was 4.000 and for FD subjects 3,000) and hence no support was shown for the hypothesis that field-independent (FID) subjects would score fewer regressions on Piagetian total scores than field-dependent (FD) subjects.

Table 15 shows the tallied results of regressions for the Piagetian battery of scores over the four testings by sex and cognitive style.

TABLE OF REGRESSIONS - TOTALLED FOR PIAGETIAN TASK TOTAL SCORES BY
COGNITIVE STYLE AND SEX OVER THE FOUR TESTINGS
TWO-WAY CLASSIFICATION OF SAMPLE

Testing	1 - 2	2 - 3	3 - 4	Total
FD Boys (N = 18)	6	7	(N = 11) 3	16
FD Girls (N = 17)	3	7	(N = 15) 5	15
FD Totals (N = 35)	9	14	(N = 26) 8	31 —
FID Boys (N = 21)	2	7	(N = 16) 5	14
FID Girls (N = 9)	2	5	(N = 8) 3	10
FID TOTALS (N = 30)	4	12	(N = 24) 8	24 —
TOTAL REGRESSIONS FD Subjects - 31				
TOTAL REGRESSIONS FID Subjects - 24				

TABLE 15

HYPOTHESIS III

The third HYPOTHESIS stated that:

"As Piagetian tasks are organised in relation to style of presentation, as either IMPERSONAL or SOCIAL, it is hypothesized that field-independent (FID) children may score higher on tasks presented in an IMPERSONAL manner while children classified as field-dependent (FD) may score higher on those tasks presented in a SOCIAL manner."

Witkin et al (1977) suggest that there are educational implications related to mode of presentation of learning situations and individual's cognitive style. Recent studies reviewed by Messick (1982) support this aspect of the Witkin theory of differentiation and these notions have been discussed in earlier sections of this study (See Chapter II, "Psychological Differentiation Theory" and Chapter IV, "Methodology", page 124). The grouping of the Piagetian tasks and details concerning the style of presentation were outlined in these sections.

Briefly, the Piagetian battery of six tasks consisted of two conservation tasks reported as assessment instruments for understanding of the mathematical concepts of length, area and horizontal/vertical co-ordinates. One task in each unit was presented in the IMPERSONAL manner and the other in the SOCIAL manner. Witkin et al (1974) suggest that field-dependent (FD) subjects may prefer information presented in a SOCIAL manner and thereby process such information more easily. Field-independent (FID) subjects are thought to process and prefer information of an abstract or IMPERSONAL character.

The justification for this grouping of Piagetian tasks and the relationship between manner of presentation and Witkin's theory of cognitive style were presented in Chapter IV, page 115.

In order to test this third HYPOTHESIS, a factor 'D' was calculated for each individual subject for each of the four testings in the following manner. The three Piagetian tasks administered in the IMPERSONAL manner were summed and the scores of the three SOCIAL tasks

were summed and then subtracted from the summed IMPERSONAL scores.

That is,

$$(PT_1 + PT_3 + PT_5) - (PT_2 + PT_4 + PT_6) = D$$

If the subject scored higher on the IMPERSONAL battery of tasks, his/her score would be a positive value. If the subject scored higher on the SOCIAL tasks, the value of D would be negative. The results of this calculation for factor D are shown in Table 16 which follows.

Results of this table were considered in respect of the third HYPOTHESIS which was further specified as:

"As Piagetian tasks are organised in relation to style of presentation, as either IMPERSONAL or SOCIAL, it is hypothesised that field-independent (FID) subjects may score higher on tasks presented in an IMPERSONAL manner than will field-dependent (FD) children."

and,

"As Piagetian tasks are organized in relation to style of presentation as either IMPERSONAL or SOCIAL, it is hypothesized that field-dependent (FD) children may score higher on tasks presented in a SOCIAL manner than will field-independent (FID) children."

When the data was analysed using a 't' test for related samples (Clegg 1982) for the first sub-hypothesis, results ($p < 0.05$ for a one-tailed test, $N = 4$, $T = 1.093$) were not significant and no support could be given to the hypothesis which stated that field-independent (FID) children would score higher on IMPERSONAL tasks than would field-dependent (FD) children.

However, when this two-way classification of the data was analysed using the same 't' test for related samples (Clegg 1982, suggests that this statistical measure is appropriate for use with samples which are normally distributed, variances are similar to each other, and the samples comprise scores of at least interval measurement) the results for the second sub-hypothesis that field-dependent (FD) children may score higher on tasks presented in a SOCIAL manner than will field-independent (FID) children were significant. The null hypothesis was

TABULATION OF FACTOR 'D' BY COGNITIVE STYLE AND SEX FOR FOUR TESTINGS - TWO-WAY CLASSIFICATION

	TESTING	FD BOYS (N = 18)	FD GIRLS (N = 17)	FD TOTAL (N = 35)	FID BOYS (N = 21)	FID GIRLS (N = 9)	FID TOTAL (N = 30)
Higher on Impersonal Tasks (+D)	1	6	4	10	7	2	9
Higher on Social Tasks (-D)	1	10	9	19	12	7	19
Scored Same (D = 0)	1	2	4	6	2	0	2
Higher on Impersonal Tasks (+D)	2	(N = 19) 3	(N = 16) 2	(N = 35) 5	(N = 17) 2	(N = 9) 2	(N = 26) 4
Higher on Social Tasks (-D)	2	15	13	28	11	7	18
Scored Same (D = 0)	2	1	1	2	4	0	4
Higher on Impersonal Tasks (+D)	3	(N = 18) 3	(N = 16) 2	(N = 34) 5	(N = 20) 6	(N = 9) 3	(N = 29) 9
Higher on Social Tasks (-D)	3	15	13	28	13	5	18
Scored Same (D = 0)	3	0	1	1	1	1	2
Higher on Impersonal Tasks (+D)	4	(N = 11) 0	(N = 15) 1	(N = 26) 1	(N = 16) 5	(N = 8) 1	(N = 24) 6
Higher on Social Tasks (-D)	4	7	11	18	6	7	13
Scored Same (D = 0)	4	4	4	8	4	0	4

TABLE 16

rejected ($p \leq 0.05$ for a one-tailed test, $N = 4$, $T = 2.61$) and the sub-hypothesis that field-dependent (FD) children would score higher on SOCIAL tasks than field-independent (FID) children was confirmed over the four testings.

An inspection of the raw data given in Table 16, page 156, showing the tallies of factor 'D' over the four testings illustrates that the numerical differences between the tallies for the FD subjects and the FID subjects became more disparate over the four testings. Initially FD and FID subjects showed the same number of negative 'D' values (subject scores higher on tasks presented in a SOCIAL manner) at the first testing. Account must be taken, however, of the number of FD subjects ($N = 35$) compared with FID subjects ($N = 30$) in relation to the total sample of 65 subjects. At the second testing, the FD subjects ($N = 35$) showed 38 negative 'D' values; FID subjects ($N = 30$) showed 18. The same set of figures appeared at the third testing and the composition of the sample as regards FD and FID subjects also remained the same. At the fourth testing (when the sample size diminished) the FD subjects ($N = 26$) tallied a total of 18 negative 'D' values while FID subjects ($N = 24$) yielded a total of 13.

ANALYSIS - THREE-WAY CLASSIFICATION OF SAMPLE

HYPOTHESIS I

A second classification of the raw data was also made. Several researchers (Satterly, 1976; Satterly and Telfer, 1979 and Brumby, 1982) have reported a tripartite classification when studying cognitive style. Thus it seemed justifiable to investigate the findings in this classification as well as in the dichotomous classification which is normally used in studies of Witkin's theory of psychological differentiation.

Subjects were assigned into three equal (approximately) groupings by comparing and ranking of the subject's first CHILDREN'S EMBEDDED FIGURES TEST (CEFT) score. These groups were labelled field-dependent (FD), field-independent (FID), and field dependent/field independent (FD/FID). This three-way classification of subjects and resulting grouping of raw data is shown in Table 17, page 159.

The first HYPOTHESIS which stated that children who had been categorized as field-independent (FID) would score higher on individual Piagetian task scores, on Piagetian total scores and on the British Ability Scale tests than would field-dependent (FD) children was further examined in relation to this three-way classification of the sample by applying the Kruskal-Wallis One-Way Analysis of Variance.

Immediately following are Tables 18 and 19 which show the results of the Kruskal-Wallis One-Way Analysis of Variance when the sample was arranged in the three-way classification in respect of Hypothesis Ia which stated that:

"Children assessed as field-independent (FID) will achieve higher scores on individual Piagetian tasks than field-dependent (FD) children."

No significant differences arise from this analysis across the four testings and thus no support is given to the hypothesis that field-independent (FID) subjects will score higher on individual Piagetian

SUBJECT NO.	CEFT FD	PIAGETIAN TOTALS					SUBJECT NO.	CEFT FD-FID	PIAGETIAN TOTALS					SUBJECT NO.	CEFT FID	PIAGETIAN TOTALS				
		1	2	3	4	5			1	2	3	4	5			1	2	3	4	5
BOYS																				
4	4	17	18	17	17	23	1	11	19	18	25	23		7	13	17	17	21	24	
3	5	16	19	16	17		38	11	21	14	25	26		39	14	10	23	20	22	
8	6	17	21	21	20		53	11	9	9	8			42	15	11	16	11	10	
37	6	15	16	15	19		59	11	15	12	18			55	15	11		20		
57	6	14	10	9			13	12	15	18	24	26		35	16	10		17	28	
11	7	7	11	10	14		32	12	19	16	16	15		61	16	17	18	28		
14	7	14	11	11	10		41	12	19	25	24	28		33	17	10		17	20	
36	7	14	20	22	26		58	12	8	17	16			40	17	14	13	15	18	
5	8	13	15	18			9	13	15	15	13	16	22	6	18	14	18	14	16	24
34	8	13	19	21	22		30	13	22	27				12	18	13	13	17	16	
10	9	10	13	12	18	15	31	13	22	27	26	19		29	19	17	22	24	23	
63	9	12	20	27			62	13	14	17	18			2	20	16	18	22	23	26
56	10	18	11	24			54	10	9	14	19			60	21	15	22	24		
GIRLS																				
27	3	12	16	15	27	22	51	9	7		11	9		23	12	17	21	20	21	28
16	4	12	13	12	15		15	10	13	20	17	22		46	12	20	28	23	27	
50	4	12	27	28	27		52	10	19	23	20	19		17	14	10	20	15	19	
20	5	10	9	11	12		64	10	21	14	25			65	14	10	11	13		
44	6	9	19	11	18		19	11	13	11	15	18		43	15	15	19	18	21	
48	6	12	13	11	17		25	11	11	11	14	11		47	15	14	13	18	14	
28	7	10	11	11	10	18	26	11	15	15	21	25		49	16	22	26	25		
24	8	14	17	19	20	19	45	11	17	23	21	26		18	17	17	21	15	13	
21	9	17	21	21	27									22	21	15	13	13	13	

PIAGETIAN TOTAL AND CEFT SCORES FOR FIVE TESTINGS BY COGNITIVE STYLE AND SEX - THREE-WAY CLASSIFICATION

TABLE 17

KRUSKAL-WALLIS ONE-WAY ANALYSIS OF VARIANCE - INDIVIDUAL PIAGETIAN
TASK SCORES FOR TOTAL SAMPLE BY COGNITIVE STYLE - 3-WAY CLASSIFICATION

FIRST TESTING N = 64					
Task	FD (N = 22) Mean Rank	FD/FID (N = 20) Mean Rank	FID (N = 22) Mean Rank	Chi Square	p
1	27.45	38.17	32.39	4.0054	0.1350
2	34.25	34.15	29.25	1.0886	0.5802
3	27.91	37.50	32.55	3.5128	0.1727
4	28.61	34.08	34.95	1.6411	0.4402
5	28.43	35.95	33.43	2.2549	0.3239
6	32.05	32.20	33.23	0.0580	0.9714
SECOND TESTING N = 64					
1	26.68	35.38	35.70	3.7860	0.1506
2	33.36	28.15	35.59	1.8614	0.3943
3	29.55	32.70	35.27	1.1616	0.5594
4	26.66	33.30	37.61	4.0264	0.1336
5	27.39	35.58	34.82	2.9504	0.2287
6	27.70	34.20	35.75	2.4169	0.2987
THIRD TESTING N = 64					
1	28.91	33.88	34.84	1.4891	0.4749
2	31.18	36.00	30.64	1.1348	0.5670
3	28.93	35.13	33.68	2.0756	0.3542
4	27.36	35.63	34.80	2.8530	0.2402
5	28.43	34.15	35.07	1.9537	0.3765
6	33.98	34.83	28.91	1.3640	0.5056
FOURTH TESTING N = 50					
1	28.09	35.95	33.77	2.3241	0.3129
2	30.77	35.95	31.09	1.0652	0.5871
3	31.55	36.92	29.43	1.8964	0.3874
4	29.91	36.55	31.41	1.5118	0.4696
5	28.68	35.45	33.64	1.6829	0.4311
6	33.84	34.70	29.16	1.1646	0.5586

TABLE 18

tasks than will field-dependent (FD) subjects when the sample was examined in the tripartite classification.

Although Table 19 shows the Kruskal-Wallis analysis for the total sample, the analysis was also done by sex for each of the four testings and the mean ranks for each of the three cognitive style groupings (FD, FID and FD/FID) were calculated for 48 instances. However, no statistically significant case at even the lowest (0.05) level of significance arose to support the hypothesis; nor did the pattern of relationship of mean ranks appear (that is, higher mean ranks were achieved by FID subjects across the testings) as it did in the analysis conducted on the sample organised in the dichotomous classification. The analysis by sex for the testings is available by request.

The second sub-hypothesis of HYPOTHESIS I was concerned with the achievement of field-independent (FID) children in regard to the total Piagetian scores for the battery of tasks over the four testings. Results of the Kruskal-Wallis One-Way Analysis of Variance are given below.

TESTING	N	MEAN RANK FD N = 22	MEAN RANK FD/FID N = 20	MEAN RANK FID N = 22	CHI SQUARE	P
1	64	26.86	38.00	33.14	3.8231	0.1478
2	64	30.82	31.45	35.14	0.6881	0.7089
3	64	33.98	33.85	35.80	2.1033	0.3494
4	64	32.95	30.92	33.48	0.2190	0.8963

Table 19

No support was given to this hypothesis when the tripartite classification of the sample was analyzed. Nor was support shown when the sample was grouped by sex and further analyzed. Thus this second sub-hypothesis of HYPOTHESIS I that:

"Children assessed as field-independent (FID) will achieve higher scores overall on total Piagetian task scores for each testing than field-dependent (FD) children."

could not be accepted. An examination of the mean ranks for each of the three groups of the sample shows a difference at the first testing between the mean ranks which favours the middle group of the sample. After this first testing, however, the field-independent (FID) group do achieve the highest mean rank score of the three groups. However, as stated earlier, the difference in favour of this FID group is not large enough to warrant any consideration.

The third and final sub-hypothesis of HYPOTHESIS I was concerned with the theory that field-independent (FID) children would achieve higher scores than field-dependent (FD) children in relation to the sample's scores on the British Ability Scale. As referred to earlier, two scores were obtained for each subject, the ABILITY SCORE - BAS 1 and the POWER SCORE - BAS 2. The Kruskal-Wallis analysis showed a significant difference between the scores of the three groups of children for the ABILITY - BAS 1 test. Results are shown in the table below.

TESTING	N	MEAN RANK FD N = 22	MEAN RANK FD/FID N = 20	MEAN RANK FID N = 22	CHI SQUARE	P
1	64	24.70	37.45	35.80	6.0603	0.0483*
2	64	28.32	34.25	35.09	1.7726	0.4122

Table 20

The result of this analysis shows a significant ($P = 0.0483$, $N = 64$) difference for the ABILITY - BAS 1 scores. The highest mean rank score was achieved by the middle group of subjects - those classified as field-dependent/field-independent (FD/FID). Using a multiple comparison procedure for the Kruskal-Wallis (Daniel, 1978, page 211) we can conclude

that the field-dependent/field-independent (FD/FID) subjects scored higher on the ABILITY - BAS 1 test overall than did either the field-dependent (FD) or the field-independent (FID) subjects. Thus, the sub-hypothesis of HYPOTHESIS I, children who have been classified as field-independent (FID) subjects will achieve higher scores on the British Ability Scale, is not supported.

HYPOTHESIS II

In order to investigate the second HYPOTHESIS under the tri-partite classification the same procedure was followed as was done for the two-way classification of the sample. Thus, regression scores were tallied for both the individual Piagetian task and total task scores for the Piagetian battery of the six tasks. The data is shown in Table 21, page 164 and Table 22, page 165.

Statistical analysis of this information gave results similar to those of the analysis of the two-way classification of regression tallies in that no significant support was given for the sub-hypothesis of HYPOTHESIS II which stated that:

"Children assessed as field-independent (FID) will show fewer regressions on total Piagetian scores from testing to testing than field-dependent (FD) children."

When the regression scores for the Piagetian totals for testings 1-2, 2-3 and 3-4 were analysed by use of the Kruskal-Wallis One-Way Analysis of Variance, the results were again in line with those given above for the first sub-hypothesis. The mean ranks were 4.5 for the field-dependent (FD) group, 5.6 for the field-dependent/field-independent (FD/FID) group and 4.8 for the field-independent (FID) group. The results were not significant at level $p > 0.05$, $H = 0.288$, $df = 2$.

Results of these Kruskal-Wallis analysis suggest that stability of scores on Piagetian tasks as achieved by the subjects of this study when analysed in the tri-partite classification are unrelated to cognitive style.

TABLE OF REGRESSIONS - TOTALLED FOR INDIVIDUAL PIAGETIAN TASK SCORES BY COGNITIVE
STYLE AND SEX OVER THE FOUR TESTINGS - THREE-WAY CLASSIFICATION OF SAMPLE

TESTING 1 - 2								TESTING 2 - 3								TESTING 3 - 4							
Task	1	2	3	4	5	6	Totals	1	2	3	4	5	6	Totals	1	2	3	4	5	6	Totals		
FD Boys (N = 13)	4	4	2	1	3	2	16	2	5	5	4	2	1	19	0	5	0	2	3	1	11		
FD Girls (N = 9)	0	3	4	1	2	3	13	0	3	4	2	2	3	14	0	2	0	1	1	1	5		
FD Total (N = 22)	4	7	6	2	5	5	29	2	8	9	6	4	4	33	0	7	0	3	4	2	16		
FD/FID Boys (N = 12)	4	5	4	3	1	2	19	1	3	2	2	3	0	11	1	3	1	1	1	3	10		
FD/FID Girls (N = 8)	1	1	4	3	2	2	13	2	1	2	0	1	0	6	1	4	0	0	3	1	9		
FD/FID Total (N = 20)	5	6	8	6	3	4	32	3	4	4	2	4	0	17	2	7	1	1	4	4	19		
FID Boys (N = 13)	3	2	4	2	2	1	14	1	4	3	3	1	5	17	0	3	3	3	1	1	11		
FID Girls (N = 9)	1	4	0	1	2	5	13	2	3	3	1	2	4	15	1	3	2	1	4	2	13		
FID Totals (N = 22)	4	6	4	3	4	6	27	3	7	6	4	3	9	32	1	6	5	4	5	3	23		

TABLE 21

TABLE OF REGRESSIONS - TOTALLED FOR PIAGETIAN TASK TOTAL SCORES BY
COGNITIVE STYLE AND SEX OVER THE FOUR TESTINGS
THREE-WAY CLASSIFICATION OF SAMPLE

Testing	1 - 2	2 - 3	3 - 4	Total
FD Boys (N = 13)	2	6	2	10
FD Girls (N = 9)	1	4	2	7
FD Totals (N = 22)	3	10	4	17
FD/FID Boys (N = 12)	4	5	3	12
FD/FID Girls (N = 8)	2	3	3	8
FD/FID Totals (N = 20)	6	8	6	20
FID Boys (N = 13)	1	4	3	8
FID Girls (N = 9)	2	5	3	10
FID Totals (N = 22)	3	9	6	18

TOTAL REGRESSIONS FD Subjects - 17

TOTAL REGRESSIONS FD/FID Subjects - 20

TOTAL REGRESSIONS FID Subjects - 18

TABLE 22

HYPOTHESIS III

The third HYPOTHESIS stated:

"As Piagetian tasks are organised in relation to style of administration, as either IMPERSONAL or SOCIAL, it is hypothesized that field-independent (FID) children may score higher on tasks presented in an IMPERSONAL manner while children classified as field-dependent (FD) may score higher on those presented in a SOCIAL manner."

As described earlier in this paper, page 154, a factor 'D' was calculated for each individual subject for each of the four testings. Briefly, the three Piagetian tasks which had been organised and presented in the IMPERSONAL manner were summed as were the scores of the three tasks which had been classified as SOCIAL. The SOCIAL summation score was subtracted from the IMPERSONAL summed score and the result was termed factor D. That is;

$$(PT_1 + PT_3 + PT_5) - (PT_2 + PT_4 + PT_6) = D$$

Subjects scoring higher on the IMPERSONAL battery of tasks showed a positive D value, while subjects scoring higher on the summed SOCIAL tasks showed a negative D value. This information is presented in Table 23, page 167.

The third HYPOTHESIS was specified as two sub-hypothesis. The first sub-hypothesis was:

"As Piagetian tasks are organised in relation to style of presentation, as either IMPERSONAL or SOCIAL, it is hypothesized that field-independent (FID) subjects may score higher on tasks presented in an IMPERSONAL manner than will field-dependent (FD) subjects."

When the Kruskal-Wallis analysis was used to assess the data gathered in relation to the first sub-hypothesis, results were not significant ($p = 0.097$ for a one-tailed test, $N = 4$, $H = 4.6539$). Mean ranks for each of the three groupings were FD subjects, $\bar{R}_1 = 6.25$ ($N = 22$); FD/FID subjects, $\bar{R}_2 = 9.375$ ($N = 21$) and FID subjects, $\bar{R}_3 = 3.875$ ($N = 22$). The multiple comparison procedure showed that Group 2, the FD/FID subjects

	TESTING	FD BOYS (N = 13)	FD GIRLS (N = 9)	FD TOTAL (N = 22)	FD/FID BOYS (N = 12)	FD/FID GIRLS (N = 8)	FD/FID TOTAL (N = 20)	FID BOYS (N = 13)	FID GIRLS (N = 9)	FID TOTAL (N = 22)
Higher on Impersonal Tasks (+D)	1	4	3	7	7	2	9	2	1	3
Higher on Social Tasks (-D)	1	10	6	16	5	7	12	7	3	10
Scored Same (D = 0)	1	2	4	6	1	0	1	1	0	1
Higher on Impersonal Tasks (+D)	2	2	2	4	2	2	4	1	0	1
Higher on Social Tasks (-D)	2	14	10	24	7	6	13	5	4	9
Scored Same (D = 0)	2	0	0	0	3	1	4	2	0	2
Higher on Impersonal Tasks (+D)	3	2	2	4	3	3	6	4	0	4
Higher on Social Tasks (-D)	3	14	10	24	8	4	12	6	4	10
Scored Same (D = 0)	3	0	0	0	1	2	3	0	0	0
Higher on Impersonal Tasks (+D)	4	0	0	0	3	2	5	2	0	2
Higher on Social Tasks (-D)	4	5	9	14	5	5	10	3	4	7
Scored Same (D = 0)	4	4	3	7	0	1	1	4	0	4

TABULATION OF FACTOR 'D' BY COGNITIVE STYLE AND SEX FOR FOUR TESTINGS - THREE - WAY CLASSIFICATION

TABLE 23

received the highest number of positive 'D' values and not the FID subjects. Hence there was no statistical support for this hypothesis.

However, when the data collected and organised in the tri-partite classification was analysed in relation to the second sub-hypothesis of HYPOTHESIS III:

"As Piagetian tasks are organised in relation to style of presentation as either IMPERSONAL or SOCIAL, it is hypothesized that field-dependent (FD) children may score higher on tasks presented in a SOCIAL manner than will field-independent (FID) children",

a Kruskal-Wallis analysis yielded a significant difference ($p \geq 0.008$, $H = 40$, $df = 2$) among the three groups. Mean ranks for each of the three groupings used in this analysis were:

FD Subjects	$\bar{R}_1 = 9.75$	$N = 22$
FD/FID Subjects	$\bar{R}_2 = 6.25$	$N = 20$
FID Subjects	$\bar{R}_3 = 6.5$	$N = 22$

Use of the Multiple Comparison procedure (Daniel 1978) and selection of α at 0.25^5 resulted in a calculation which showed that mean ranks of FD subjects differed significantly ($p = 0.025$) from that of the FD/FID subjects and the FID subjects. Thus the hypothesis that FD subjects would score higher on the Piagetian tasks which were administered in a SOCIAL manner was supported by the data of the study organised in a tripartite classification.

⁵ Daniel (1978) notes that the value for α is generally larger for multiple comparisons than for single comparison inference procedures.

Sex Differences - Results

It will be noticed in some tables that subjects have been divided into boys and girls as sex differences in the results were anticipated.

In respect of sex differences as regards cognitive style Witkin et al (1974) report that women tend to be more field-dependent than men. They cite studies of perceptual development (Witkin, Goodenough and Karp, 1959) have demonstrated sex differences down to the 8-year level. At ages younger than 8 the sex differences problem cannot easily be investigated, since the tests (EFT and RFT) are not well suited for children below that level. However, studies of children in the 5-8 year range, with perceptual tests (the CHEF and CEFT) similar to the EFT and the RFT suggest that there may be no significant difference in field-dependence at these younger ages (Crudden 1941; Goodenough and Eagle 1963). Connor, Schachman and Serbin (1978) have reported that girl's (mean age 6.5 years) performance in the Children's Embedded Figures Test (CEFT) improved significantly more from pre-test to post-test than the performance of the boys. This work is discussed in more detail in relation to the CEFT results on page 197ff.

Generally speaking, few significant sex differences have arisen in the statistical analyses of the data of this study. Visual inspection of the data presented in the tables does appear to follow the trends reported by other researchers which suggest that girls even at this young age range are relatively more field-independent than boys.

CEFT Results

Witkin, Oltman, Raskin and Karp (1971) report that the CEFT or Children's Embedded Figures Test used in this study, was standardised on a sample of 160 children, divided equally among 5-9 year olds, half boys and half girls, from two New York, USA elementary schools. They write that the sample was drawn from neighbourhoods of diverse ethnic, religious and economic composition. Further, on the basis of the total test scores, two criterion groups were formed, comprising respectively, the 27% highest and 27% lowest scores in each age group regardless of sex. Norms were determined by use of scores from these criterion groups.

The administration of the CEFT allows and supplies materials for conducting a 'training procedure' before actual administration of the test items.

This procedure was followed by the experimenter in all instances. The same experimenter administered the CEFT to all subjects over all the four testings of the sample as well as to the small sub-group at the fifth testing.

Results of the CEFT scores in this study were slightly higher at the initial testing than norms given in the MANUAL (1971) for the age range. The following Table 24 shows Mean Scores and Standard Deviations for the CEFT for the five testings. Individual CEFT scores for each subject for each of the testings are shown in Table 6, page 132. The norms as stated in the Manual are also given in Table 26 which follows, page 171.

MEAN CEFT SCORES BY MEAN AGE OF TOTAL SAMPLE AT EACH TESTING					
TESTING	1	2	3	4	5
N	64	63	64	51	9
MEAN AGE	6:4	6:7	6:10	7:2	7:9
MEAN CEFT	11.3438	13.4921	16.6094	19.1765	20.88
SD	4.4623	4.8222	4.6891	4.0925	2.1602

CEFT SCORE MEANS AND STANDARD DEVIATIONS BY SEX OVER FIVE TESTINGS

TESTING	1	2	3	4	5
N BOYS	35	36	38	26	5
MEAN CEFT BOYS	11.97	14.40	16.63	19.88	20.0
SD BOYS	4.37	4.83	4.46	3.96	1.89
N GIRLS	25	25	26	26	4
MEAN CEFT GIRLS	10.44	13.08	16.15	18.96	22.0
SD GIRLS	4.44	4.67	4.84	4.05	2.44

TABLE 25

Norms for age ranges of the CEFT were given in the MANUAL (1971) as follows:

CEFT MEANS AND STANDARD DEVIATIONS				
AGE	SEX	N	MEAN	SD
5 - 6	M	20	6.8	3.8
	F	20	7.4	4.2
	All	40	7.1	4.0
7 - 8	M	20	11.4	6.2
	F	20	9.8	4.8
	All	40	10.6	5.6
9 - 10	M	20	16.6	5.4
	F	20	16.3	5.7
	All	40	16.4	5.5
11 - 12	M	29	18.9	5.5
	F	20	17.2	4.8
	All	40	18.0	5.1

From: MANUAL by H. Witkin, P. Oltman,
E. Raskin and S. Karp 1971
Consulting Psychologists Press,
page 24.

TABLE 26

Draw-A-Figure Test - Results

The tables which follow show means and standard deviations of the Draw-A-Figure test as it was scored over four testings by two independent scorers, X and Y.

Directions for the administration of the Witkin Draw-A-Figure Test required that the scoring be accomplished by a person other than the administer of the instrument. Thus these results were evaluated by two independent assessors⁶ and both sets of results are presented in Table 27. Correlation analysis of the outcomes of the Children's Embedded Figures Test as related to the Draw-A-Figure test over the four testings by the two scorers are also presented in Table 30.

Results of the DAF and CEFT did not correlate. The means for the DAF show little change over the four testings. Indeed the mean for the results of the DAF as assessed by Scorer X was higher at the first testing ($\bar{X}_{X1} = 1.5385$) than the last testing ($\bar{X}_{X2} = 1.3529$). The Witkin Draw-A-Figure or Articulation of Body Concept Scale is assessed on a scale of 5-1, that is, the lowest mark awarded the most primitive drawings is "5"; highest score is "1". For computer analysis purposes, this scale was reversed; "1" became lowest score awarded, "5" the highest, to align with the five-point scale used in assessing the Piagetian tasks.

Other researchers (Vernon, 1972; Satterly, 1976; Bowd, 1977) have reported similar findings. Satterly and Telfer (1979) stated that they chose to use only one measure of field-dependence (Children's Embedded Figures Test) as enquiries have shown that other measures had only a low correlation.

⁶ These same assessors also corroborated the experimenter's use of the Piagetian scales as described earlier in Chapter IV, page 128. A representative selection of this data (N = 20) was evaluated by both assessors for each of the four testings.

As in the scoring of the DAF drawings there was very close agreement - approaching unanimity - among the three assessors as regards the evaluations given to the individual responses of the subjects.

DRAW-A-FIGURE TEST - MEANS AND STANDARD DEVIATIONS

VARIABLE NAME	N	MEAN	STANDARD DEVIATION
DAF 1	65	1.5385	0.6864
DAF 2	65	1.3538	0.5429
DAF 3	61	1.5574	0.6714
DAF 4	60	1.5000	0.6244
DAF 5	64	1.4844	0.7125
DAF 6	64	1.6250	0.8262
DAF 7	51	1.3529	0.6269
DAF 8	52	1.3725	0.5277

NB: DAF 1, 3, 5, 7 scores were those results assessed by Scorer X.
DAF 2, 4, 6, 8 scores were those results assessed by Scorer Y.

TABLE 27

CORRELATION BETWEEN DAF RESULTS AS SCORED BY TWO INDEPENDENT SCORERS X AND Y

VARIABLES		COEFFICIENT	CASES	SIGNIFICANCE
DAF 1	DAF 2	0.5709	65	0.0000
DAF 3	DAF 4	0.5030	60	0.0000
DAF 5	DAF 6	0.6370	64	0.0000
DAF 7	DAF 8	0.6829	51	0.0000

TABLE 28

CORRELATION SHOWING RELATIONSHIP BETWEEN
CEFT AND DAF RESULTS

VARIABLES		COEFFICIENT	CASES	SIGNIFICANCE
CEFT 1	DAF 1	0.0223	64	0.431
CEFT 1	DAF 2	0.1278	64	0.157
CEFT 2	DAF 3	-0.0188	61	0.443
CEFT 2	DAF 4	-0.0118	60	0.464
CEFT 3	DAF 5	0.2333	64	0.032
CEFT 3	DAF 6	0.2115	64	0.047
CEFT 4	DAF 7	-0.0559	51	0.348
CEFT 4	DAF 8	-0.0616	51	0.334

TABLE 29

Results of British Ability Scale - Block Design

Results of the Block Design test - Ability and Power can be used to compare subjects within the sample one to another and to identify subjects who achieved very high or very low scores and thus relate these results to the individual's classification as either field-dependent or field-independent.

Mean scores and standard deviations for the raw BAS 1 - Ability scores and the BAS 2 - Power scores of the sample as well as means and standard deviations for the converted scores in relation to the age of the individual subject for the two administrations of the instrument are shown in the following Table 30, page 176.

The raw scores for each subject as well as the age adjusted and percentile scores were given earlier in Table 8, page 132e.

The results of the first testing were used in the computations throughout the study. Comparison of the mean scores for testings 1 and 2 suggest a 'practice' effect similar to that found in the longitudinal results of the Children's Embedded Figures Test.

BRITISH ABILITY SCALE - BLOCK DESIGN (Ability and Power) RESULTS

Variable	Cases	Mean	Standard Deviation
FIRST TESTING			
BAS ₁	63	6.0159	2.6910
BAS ₂	58	3.2586	1.4334
BAS ₃	63	45.0794	18.1164
BAS ₄	58	31.4310	14.5447
BAS ₅	63	75.3968	22.7338
BAS ₆	59	85.3220	16.6262
SECOND TESTING			
BAS ₇	50	7.2200	2.7277
BAS ₈	49	4.0612	1.9728
BAS ₉	50	52.7200	17.2213
BAS ₁₀	49	36.5510	15.5832
BAS ₁₁	50	74.4000	25.3514
BAS ₁₂	50	80.0600	22.7358

KEY TO VARIABLE NAMES

BAS ₁ and BAS ₇	-	Raw Scores Block Design - Ability
BAS ₂ and BAS ₈	-	Raw Scores Block Design - Power
BAS ₃ and BAS ₉	-	Converted Scores in relation to age of subjects for Ability Results
BAS ₄ and BAS ₁₀	-	Converted Scores in relation to age of subjects for Power Results
BAS ₅ and BAS ₁₁	-	Percentile Scores for Ability Results
BAS ₆ and BAS ₁₂	-	Percentile Scores for Power Results

TABLE 30

Scattergram Results

Specific attention should be given to the scattergram results which were generated by the SPSS^X programme. The four diagrams shown on page 176b are the result of plotting each subject's total score on the Piagetian battery for each of the four testings against the subject's score on the first administration of the Children's Embedded Figures Test (CEFT). The four scattergrams shown suggest that no clear cut relationship exists between the subject's scores on the Piagetian tasks and the score on the Witkin test of field-dependence for the first, second and fourth testings. Some relationship was apparent at the third testing between the Piagetian battery of scores and the first testings of the CEFT. The scattergrams are shown enlarged in the appendix. The SPSS^X analysis gave the following information concerning the scattergrams.

SUMMARY OF SCATTERGRAM STATISTICS				
Testing	Plotted Pairs	Missing Values	Intercept A	Slope B
1	64	0	12.62745	0.14441
2	60	4	14.92838	0.18878
3	63	1	15.04570	0.24701
4	49	15	19.13482	0.00258

Table 31

SCATTERGRAMS OF FOUR LONGITUDINAL TESTINGS - PIAGETIAN TOTAL
TASK SCORES FOR TESTINGS 1 - 4 RELATED TO CEFT SCORE FOR EACH
SUBJECT AT THE FIRST TESTING

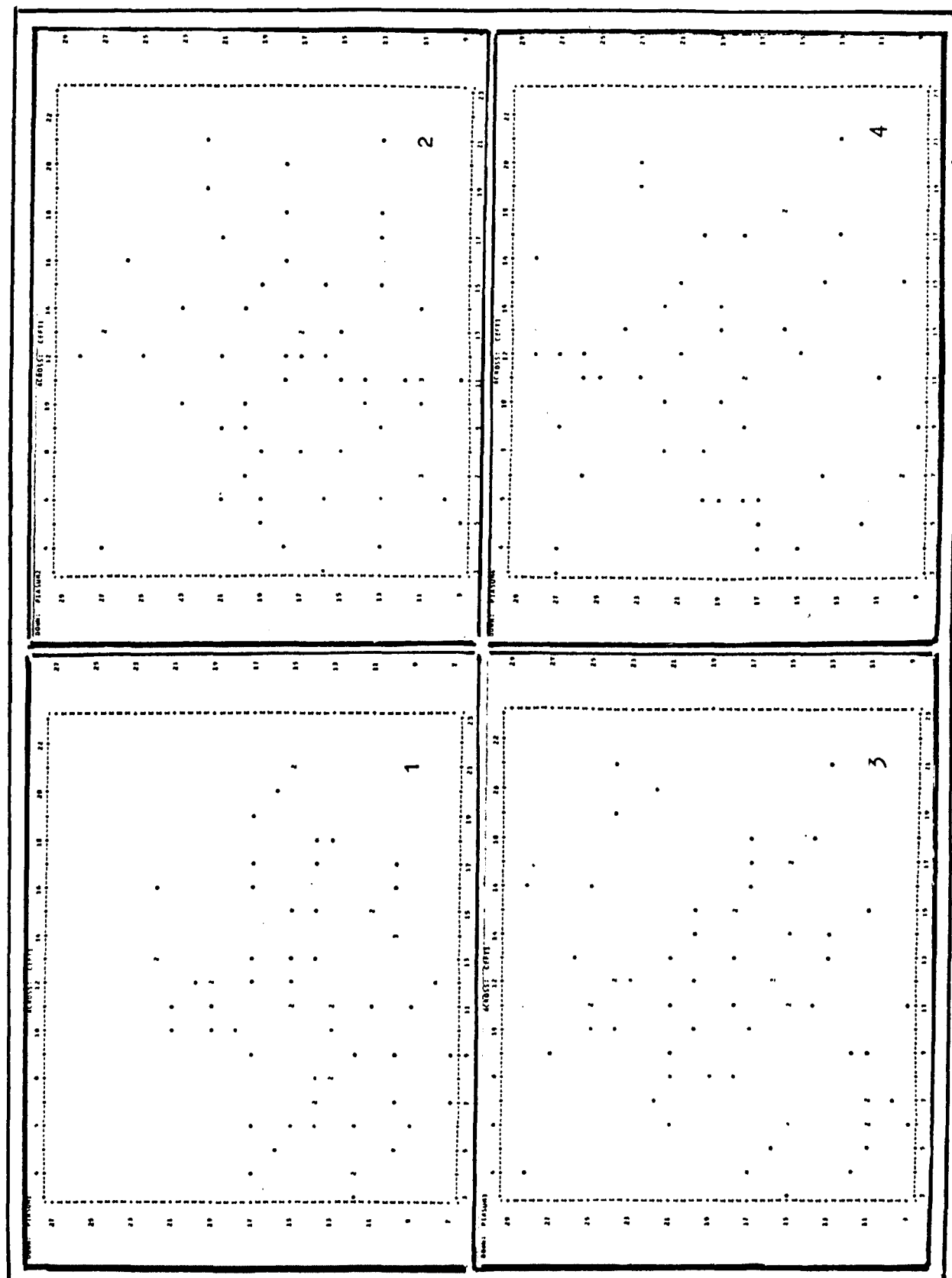


FIGURE 3

CHAPTER VII

DISCUSSION OF RESULTS

"The concept of generality presents much less of a problem to the natural scientist working chiefly with inanimate matter than to the human scientist, who of necessity having to deal with samples of larger human populations, has to exercise great caution when generalising his findings to the particular parent populations."

From RESEARCH METHODS IN EDUCATION
Cohen and Manion, Croom Helm, 1980,
page 16.

DISCUSSION OF RESULTS - TWO-WAY CLASSIFICATION

When data collected by the four longitudinal testings of this study were arranged and analysed in a dichotomous grouping, some limited support was given to the first hypothesis which stated that children classified as field-independent (FID) would score higher on individual Piagetian tasks, on the total Piagetian battery of six conservation tasks and that field-independent (FID) children would also score higher on the British Ability scale (Block Design Test) than would field-dependent (FD) subjects.

Limited significantly statistical support was given to each of the sub-hypothesis of this first hypothesis and careful examination of the results of the analysis suggest that the general pattern of achievement of the field-independent (FID) subjects maintained and extended the assumptions that field-independent children would generally score higher on the Piagetian tasks than would field-dependent (FD) children.

This finding is in agreement with Witkin and his colleagues' theoretical assumptions as well as the Piagetian literature (Pascual-Leone, 1969; Bowd 1975, 1977; Huteau, 1980) which suggests that some conservation tasks demand a re-structuring ability which may be closely related to the perceptual ability identified as field-independence by Witkin and his colleagues (Witkin et al, 1977). The Witkin group maintain, specifically, that their factor-analytic studies show that the relation between field-independency and intellectual functioning depends on factors other than 'general' intelligence. They claim that the many significant relations reported between perceptual measures and full-scale intelligence test scores can only be interpreted as evidence that field-independency is a quality apart from intelligence. The finding of striking differences in the extent to which various IQ sub-tests (for example, Block Design, Picture Completion and Object Assembly of the WISC) contribute to the total IQ

score rules out the interpretation that field-independency is related to general intelligence (Witkin et al, 1974).

Other educationalists would suggest that field-independent (FID) children could reasonably be expected to score higher overall on the Piagetian tasks especially as they had scored higher on the CEFT in order to be classified as field-independent perceiving. They claim (Vernon 1972; Roberge and Flexner 1981) that field-independence is closely related to general intelligence.

Satterly (1976) as cited in the Review of Literature reports his own findings in partial agreement with those of Vernon (1972) which indicate that among children considerable overlap in variance exists between field-independence and verbal intelligence. Of his own work, Satterly reports that despite the overlap, there exists a small factor of cognitive style distinct from intelligence and spatial ability.

The view of these various researchers concerning the relationship between field-independence, intelligence and spatial ability seem especially relevant to the Hypothesis 1c. This sub-hypothesis was concerned with testing for a relationship between field-independent subjects' Piagetian total task scores and the same subjects' scores on the British Ability Scale (Block Design Test).

The Block Design (Ability and Power) test of the British Ability Scales (1978) was chosen as it aims to give a measure of visual/motor ability in young children. Further, as cited above, the Block Design (WISC) - after which the British Ability measure was fashioned - has been reported (Witkin et al, 1974) as correlating closely with other measures of field-dependence. Therefore, it was logically expected that the field-independent subjects in this study might achieve higher scores on the British Ability Scale than would the field-dependent subjects.

However, when the sample was analysed in the dichotomous grouping,

field-independent subjects did score significantly ($p = 0.0468$, $N = 63$, Mean rank FD subjects = 27.67; mean rank FID subjects = 36.77) higher on the British Ability - BAS 1 test. A somewhat different result arose, however, when the scores of the British Ability - BAS 2 test were examined. The scores for this test were found by further appraising the score awarded for each item of the BAS 1 in respect of a specific time factor for each of the twenty-five items which comprised the test. It should be noted that the BAS 1 - Ability and BAS 2 - Power tests were one and the same as regards both materials and method of administration of the instrument. This test has been discussed in detail in Chapter V, page 122 ff. Although the test was timed, the subject was carefully positioned to the left of the experimenter and the timing device was concealed or kept out of the subject's view to the experimenter's right side. The children generally related in a very positive manner to this Block Design instrument and accepted it as a 'puzzle' or game.

No significant relationship appeared between the children's scores on the BAS 2 - Power test and the children's Piagetian total scores when the Kruskal-Wallis One-Way Analysis of Variance was applied. The mean rank scores (FD Mean Rank = 29.52; FID Mean Rank = 34.73) of the BAS 2 do suggest that the trend toward achievement of higher scores by the FID children is maintained.

As the subjects were very young (Mean Age 6 years 7 months at the initial testing) and were generally unexperienced in the testing situation, it is perhaps not surprising that some did not score as well on the Power Test (BAS 2) as they have done on the untimed BAS1 Ability Test.

Yet, from the literature reviewed, the nature of this test itself (Block Design), its reported commonality with spatial and intelligence factors and the fact that the untimed BAS 1 scores showed a significant relationship with the Piagetian scores of the field-independent subjects,

a correspondence between these two variables was anticipated. A possible explanation of the situation might be related to an observation made by Satterly and Brimer (1971) which has been discussed in the Review of the Literature (page 8 ff). These researchers aimed to study 10-11 year old subject's preference for contrasting styles of functioning. In describing cognitive style in terms of 'analytic power' and 'analytic preference', Satterly and Brimer (1971) remark that measures of field-independence should be considered tests of analytic power, but figure sorting and similar tasks (which might be considered analogous to those of the untimed BAS 1 - Ability Scale) are tests of analytic preference. This distinction might relevantly be applied to the two sections of the British Ability Scale. That is, the first untimed instrument served as a test of analytic preference - and as it was untimed and the subjects very young - a high percentage of the field-independent (FID) sample achieved high BAS 1 scores.

However, when the additional timed criterion was applied to the children's initial score, the test became a measure of 'analytic power' and fewer subjects who had been classified as field-independent achieving for the analysis of the first BAS 1 test - achieved high Power scores on the BAS 2 - and thus their scores did not register as high ranking FID results in the analysis.

HYPOTHESIS II aimed to study the stability of the children's achievement and their consistency of performance on the conservation tasks. This hypothesis considered the score regressions of subjects on both the individual Piagetian tasks and the total score of the Piagetian battery for each child. No statistically significant relationship whatever appeared between field-independent (FID) children and the regression scores. It had been anticipated that the field-independent (FID) subjects would score fewer regressions than field-dependent (FD) subjects. Nor did a pattern

or trend arise which would suggest even a tendency toward support for this hypothesis. Rather the reverse of this expected situation appeared as can be observed when the summary table of regressions on individual Piagetian task scores (given below) is inspected.

SUMMARY OF INDIVIDUAL PIAGETIAN TASK SCORE REGRESSIONS TWO-WAY CLASSIFICATION OF SAMPLE						
Testing	FD Boys N = 18	FD Girls N = 17	Total FD N = 35	FID Boys N = 21	FID Girls N = 9	TOTAL N = 30
1-2	28	23	51	23	14	37
2-3	20	21	41	26	15	41
3-4	N = 11 14	N = 15 13	N = 26 27	N = 16 18	N = 8 14	N = 24 32
	Total FD Regressions over four testings = 119			Total FID Regressions over four testings = 110		

Table 32

Not only was there no difference statistically between the tallied regressions in respect of the individual Piagetian task scores between field-independent (FID) and field-dependent (FD) subjects, but results were numerically so close that when the actual sample sizes of the FID subjects is considered in relation to that of the FD subjects, one might even say that the field-dependent (FD) children appear to have shown a more stable pattern of achievement on the individual Piagetian conservation tasks than the FID subjects - as an inspection of Table 31 above shows. Ratios for this tally of regressions were also calculated and results showed that for testings 2-3 and 3-4, regressions tallied for FD subjects were proportionately less than one would have expected for FID subjects.

A similar pattern emerged when the regression figures for the total Piagetian battery of tasks were examined. The table below again suggests that regression results as regards both the field-independent (FID) and field-dependent (FD) groups were very close - especially when the sample size of both groups is taken into account.

SUMMARY OF TOTAL PIAGETIAN BATTERY TASK SCORE REGRESSIONS TWO-WAY CLASSIFICATION OF SAMPLE							
Testing	FD Boys N = 18	FD Girls N = 17	Total FD N = 35	FID Boys N = 21	FID Girls N = 9	Total FID N = 30	
1 - 2	6	3	9	2	2	4	
2 - 3	7	7	14	7	5	12	
3 - 4	N = 11 3	N = 15 5	N = 26 8	N = 16 5	N = 8 3	N = 24 8	
Total FD Regressions over four testings			= 31	Total FID Regressions over four testings			= 24

Table 33

This result does not appear to be in line with current literature. Case and Pascual-Leone (1975) as discussed in the Review of the Literature (page 85) consider that field-dependent subjects typically over-react to salient cues, whether these facilitate the correct answer to the task or not. It is their view that such field-dependent subjects also tend to structure the task input in a 'global' rather than an 'analytical' fashion. Thus, a subject's degree of field-dependence is assumed to affect both the subject's tendency to activate schemes which are set off by visual cues and his tendency to use less than his full mental (M) space. Hence when children who are highly field-dependent are given conservation tasks, these children can be expected to give wrong answers although they may already have developed necessary skills for answering correctly. Case and

Pascual-Leone (1975) continue to argue that the salient visual cues present at the time when the question is asked are clearly misleading: one of the objects almost invariably (in the conservation tasks) looks larger than the other. Second of all, an answer based on the salient visual appearance of the objects requires more mental activity than the answer based on the fact that the objects were equal a few minutes earlier, and that nothing has been added or subtracted.

Fleck (1972) and Dolecki (1976) using Piagetian conservation tasks with young children found a significant correlation between conservation scores and field-independence scores. Hence, it was anticipated that in this study, children classified as field-dependent when tested longitudinally - would show less stability in the acquisition of conservation tasks - and that field-independent children would acquire and maintain understanding of the conservation tasks prior to that of the field-dependent subjects.

A possible explanation for this result of the study, that field-dependent children and field-independent showed very similar patterns of regression scores on both the individual Piagetian conservation tasks and the summed score for the Piagetian battery of tasks, may again be related to the age of the subjects. It has been suggested (Witkin et al, 1974) that field-independence increases with age and that very young children are relatively more field-dependent. As suggested earlier, it may well be that children of this age range have not yet achieved the potential of their individual preferred cognitive style. It is therefore possible that even though some children of the study were categorised as field-independent, they did not perform consistently in this mode.

An observation of Donaldson (1982) may , as well, be related to this outcome as regards observed regression scores of the children in this study. She writes concerning children's learning and development that it is possible some children at some points in development may tend to

respond to impersonal, physical features while others - or the same children at other times - may tend to respond to interpersonal or social ones. In respect of Piagetian type tasks, some may concern themselves with level of liquid and length of row, while others wonder what the experimenter is up to. It is likely that many wonder about both and are apt to be swayed by each in turn. However, it seems reasonable to suppose that enduring personal characteristics will make themselves manifest.

We are led, continues Donaldson (1982), to the general conclusion that the situation is more complicated than Piaget (or Witkin) had supposed and that there are common sources of failure in conservation tasks which his theory does not envisage.

Nisbet and Entwistle (1980) report that recent research in reference to Piagetian theory has turned its attention from the relative stability of individual differences to focus on the remaining variability. For example, Piaget tended to dismiss the observed differences in performance between tasks intended to be equally difficult. But if these differences are examined, it becomes clear that they are affected by the nature of the particular tasks provided. Indeed it is becoming clear that the performances from which the existence of stages are inferred are also dependent on the experimental conditions - and form of questions asked, the language used, the rapport between child and experimenter. If this is true of Piagetian experiments then we should, write Nisbet and Entwistle (1980), also expect similar differences in performance between children at the same overall intellectual level in the task set by teachers in school. This focus on variability produces yet another hypothetical construct - that of 'approach to learning' and 'style of learning'.

These recently expressed views of researchers Donaldson and Nisbet and Entwistle writing in the 1980's suggest that the observed pattern of

regression scores in this study may not be as aberrant as the literature of the earlier decades would suggest.

HYPOTHESIS III aimed to study that aspect of the Witkin theory which claims that field-independent (FID) subjects prefer and process information of a specific style - abstract and impersonal - while field-dependent (FD) subjects are said to achieve better understanding and to process more easily information presented them in an informal or social manner.

Frank and Davis (1982) investigated recently this notion and further linked it to the idea that in terms of teacher-student interaction, matching students' and teachers' cognitive styles may be a factor contributing to a more effective outcome of the teaching-learning process, whereas mis-matching might result in a less effective outcome. They found that particular combinations of cognitive styles of participants when linked to the context of a communication task (using either 'social' or 'non-social' task words) had a significant influence on performance. It should be noted that the subjects used in Frank and Davis' study were university undergraduate females, hence of an older age range than those of this present study.

However, it might be argued that the results of this study (which arose when the analysis of the data were conducted in relation to the third Hypothesis in the dichotomous classification) are in line with those related to the first Hypothesis as well as with the work of other researchers, for example Bryant (1982), Messick (1982), Donaldson (1978, 1980), Nisbet and Entwistle (1982) have been concerned with the context of the teaching/learning situation.

An examination of the Piagetian task scores - classified into two sub-groups as IMPERSONAL and SOCIAL, shows that overall, the children achieved higher scores on the SOCIAL tasks than they did on the tasks

administered in an IMPERSONAL manner. This finding held for both field-independent and field-dependent groups of children. Differences were generally very small between the group of tasks administered in an IMPERSONAL manner and the group of three tasks administered in the SOCIAL fashion.

Tables 34 and 35, showing mean scores for all of the individual Piagetian tasks as well as the means for the two sub-groups, IMPERSONAL (IMP) and SOCIAL (SOC) can be found on pages 188 and 189.

As mentioned earlier, the children considered as field-independent (FID) also scored higher on the tasks administered in the SOCIAL manner. Both FD and FID children achieved highest scores on the group of Piagetian tasks which were administered in the SOCIAL manner.

What explanation can be given for this aspect of the results which runs counter in some aspects to Witkin's theory?

First, the sample of children were of a young age group. The proponents of the cognitive style theory have called generally for more research into differentiation theory as well as for studies using the CEFT as an instrument to measure field-dependence, in the lower age range.

This factor of age may have affected the study in several ways. Although the subjects were categorised as either FD or FID (and scores on the CEFT were generally higher than those suggested as NORMS in the Witkin et al MANUAL 1971), see Table 26, page 170, it is possible that being so young (mean age: 6 years 4 months at initial testing - 7 years 2 months at fourth testing) the characteristics of field-independence had not yet fully emerged. Specifically, the preference of these children for abstract, impersonal material had not yet developed. It would be interesting to follow the maturation of cognitive style in this group of children for a longer period to assess any further progress they may make. Some indication of progress may be seen in the fifth testing of the sub-group of School A which was administered the CEFT and Piagetian Battery

MEANS AND STANDARD DEVIATIONS OF PIAGETIAN TASKS BY CONCEPT AND
STYLE OF ADMINISTRATION

TESTING	VARIABLE	CONCEPT AND STYLE OF ADMINISTRATION	CASES	MEAN	STANDARD DEVIATION
1	PT ₁	Length - IMP	65	1.6462	1.5045
1	PT ₂	Length - SOC	65	3.1385	1.4671
1	PT ₃	Area - IMP	65	1.7077	1.1000
1	PT ₄	Area - SOC	65	1.9846	1.3520
1	PT ₅	H/V Coord. - IMP	64	2.8769	0.8198
1	PT ₆	H/V Coord. - SOC	65	2.9077	1.2836
2	PT ₇	Length - IMP	61	2.2787	1.7140
2	PT ₈	Length - SOC	61	3.6557	1.3151
2	PT ₉	Area - IMP	61	2.1476	1.5257
2	PT ₁₀	Area - SOC	61	2.7213	1.5930
2	PT ₁₁	H/V Coord. - IMP	61	3.0984	0.8889
2	PT ₁₂	H/V Coord. - SOC	61	3.1475	1.3764
3	PT ₁₃	Length - IMP	64	2.9062	1.9495
3	PT ₁₄	Length - SOC	64	3.4688	1.5632
3	PT ₁₅	Area - IMP	64	1.9219	1.6060
3	PT ₁₆	Area - SOC	64	2.8750	1.7862
3	PT ₁₇	H/V Coord. - IMP	64	3.1563	0.7605
3	PT ₁₈	H/V Coord. - SOC	64	3.6406	1.2519
4	PT ₁₉	Length - IMP	50	3.4000	1.9483
4	PT ₂₀	Length - SOC	50	3.4800	1.4320
4	PT ₂₁	Area - IMP	50	2.2200	1.4327
4	PT ₂₂	Area - SOC	50	3.3600	1.5877
4	PT ₂₃	H/V Coord. - IMP	50	3.1800	0.7743
4	PT ₂₄	H/V Coord. - SOC	51	3.7843	1.1012

TABLE 34

MEAN SCORES FOR IMPERSONAL AND SOCIAL GROUPS

OF PIAGETIAN TASKS FOR FOUR TESTINGS

TESTING	N	IMP PT ₁	MEAN + PT ₃	SCORE + PT ₅	CONSERVATION CONCEPT	SOC PT ₂	MEAN + PT ₄	SCORE + PT ₆
1	65	1.6462	(PT ₁)		Area	3.1385	(PT ₂)	
1	65	1.7077	(PT ₃)		Length	1.9846	(PT ₄)	
1	65	2.8769	(PT ₅)		H/V Coordinates	2.9077	(PT ₆)	
		3 / 6.2308				3 / 8.0308		
		2.0769	IMP MEAN ₁		1st Testing	2.6769	SOC MEAN ₁	
TESTING	N	IMP PT ₇	MEAN + PT ₉	SCORE + PT ₁₁	CONSERVATION CONCEPT	SOC PT ₈	MEAN + PT ₁₀	SCORE + PT ₁₂
2	61	2.2787	(PT ₇)		Area	3.6557	(PT ₈)	
2	61	2.1475	(PT ₉)		Length	2.7213	(PT ₁₀)	
2	61	3.0984	(PT ₁₁)		H/V Coordinates	3.1475	(PT ₁₂)	
		3 / 7.5246				3 / 9.5245		
		2.5082	IMP MEAN ₂		2nd Testing	3.1748	SOC MEAN ₂	
TESTING	N	IMP PT ₁₃	MEAN + PT ₁₅	SCORE + PT ₁₇	CONSERVATION CONCEPT	SOC PT ₁₄	MEAN + PT ₁₆	SCORE + PT ₁₈
3	64	2.9062	(PT ₁₃)		Area	3.4688	(PT ₁₄)	
3	64	1.9219	(PT ₁₅)		Length	2.8759	(PT ₁₆)	
3	64	3.1563	(PT ₁₇)		H/V Coordinates	3.6406	(PT ₁₈)	
		3 / 7.9844				3 / 9.9844		
		2.6614	IMP MEAN ₃		3rd Testing	3.3281	SOC MEAN ₃	
TESTING	N	IMP PT ₁₉	MEAN + PT ₂₁	SCORE + PT ₂₃	CONSERVATION CONCEPT	SOC PT ₂₀	MEAN + PT ₂₂	SCORE + PT ₂₄
4	50	3.4000	(PT ₁₉)		Area	3.4800	(PT ₂₀)	
4	50	2.2200	(PT ₂₁)		Length	3.3600	(PT ₂₂)	
4	50	3.1800	(PT ₂₃)		H/V Coordinates	3.7843	(PT ₂₄)	
		3 / 8.8000				3 / 10.6243		
		2.9333	IMP MEAN ₄		4th Testing	3.5414	SOC MEAN ₄	

TABLE 35

for a fifth time seven months after their fourth testing. These results are shown in Tables 4 and 5, pages 132a and 132b.

Another factor affecting the results of the study may be a real difference between the SOCIAL Piagetian tasks and the IMPERSONAL tasks in degree of intellectual difficulty. Piagetian literature suggests, however, that the two tasks in each of the three areas may be used to assess conservation of the concepts of length, area and horizontal/vertical co-ordinates.

The detailed analysis of the tasks undertaken in Chapter V, page 107 ff, aimed to convince readers of the similarity of mental activity between the two related tasks in each of the three units testing for conservation of length, area and horizontal/vertical frames of reference. If this similarity between tasks as regards the intellectual level of the tasks were to be accepted, then it might be assumed that the style of presentation of tasks - as well as some related factor of field-dependence - might be contributing to the differences observed in the scores of the subjects on the Piagetian tasks.

The following tables showing the results of the Friedman Two-Way Analysis of Variance for the Piagetian tasks over the four testings appear to give some support to this assumption. The Friedman analysis shows the mean ranks for each pair of the Piagetian conservation tasks for each of the four testings. The results show a significant difference between the pairs in some instances but they also show that in every comparison except two, the task administered in the SOCIAL manner has the higher mean rank of the pair. The pattern of higher mean rank scores might be considered as supportive of the notion that the style of administration of the tasks made it easier for the children to achieve higher scores on the SOCIAL tasks than on the IMPERSONAL. The two exceptions to this pattern of higher mean ranks appear in the

FRIEDMAN TWO-WAY ANALYSIS OF VARIANCE - PAIRED
PIAGETIAN CONCEPTS - TOTAL SAMPLE FOR FOUR TESTINGS

First Testing						
N	Variable Pair	Conservation Concept	Mean Rank	Chi Square	DF	p
63	PT ₁	Length	1.22	19.4445	1	0.0000
	and PT ₂		1.78			
	PT ₃	Area	1.43	1.2857	1	0.2568
	and PT ₄		1.57			
	PT ₅	H/V Coordinates	1.54	0.3969	1	.5287
	and PT ₆		1.46			
Second Testing						
60	PT ₇	Length	1.26	14.0167	1	0.0002
	and PT ₈		1.74			
	PT ₉	Area	1.38	3.7500	1	0.0528
	and PT ₁₀		1.63			
	PT ₁₁	H/V Coordinates	1.50	0.0000	1	.9958
	and PT ₁₂		1.50			
Third Testing						
64	PT ₁₃	Length	1.39	3.0625	1	0.0801
	and PT ₁₄		1.61			
	PT ₁₅	Area	1.32	8.2656	1	0.0040
	and PT ₁₆		1.68			
	PT ₁₇	H/V Coordinates	1.39	3.0625	1	0.0801
	and PT ₁₈		1.61			
Fourth Testing						
50	PT ₁₉	Length	1.47	0.1800	1	0.6714
	and PT ₂₀		1.53			
	PT ₂₁	Area	1.31	7.2200	1	0.0072
	and PT ₂₂		1.69			
	PT ₂₃	H/V Coordinates	1.33	5.7800	1	0.0162
	and PT ₂₄		1.67			

TABLE 36

FRIEDMAN TWO-WAY ANALYSIS OF VARIANCE
BATTERY OF SIX PIAGETIAN TASKS COMPARED FOR EACH OF FOUR TESTINGS

First Testing						
N	Style	Task	Mean Rank	Chi Square	DF	p
63	IMP	PT ₁	2.46	76.6712	5	0.0000
	SOC	PT ₂	4.52			
	IMP	PT ₃	2.60			
	SOC	PT ₄	2.98			
	IMP	PT ₅	4.30			
	SOC	PT ₆	4.13			
60	IMP	PT ₇	2.81	46.4429	5	0.0000
	SOC	PT ₈	4.55			
	IMP	PT ₉	2.61			
	SOC	PT ₁₀	3.28			
	IMP	PT ₁₁	3.83			
	SOC	PT ₁₂	3.92			
Third Testing						
64	IMP	PT ₁₃	3.39	40.1273	5	0.0000
	SOC	PT ₁₄	4.05			
	IMP	PT ₁₅	2.33			
	SOC	PT ₁₆	3.42			
	IMP	PT ₁₇	3.61			
	SOC	PT ₁₈	4.20			
Fourth Testing						
50	IMP	PT ₁₉	3.72	31.9143	5	0.0000
	SOC	PT ₂₀	3.83			
	IMP	PT ₂₁	2.25			
	SOC	PT ₂₂	3.61			
	IMP	PT ₂₃	3.39			
	SOC	PT ₂₄	4.20			

TABLE 37

comparison made between tasks 5 and 6 (horizontal/vertical co-ordinates) in the first testing where the mean rank for task 5 (IMPERSONAL style of administration) is 1.54 and that of task 6 (SOCIAL style of administration) is 1.46. The second exception to the pattern of higher mean ranks among the SOCIAL style tasks occurs at the second testing again between tasks 5 and 6. At this second testing, the mean ranks are identical. Each task received the rank of 1.50.

This pattern of higher mean rank results for the tasks administered in the SOCIAL style was evident earlier in the study and attention is directed to the outcome of the administration of the tasks concerned with the field-dependent (FD) children's achievement of higher mean rank scores on the individual Piagetian tasks than the field-independent (FID) children. Table 11, page 146 shows that the field-dependent (FD) children did achieve slightly higher mean rank scores for 6 cases of the 24 cases considered. The point to note is that the tasks in which the field-dependent (FD) children did consistently achieve slightly higher mean rank scores were tasks 2 and 6. Both tasks 2 and 6 were administered in the SOCIAL manner.

Tasks 5 and 6 were testing for conservation of horizontal/vertical co-ordinates. In this third unit of the conservation tasks the IMPERSONAL style H/V co-ordinate task (water rotated-in-a-jar) demanded both high level of observational and visual memory skills. The last task, the SOCIAL style H/V co-ordinate task (drawing a house and tree on a hill) demanded maturation of drawing as well as observational and memory skills. Certainly the children had had more experience of drawing houses and trees than of experience related to the water-in-a-jar task. Some may recently have had experience of water-play, but it is doubtful, indeed, that many had had adult intervention in the water-play situation wherein attention was directed to the water-level of a container as it was rotated in a circle.

The question, then, of a major difference in the level of the intellectual complexity between the two groups of tasks does not seem likely. The Spearman Correlation calculations shown in the following Table 38 do show some variations. However, by the fourth administration the pairs of tasks had reached agreement as regards resulting mean scores. Thus, if the tasks can be shown to be of approximately the same level of difficulty as regards the mental activity required for each task, style of presentation linked to a factor of field-dependence can be considered the most likely variables which are affecting the children's performances on the Piagetian tasks.

It is then possible that the SOCIAL style of presentation made these tasks more interesting to the children, since these were presented in contexts which the children could understand and relate to their own experience. The length SOCIAL style conservation task was presented as a story of two little mice running along a set of pretend paths and explanations were linked to the child's own experiences of walking to and from school with mother or friends. Conservation of area was introduced in story-fashion, linked to an actual garden problem of the experimenter. This situation frequently led the children to propose very logical and delightful solutions to the problem. The H/V frame of reference task necessitated a request for a 'lovely' picture which the experimenter would be allowed to take away to use in the 'work'.

It was also easier during the presentation of the SOCIAL tasks for the child to enter into conversation with the experimenter, and thereby to clarify his or her own understanding of the tasks by means of this interaction.

Conversation and opportunity to clarify by questioning was not ruled out during the presentation of the IMPERSONAL tasks but there were fewer details or reference points within the three IMPERSONAL situations which

SPEARMAN RANK CORRELATION ANALYSIS

PIAGETIAN TASKS OVER FOUR TESTINGS

TESTING	N	CONCEPT	VARIABLES	COEFFICIENT	p
1	63	Length	PT ₁ - PT ₂	0.2179	0.083
1		Area	PT ₃ - PT ₄	0.3505	0.011 *
1		H/V Coord.	PT ₅ - PT ₆	0.0958	0.273
2	60	Length	PT ₇ - PT ₈	0.0931	0.279
2		Area	PT ₉ - PT ₁₀	0.4433	0.002 *
2		H/V Coord.	PT ₁₁ - PT ₁₂	0.0176	0.456
3	64	Length	PT ₁₃ - PT ₁₄	0.1287	0.208
3		Area	PT ₁₅ - PT ₁₆	0.4335	0.002 *
3		H/V Coord.	PT ₁₇ - PT ₁₈	0.1140	0.241
4	50	Length	PT ₁₉ - PT ₂₀	0.5074	0.000 *
4		Area	PT ₂₁ - PT ₂₂	0.3404	0.014 *
4		H/V Coord.	PT ₂₃ - PT ₂₄	0.3171	0.020 *

* Two tasks compared reached statistical significance.

TABLE 38

the child could relate to his own set of experiences.

Messick (1982), Donaldson (1982) and Nisbet and Entwistle (1980), all quoted earlier, have stressed the importance of context and style in school learning. Messick remarks that a critical problem in this area is that we have at present no systematic way of specifying what constitutes 'context'. Context is not any and all attributes of the environment, but, as in discourse, those aspects of the surround that illuminate or add to the meaning of the focal variables and their functioning. Messick (1982) further subdivides the notion of context into the areas of 'context of learning', the 'context of teaching' and 'teaching in context'. While all three areas might easily be linked to this particular study, the latter two are especially pertinent to this third hypothesis concerned with the manner or style in which the Piagetian tasks were presented to the children.

Messick (1982) elaborates:

"THE CONTEXT OF TEACHING. Other potential sources of differential effects on learning stem from the method, material and manner of teaching and from the circumstances in which it occurs. These include cognitive, stylistic and personality characteristics of materials and tasks; aspects of the physical surround (furnishings, ventilation, lighting, temperature); dimensions of the social setting (classroom, small group, tutorial); and, perceptions of the learning climate (evaluative or test-like, spontaneous or game-like, productive or work-like).

TEACHING IN CONTEXT. Still other sources of differential learning effects are the interactive influences stemming from the combinations of the previous sources, especially in regards to the nature and degree of match or mismatch between context of teaching and the student's intrapersonal and situational context of learning".

Applying Messick's ideas and relating them to the style of presentation of the Piagetian tasks of this study, one might say that the IMPERSONAL group of tasks were not as well matched to the age and situation of the subjects as were the SOCIAL tasks. The IMPERSONAL style of administration gave the children fewer points of reference or comparison in relation to their own personal levels of development and experience.

These IMPERSONAL style tasks also gave fewer opportunities for legitimate interaction and conversation between the child and experimenter, while the SOCIAL style of presentation of the tasks was more appropriately matched to both the children's developmental level and the context and situation in which the tasks were administered.

In concluding this discussion of the results as they relate to Hypothesis III, it must be reiterated that the results of the analysis in respect of the first part of this third hypothesis which held that the field-independent (FID) children would achieve higher overall scores on the Piagetian tasks administered in an IMPERSONAL manner were not supported statistically at any level. In fact at the third and fourth testings, field-independent (FID) children actually fell way below the expected target of performance as regards high achievement on the Piagetian tasks administered in an IMPERSONAL manner.

However, after considering further the results of the SOCIAL style of presentation of the Piagetian tasks, the opinions of other researchers and the age of the subjects of this study, it is the writer's view that this result may well be an appropriate one.

Finally, the analysis of the data supported the second sub-hypothesis that field-dependent (FD) subjects would score higher on tasks presented in a SOCIAL manner than would field-independent (FID) subjects ($p = 0.05$, for one-tailed test, $N = 4$, $T = 2.61$). This outcome appears logical when the related variables of the situation - subjects' age, field-dependency, task style and level of difficulty - are considered.

DISCUSSION OF RESULTS - THREE-WAY CLASSIFICATION OF SAMPLE

The data were arranged in a tri-partite mode wherein subjects results were grouped by means of ranking the scores of the CHILDREN'S EMBEDDED FIGURES TEST (CEFT) achieved by the subjects at the first testing from lowest to highest score. Group 1, field-dependent (FD) subjects (N = 22), were those children who had received the lowest scores on the CEFT; Group 2, field-dependent/field-independent (FD/FID) subjects (N = 21) achieved the next set of ranked scores and Group 3, field-independent (FID) subjects (N = 22) were selected because they had achieved the highest scores on the CHILDREN'S EMBEDDED FIGURES TEST at the first administration of the instrument.

When the data were analyzed in this arrangement, no support was given to either the first or second hypothesis of the study. Statistically significant support was accorded to the second sub-hypothesis of HYPOTHESIS III; "Children assessed as field-dependent (FD) will score higher on Piagetian tasks presented in a SOCIAL manner than will field-independent (FID) children". It is felt that the support given this hypothesis in the tri-partite classification emphasizes the strength of of the same result as it arose in the dichotomous classification.

It does appear, however, that the tri-partite classification produced a levelling effect upon the data (as may be seen by visually inspecting the means and mean rank scores shown for the three groups in the previous Chapter VI, Tables 18, 19 and 20, pages 160 ff. Other than the result given for the third hypothesis, this tri-partite analysis of the data has not been as productive or insightful as had been anticipated.

Table 39 which follows presents a summary of the results of the analyses as they relate to each of the hypothesis in respect of the two modes of classification of the data.

SUMMARY OF RESULTS OF ANALYSES

TWO-WAY CLASSIFICATION OF SAMPLE							
HYPOTHESIS	Ia	Ib	Ic	IIa	IIb	IIIa	IIIb
Concerned with:	FID subjects individual Piagetian Scores	FID subjects Piagetian Total Scores	FID subjects BAS Scores	REGRESSIONS Individual Scores	REGRESSIONS Total Piagetian Scores	Piagetian Tasks IMPERSONAL Style	Piagetian Tasks SOCIAL Style
Result:	Supported 3 of 24 instances	Supported 1 of 4 instances	Supported 1 of 2 instances	No support	No support	No support	Supported
THREE-WAY CLASSIFICATION OF SAMPLE							
Result	No support	No support	No support	No support	No support	No support	Supported

TABLE 39

Discussion of Children' Embedded Figures Results

Results of the Children's Embedded Figures Test administered to each subject four times at three month intervals have been shown in Table 6, page 132c; Table 9, page 141; Table 9a, page 142; and Table 17, page 159. An examination of these results over the four testings shows that the children acquired a facility for accomplishing the tasks of the CEFT and a 'practice' effect is evident in the results over the four testings. Connor, Schackman and Serbin (1978) report that both girls and boys benefitted from the effect of direct practice on the CEFT.

However, readers of the study are reminded that the median score of the CEFT for the first testing (a score of 11) was used as the criterion for classifying a child as either FD or FID, and this initial classification was maintained in all analysis of further testings.

It is still relevant to discuss the 'practice' effect and relate the results of this study to that of other researchers.

Table 25 which shows means and standard deviation scores by sex for the CEFT over the five testings of the sample is given again on this page to facilitate this discussion.

CEFT SCORE MEANS AND STANDARD DEVIATIONS BY SEX OVER FIVE TESTINGS

TESTING	1	2	3	4	5
N BOYS	35	36	38	26	5
MEAN CEFT BOYS	11.97	14.40	16.63	19.88	20.0
SD BOYS	4.37	4.83	4.46	3.96	1.89
N GIRLS	25	25	26	26	4
MEAN CEFT GIRLS	10.44	13.08	16.15	18.96	22.0
SD GIRLS	4.44	4.67	4.84	4.05	2.44

The mean age for the total sample of this study at the initial testing was six years four months; and seven years four months at the fourth testing. The mean age of the small sub-group which was administered the fifth testing was seven years and nine months at the time of the final testing.

Comparison of the tables shows that while the initial mean score of the CEFT at the first testing was within the range of the norm score given for 7-8 year olds, mean scores increased steadily over the four testings and were in the range of values suggested for the 11-12 year old subjects at the final testings.

It is evident there was a practice effect as regards this test and studies of Connor, Serbin and Schackman (1977) and Connor, Schackman and Serbin (1978) report findings which are relevant to CEFT results of this study.

In 1977 Connor, Serbin and Schackman investigated sex-related differences in visual-spatial ability by means of the Witkin CEFT. They reported results of a study carried out by Goldstein and Chance (1965) which maintained sex differences could be eradicated by practice. Goldstein and Chance's subjects were male and female adults who in a series of sixty-eight trials, over two sessions, lowered their discovery times of the embedded figures in the Witkin CEFT substantially. In the first block of trials females took sixty-three per cent longer than males to discover the embedded figure, but sex difference was markedly reduced and no longer significant for the final block of trials.

Connor et al (1977) obtained similar results by employing a brief training procedure with children. Girl's performance, but not boy's, benefitted from training on the Children's Embedded Figures Test (Witkin et al, 1971). There were no significant sex differences for either the training or control groups. There was, however, a tendency for control boys

to score higher than control girls, $p < .10$. while the tendency among children receiving training was in the opposite direction.

A further study was designed by Connor, Schackman and Serbin (1978) using as subjects one hundred and four first grade children (mean age 6.5 years) in order to investigate the effect of practice and/or training on the CEFT. The test items of the CEFT were divided into two sets of equal difficulty on the basis of previously collected data. Both sets were used with the full set of practice materials that precedes the usual administration of the CEFT. Training materials devised by Connors et al (1977) consisted of five complex figures similar to the more difficult items in the CEFT but utilizing a diamond (rhombus) shape of fixed size and orientation. Results showed that scores on the post-test of the CEFT were significantly higher than scores on the pre-test, indicating a practice effect, $F(1,88) = 22.36, p < .01$. On the pre-test there was a tendency for boys to score higher than girls, $F(1,89) = 2.86, p < .10$. The difference between boys and girls on the post-test was in the opposite direction, but not significant, $F(1,89) = 1.53, NS$. Whereas both boys and girls benefitted from practice, the interaction of testing sessions with sex showed that girls, who gained an average of 2.53 points on the second day of testing, improved more than boys, who gained an average of only 1.25 points, $F(1,89) = 4.40, p < .05$. This pattern of change was observed for children in both the training and control group, that is, the three-way interaction of sex, testing session and training condition was not significant, $F(1,89) < 1$. Thus while both sexes benefitted from practice on the CEFT, girls improved more than boys.

A pattern or change similar to that reported by Connor et al (1976) may be seen in the results of this study. Table 25, page 197, shows mean results by sex for the five testings and girls (as reported by Connors et al) made greater gains (11.36 points) over the longitudinal testings

than did the boys (9.03 points). However, the difference was not significant. Application of the Mann Whitney U test (Siegel 1956) yielded a value of $p = .075$ as regards the hypothesis that girls' gains were greater than boys'.

Little longitudinal work using the CEFT with this age group has been reported. It was not surprising to the experimenter, however, that the children's scores generally improved over the four/five testings. There was no time limit placed on the test items; materials of the test were similar to kinds which the majority of the children would have used in pre-reading games or puzzles as well as of the same or similar type to toys and games which are found in their homes from infant stage.

Some of the drawings into which either the TENT or HOUSE shape (both familiar to the children, although the TENT shape was always called the TRIANGLE shape by the children and rightly so!) had been embedded were dated and clearly belonged to the 1950's period or had little relevance for English children. For example, a TV set with V-shaped 'rabbit's ears', a stylised covered pitcher and a coffee percolator which many thought was a 'rocket'. This lack of familiarity with the items depicted did not appear to inhibit the children's performance as there was no time limit on the test items. A pair of harlequin styled slippers resting on the open edges of their box was at first 'seen' by the experimenter as the fancy ribbons and ties of the box until an FID child suggested the correct interpretations of the drawings, so there was no possibility of their being influenced by the experimenter's misconceptions.

The two drawings in series 1 which gave the children the most difficulties demanded that they find the TENT shape embedded inbetween sets of oblique lines. As the identification of the TENT shape was the easiest of the two series to be accomplished, the majority of the children always completed this set. The children failing this task always

reported they had not 'seen' the oblique lines which formed the hidden triangle (TENT) shape. The administrator could not help making the assumption that the perceptual skills required for success on these two tasks were closely related to the skills necessary for accomplishing the water-in-the-jar task. Namely, achievement on the two difficult CEFT plates necessitated that the children identify the TENT shape which in both drawings is positioned inbetween or adjacent to oblique or parallel lines. It is interesting to note that Connor, Schackman and Serbin (1978) omitted one of these plates when they designed their study concerning the

COMPARISON OF DRAWING WATER-LINE IN PIAGETIAN H/V CO-ORDINATE
TASK AND IDENTIFICATION OF TENT SHAPE IN CEFT-LIKE FIGURE

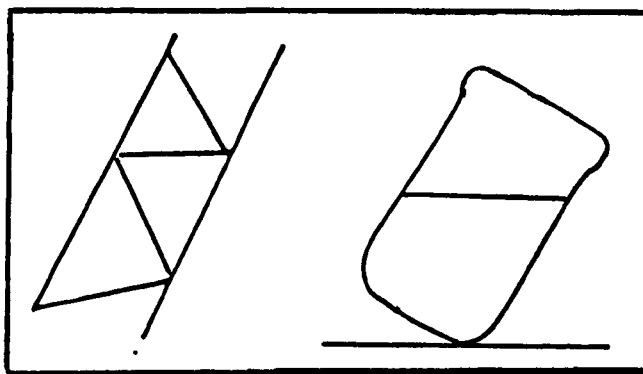


FIGURE 4

sex related differences of spatial ability in which the CEFT was organised into two sets of equal difficulty. Similarly, in the water-in-the-jar task, successful completion required the children to draw (in the prepared booklet showing the empty jar in nine different positions) a straight line between two parallel and oblique ones - the representation of the sides of the jar in tilted positions 2, 4, 6 and 8.

Thus it was possible to identify the two plates mentioned as 'trouble' spots while it was not possible to establish a consistent pattern of failure with as much certainty in the more difficult series of the embedded HOUSE shape. This later set of figures was stylised and

some items were not within the common experience of the children, the coffee percolator, (present day instant coffee or coffee machines), TV wave booster, water jug with lid, rowing skiff with oarlocks. Recent research related to visual neural development (Movshon and Sluyters, 1981; Kelton, Holmes and Pllack, 1978) and perceptual studies concerned with reading development (Meltzer, 1982) has been identifying and suggesting that individual cells perform a single function and that these cells mature at a much later stage in some children than had been thought.

However, Berman (1976) reports that nursery children's difficulty with construction of oblique lines is due to their tendency to enter on the horizontal and vertical cues which are usually provided by a rectangular frame, while similar cues for the oblique are absent in the immediate field. Berman, Cunningham and Harkulich (1974) are reported as having found that nursery children who reconstructed the horizontal, vertical and oblique from immediate memory on circular backgrounds drew the oblique as accurately as the horizontal.

One might also suggest other factors as influencing the children's performances on this CEFT instrument which were discussed in relation to their achievement on the Piagetian tasks. Namely, that replication of research is difficult once the instrument is removed from its original context and period in time.

Smedland (1977) questioned the representativeness of Piagetian tasks and remarks that the tasks were irrelevant to the children's problems in the real world. Flavell (1982) questioned the diagnostic sensitivity of tasks used by psychologists as assessment items. Finally, Buck-Morss (1975) states that cultural relativists point to a plethora of cultural variables both within the tests (methods of testing, equipment used, language and translation), and claims that the test results are therefore culturally biased. When the developmental experiences of children in the 1980's are compared with children in the 1920's, 1950's

and 1960's certain differences are evident. That is, it could be argued that the majority of children in the 1980's have wider experiences of travel, both within and without the country of their origin, than did children in the 1950's. Child-rearing patterns, especially with the growth of an 'educated middle class' in the countries who are particularly engaged in educational research, have also changed. Television and video media have given a breadth of experience, as well as experiences of a different type, to even the very young child. One might argue that children of today are equipped with a more fully developed set of concepts as a result of wider and more sophisticated social experiences than were the children of similar age groups in the 1920's, 1950's and 1960's.

The CEFT was standardised (at the most recent) in the late 1960's. Witkin et al cite studies where this test has been checked for reliability (Dreyer et al, 1969) with young children. Validity has not been established for the younger age group but the authors assumed that studies they cited suggested that the CEFT was related to some of the measures of psychological differentiation as the EFT.

Results of the use of the CEFT in this study can be summarised as supporting the work of Connor et al (1977, 1978). A practice effect was evident, although there was a lapse of approximately three months between testings. Some children of age eight years or under were achieving scores on the CEFT which Witkin et al (1971) report as Norms for eleven to twelve year olds. These results are also counter to Witkin et al's (1962/1974) statement that field-independence is relatively stable over time. However, it should be pointed out that their statement was made as a result of studies carried out with older age groups and that they themselves called for more research using the CEFT with subjects under the age of ten years.

Discussion of Draw-A-Figure Results

While the Draw-A-Figure results presented in statistical or numerical terms may appear to have had little impact on the study, they were in the writer's opinion, a most colourful and rewarding source of information concerning individual children. Collectively, they are indicative of a changing pattern of social and cultural values. ^{NB}

Lack of correlation between the numerical assessments of the Draw-A-Figure and the Children's Embedded Figures test results have been shown in Table 29, page 174. Similar findings have been reported by other researchers (Vernon 1972, Satterly 1976, Bowd 1977). Satterly and Telfer (1979) discuss the use of measures of field-dependence in their study concerned with "Cognitive Style and Advance Organisers in Learning and Retention". They justify their use of only one criterion measure of field-independence (EFT):

"Although Witkin's original work employed more than one criterion measure of field-independence subsequent enquiries have shown that these tests often have only low correlations (Vernon: 1972)."

The stability of the DAF scores as they were assessed over the five testings of the study, was a cause of concern to the independent scorers, X and Y. These two assessors felt that it was possible to observe and identify development in the children's drawings from one testing to another. The Witkin Scale for Articulation of Body Concept, presented as the tool for scoring the Draw-A-Figures test, was not, in these two assessors' opinion, an adequate instrument for measuring the development which was actually taking place in the children's drawings from testing to testing.

Whether it is possible to assess children's cognitive growth by means of drawings has been for some years a controversial question

^{NB} A paper entitled, 'Children's Drawings as an Assessment of Cognitive Style', was submitted to the National Foundation For Educational Research in England and Wales. A summary of this article was published in the Journal's 'Short Reports' section in Volume 25, Number 1, February 1983.

(Harris 1963; Kellogg 1969; Goodnow 1977). What is certain, however, is that in the hands of a competent assessor who has close contact and experience with young children as they produce their drawings and paintings, a particular drawing may reveal how well the child understands a particular concept as well as his level of interest in the concept at a specific time.

Kellogg (1969) holds that small amounts of art material cannot possibly give either precise or valid information about what the child knows about human beings or why he draws his humans as he does. Harris (1963) suggests children's drawings may indicate a child's conceptual maturity rather than intellectual maturity. Goodnow (1977) terms children's graphic work as "not only visible thinking but even as a slice of life".

From the results of this study, however, it seems that the present Witkin DAF scale is not appropriate for assessing young children's degree of field-dependence. It is suggested, however, that it is not the instrument itself which is ineffective. Rather, the scaling system by means of which the drawings are assessed is out-of-date; categories to be scored are too broad and general in relation to young children's efforts. It was not possible by means of the present scale to register numerically the advances which the children did make in their drawings over the four testings on the Draw-A-Figure's five-point scale as it is presently stated. The Articulation of Body Concept Scale was devised in the 1950's (See Machover in Witkin et al, 1954). It was based on cultural aspects and styles of dress of that period. (See page 131 for Assessment Scale and Appendix for sample drawings). In the 1950's it was generally possible to determine an individual's sex by reference to a combination of physical features and characteristics which were strongly supported by one set of dress styles for females and another pattern for males. Demarcation of occupations between male and female

was also clear in the 1950's and this was reflected in the type of uniform or dress. Today, in the '80's, physical features and bodily characteristics of male and female are often blurred by a melding of male and female customs for dress, hair style and occupation.

It is also felt that the five plus to eight plus age range of children has not yet attained a measurable amount of their tendency toward a particular cognitive style. Witkin and his colleagues (1974) maintain that young children move from being relatively field-dependent to being field-independent. Some writers (Bauman 1951; Faterson and Witkin 1970 - in Witkin et al 1977) hold that people are likely to be quite stable in their preferred mode of perceiving, but others (Messick 1982) argue that educational goals should be to develop and enhance observed flexibility in modes of thinking, rather than to encourage a 'preferred' style.

Thus it seems reasonable to argue that the young children of this study were as yet unaware of the nuances of articulation of body concept, or were unable to express such differentiation in their drawings. Their experiences were limited to home, family and school situations. They responded mainly in reference to these contexts and had not formed a consistent pattern of response which could be related to the characteristics of cognitive style as assessed by the narrowly ranged scale of the Witkin Draw-A-Figure Test.

Discussion of British Ability Scale Results

The relationship between field-independence, performance on the Piagetian conservation tasks and the Block Design Test of the British Ability Scales (1978) was investigated in this study.

This particular task of the British Ability Scale which had been closely patterned upon the WISC Block Design test was chosen for use in this study for several reasons. Firstly, Witkin et al (1974) reported that the Block Design - Wisc measure was closely correlated with other measures of field-dependence. It was their opinion that while the Block Design test may also be an assessment of visual/motor ability, the specific visual/motor factor measured by the Block Design was related to the ability to disembed a figure from its background and hence, was closely related to an independent factor of cognitive style which they identify as field-dependence.

The scale used in this study resulted in two scores for each subject: an Ability and a Power score. The BAS 1- Ability scores did show a significant relationship with the Piagetian task scores in respect of field-independence. The Kruskal-Wallis Analysis of Variance did not show a significant result when the BAS 2 - Power scores were analyzed. (See Table 13, page 148).

While other researchers have found the Block Design (WISC) a suitable criterion for measuring field-dependence and have reported that the Block Design test correlates with other measures of cognitive style, the British Ability Scales were standardized and published in 1978. Hence, the use of the British instrument in respect of and as it relates to the Witkin measures of field-dependence has not been widely tried or reported.

The results of this study do suggest some support as regards the existence of a relationship between the BAS 1 - Ability Scale and

field-dependence when the measure is used with young children of age 6 to 7 years.

Summary of Results

Hypothesis I

The findings of this study gave limited support to the first hypothesis which stated that field-independent children would achieve higher scores on Piagetian conservation tasks than would field-dependent children. Bowd's (1975) study of field-dependence in early childhood and his cross-cultural comparison of field-dependence and performance on Piagetian invariance tasks (1977) also gave limited support to the proposal that a relationship might exist between Piagetian conservation tasks and field-dependence. Bowd's (1975) work is especially relevant to this study as his work was undertaken with a sample of young subjects of mean age 71 months ($N = 53$, 34 boys and 19 girls). These subjects appeared to be similar in age and composition to those of the present work while Bowd's (1977) cross-cultural investigation was undertaken with slightly older children (age 7 - 8 years). Huteau (1980) working with children age 13 - 14 years has proposed that the ability to ignore misleading perceptual cues as assessed by measures of field-dependence is also important in performance of Piagetian conservation tasks which require a restructuring ability. The findings of this work were similar to Huteau's and both studies suggest limited support to the notion that field-independent children will achieve higher scores on some Piagetian conservation tasks which demand restructuring ability.

Hypothesis II

The notion that field-independent children would achieve conservation tasks earlier than would field-dependent and show a more stable pattern of results over the longitudinal testings had been supported by earlier work of researchers Huteau (1980), Pascual-Leone (1969) and Case and Pascual-Leone (1975). It should be noted that these research-

ers had all been using subjects of an age range above ten years.

Thus when hypothesis II of this study was not supported, the age of the subjects (six years and four months at the initial testing) was considered as a factor which might be influencing results. Witkin et al (1974) report that field-dependency decreases with age. Donaldson (1982) has also written in respect of young children and their reactions to the administration of Piagetian conservation tasks. She suggests that individual children may tend to respond at some points in their development to impersonal, physical features (within the learning/teaching situation) or the same children at other times may tend to respond to intrapersonal or social factors. This observation of Donaldson, as regards precisely WHAT children may be paying attention to, linked to the idea that field-dependency decreases with age, suggests that the results of the study may be valid for the age group studied although not supportive of the hypothesis that field-independent children would achieve conservation tasks earlier as well as maintain a stable pattern of achievement on the Piagetian tasks over the longitudinal testings.

Hypothesis III

The results relevant to the third hypothesis which was concerned with the style of presentation of the Piagetian tasks upon the first inspection appeared contradictory. Field-independent children were hypothesized as being able to achieve higher scores on the three Piagetian tasks administered in an IMPERSONAL manner while field-dependent children were hypothesized as being able to perform more successfully on the three tasks administered in a SOCIAL manner. The latter part of this hypothesis was strongly supported when the data were analyzed in both the dichotomous and tri-partite modes although some field-independent children also received higher scores on the SOCIAL battery than

than on the IMPERSONAL tasks.

A careful consideration of the literature as it pertains to the age of the subjects and the tenets of both Witkin and Piagetian theory leads to a conclusion that both outcomes may be compatible when the age range and context of the materials and tasks of the testing situation are considered.

C H A P T E R V I I I

IMPLICATIONS AND EXTENSION OF RESEARCH

"All the vital questions are extremely easy and simple of solution in theory, and it is only when it comes to applying them that they prove not so easy of solution and break up into thousands of difficult questions".

from TOLSTOY ON EDUCATION,
University of Chicago Press
1967, page 37.

Implications and Extension of Study

Hypothesis I

Some interesting and related factors arose from the study as regards the first hypothesis that there might be a relationship between achievement on Piagetian conservation tasks and Witkin's theory of cognitive style. Both the literature reviewed and the results of the study make it clear that the factor identified by Witkin et al (1974) as 'field-dependency' is a complex one and it is not easily isolated from other perceptual and intellectual qualities as spatial ability, ability to disembed a figure from its background, or the way in which an individual orients her/himself in space.

It does appear from the pattern of results of this study and from other work (Satterly 1976; Satterly and Telfer 1979) that this quality can be identified if not isolated and that it may in some way be contributing to the teaching/learning situation. Further the literature suggests that field-dependence is a quality which should be utilized and made to serve educational purposes (Messick 1982).

What is needed are new methods of studying this factor of field-dependence and careful definition of the new constructs which are arising as a result of considering the effects of cognitive style in the context of the teaching/learning situation.

The studies of McGarrigle and Donaldson (1974), Light et al (1979), and Hargreaves et al (1982) have brought attention to the social context of cognitive test situations especially when these situations involve very young learners. (See Review of Literature, page 78). Hargreaves et al (1982) state:

"Social and interpersonal aspects of the test situation are fundamental to our understanding of the child's response and should not be regarded merely as surface phenomena".

These educationalists have been mainly concerned with notions of

Piagetian theory although Donaldson (1982) remarked that Witkin's studies of field-dependency might be linked to Piagetian work concerned with social context of both testing situation and task materials. A research design utilizing the methods and approaches of Donaldson and her colleagues and incorporating instruments to assess field-dependence might prove fruitful if undertaken with subjects of age range 5 - 9 years. There is a lack of research with this age group.

Hypothesis II

This longitudinal work suggested that young children's individual responses in the testing situation may show variations and fluctuations from testing to testing as well as from task to task. The general trend of the results, however, was always in a forward, positive direction, especially when mean scores of the individual, total Piagetian tasks, CEFT and BAS results are examined. Perhaps these observed fluctuations should be accepted as the natural expected pattern of performance for this age group? Clark (1982) writes that there has been developing awareness of the limited predictive value of tests on young children, earlier attributed partly to the unreliability of the tests, fluctuating concentration of the young child and to the fact that language could be assessed only to a limited extent. Clark continues that by the sixties, Hunt and others were considering whether and to what extent these variations in scores reflected variations in ability and not merely unreliability of the measures. Recent studies have looked at differential influences on intelligence test scores of young children as a result of varying the order of presentation of items, the tester or extent of preparatory scene-setting, task, and listener, Clark's list of differential influences in relation to intelligence testing of young children is applicable to the observed variations in

this study. The observed fluctuations might be considered as indications that there was something lacking or amiss within a testing situation that showed a pattern of fluctuations and that a more careful study and analysis of both the task materials and the situation might lead to a better learning result for some if not all of the children.

Messick remarks:

"If the structuring and restructuring of knowledge and skills can be influenced by instruction, then perhaps the cognitive structures that students typically exhibit at a given age are a function not only of psychological development, as Piaget contends, but of the nature and quality of traditional teaching itself. This raises the question of the degree to which the nature and quality of teaching may impose external restrictions on learning".

page 108, Messick (1982)

Further investigations of children's variations and regressions within the context of the teaching/learning situation - with particular attention being given to the interaction of the teacher/child might prove rewarding. Further investigations in relation to identifiable regressions might also be related to the Witkin notion of cognitive style and task presentation which was considered in Hypothesis III of this study.

Hypothesis III

Style of presentation of task as investigated in Hypothesis III was perhaps the most interesting and most conclusive result of this thesis. The outcome suggests a need for further work to study this dimension of cognitive style as it relates to the methods and materials of the teaching situation. Such studies would require precision in task selection and careful preparation of style of task presentation as well as care in the choice of research design. The design should allow for isolation of the variables - style of task presentation, cognitive style of pupil and teacher - as well as facilitate obser-

vation and study of the interaction of these elements.

Recently new trends have appeared in educational theory. Traditionally pupils have been assessed in light of their individual abilities, skills and personal structures of knowledge. The pupil's response in the learning/testing situation was evaluated in respect of the individual's ability and measured against a single standard of the test instrument. Recently attention is being focused upon the interaction which takes place within the testing situation. New hypothetical constructs are being identified and attempts are being made to define and organize them so that they may inform and enhance the learning process for individual children. The teacher's method of task presentation, personal preferred cognitive style, personality characteristics - while always considered to be of importance - are now being studied, codified and considered from an interactive point of view - as being essential to and more influential to the pupil's response than had been thought in the past.

The results of this study may be related to this perspective. While Piagetian tasks of the present study were organised into the IMPERSONAL and SOCIAL styles in order to investigate the Witkin notion of cognitive style, a more careful choice and organization of the conservation tasks could, perhaps, have produced more valuable insights in relation to the interactive factors of style of presentation, task and teaching situation. Future studies carefully thought out in relation to these factors could be valuable.

It might also be possible to design studies which would allow investigation of inter-individual match or mis-match of cognitive style between pupil and teacher. Brumby's (1982) work which aimed to categorize and study cognitive style in relation to problem solving tasks might be cited as an example of such a study. (See Review of Liter-

ature, page 48ff). Brumby's study was undertaken with first year university students and would need much adaptation in order to investigate the notion of match and mis-match of cognitive style with young children. This would be difficult to organise but prove useful indeed.

Finally an interesting area which arose late in this study and which for this reason was not pursued was the notion of identity versus equivalence conservation (Silverstein et al, 1982) first noted by Elkind (1967). This is discussed in the Review of Literature, page 68. Further studies to investigate this distinction and its effect upon children's responses to conservation problems could direct teacher's attention to the mental activity required of the child for successful completion of conservation questions.

Children's Embedded Figures Test

The longitudinal pattern of score results which arose in the study are in line with work done by Connor et al (1978) in which a 'practice' effect was found when the CEFT was used with a sample of children whose mean age was 6.5 years. As stated earlier, the mean scores of the CEFT when it was used in this study increased steadily over the four longitudinal testings. The final mean score was exceptionally high in relation to the age of the children and Buck-Morss's observations concerning cross-cultural application of Piagetian tests may be applicable to the Witkin measure as well. She remarks that cultural relativists point to a plethora of cultural variables both within the tests (methods of testing, equipment used, language and translation) and among those tested (literacy level, child-rearing, parental occupation), and claim that the test results are therefore culturally biased.

Certainly an assessment instrument is related in some way to the

period in which it has been devised and the group of people upon whom it has been standardized. This may be related to the results observed in the longitudinal administrations of the Children's Embedded Figures Test. Higher scores achieved by the children even at the first testing may be linked to a number of factors. The writer suggests that children of the '80's because of the influence of the media, increased opportunities for travel with parents, outings with school parties, must be different from children in the 50's and 60's upon whom the CEFT was standardized.

It would be interesting to re-test the sample of children used in this study over a period of years to observe further the pattern of their CEFT results especially as regards stability of field-dependence. It might also be interesting (if possible) to collect previous results of this instrument from a variety of sources and age ranges in order to compare and contrast the scores by age, sex, socio-economic and cultural backgrounds.

The Children's Embedded Figures Test and the Witkin Draw-A-Figure Test did not correlate. Similar results have been reported by other researchers. The DAF does not appear to be a suitable instrument for assessing cognitive style with children under the age of ten years. Some of the cultural factors discussed above in relation to the CEFT may be applicable to this instrument. It is still the view of this writer that it might be worth while to extend and elaborate the present scale of this Witkin instrument in order that it might be used to assess cognitive style in young children. Skilled and experienced people would be needed to accomplish such a task. Such individuals would need to have had much experience of working with young children as these children had actually been in process of producing drawings and paintings. They would need as well an indepth

understanding of the theory underlying children's development as it is demonstrated in expressive drawings and paintings.

Specific Implications for Teachers of Young Children

Many educationalists do not accept the notion of field-dependence/field-independence and argue that this factor cannot be separated from general intelligence. Nevertheless, the results of this study even if accepted with some caution call our attention to issues which are of paramount importance to the classroom teacher of young children.

These are:

1. It cannot be stressed too often that the teacher must be aware of the individual differences of the children.
2. She/he must make detailed observations of children in the classroom and pay particular attention to differences in the child's learning style and the ways in which this style is affected by the context of the situation.
3. Nor should the teacher expect a common performance from a class or group of young children - especially as a result of a standardized or 'formal' test.
4. Teacher must be judicious in the use made of test results or of any single, isolated measure of a young child's performance.
5. It is essential that the teacher keep an open mind as regards young pupil's abilities in order to avoid the dangers of labelling a child as 'slow' or 'dull'.
6. The teacher must recognize that recent research suggests the influence of the teacher is much more influential upon the individual child's success or failure in the classroom than was believed in the past.

The notion of field-dependence/field-independence gives an additional dimension - and one which is bi-popular rather than uni-popular - to aid the teacher in the day to day application of these ideas.

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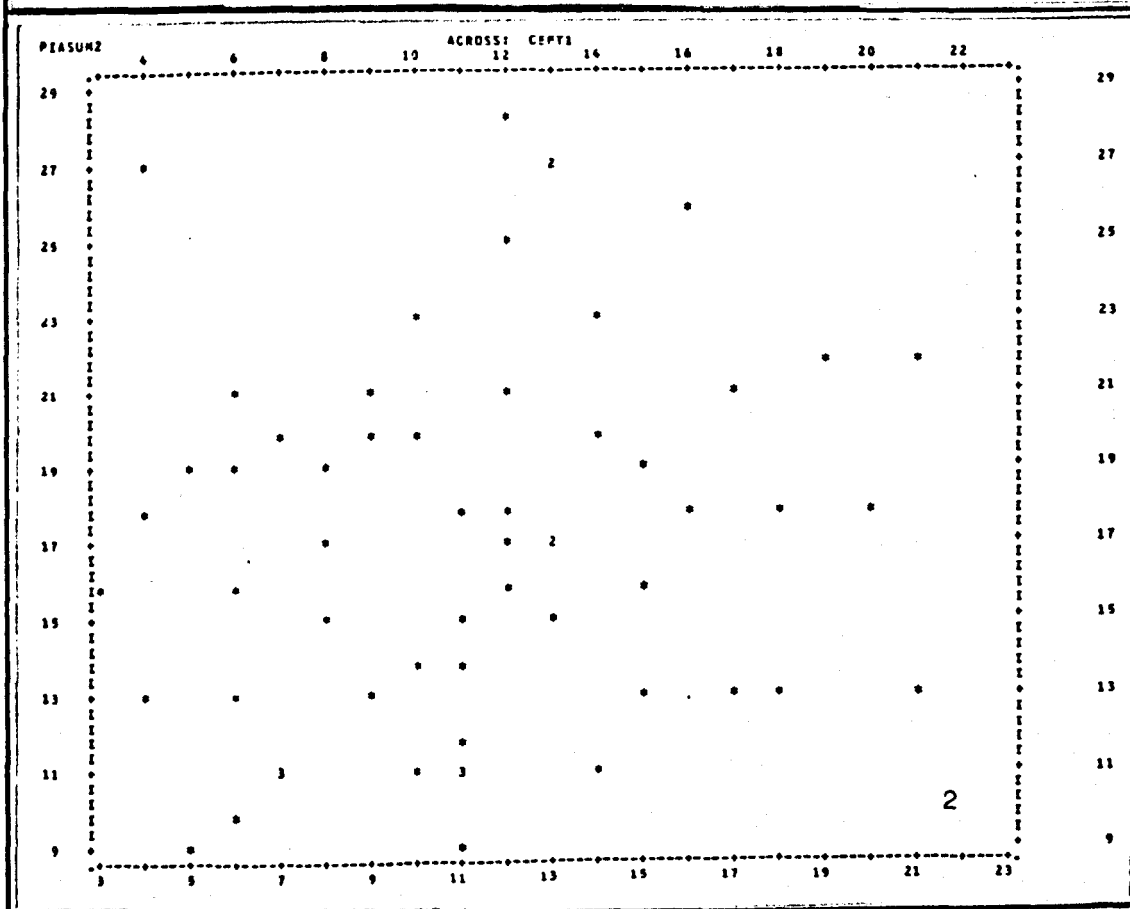
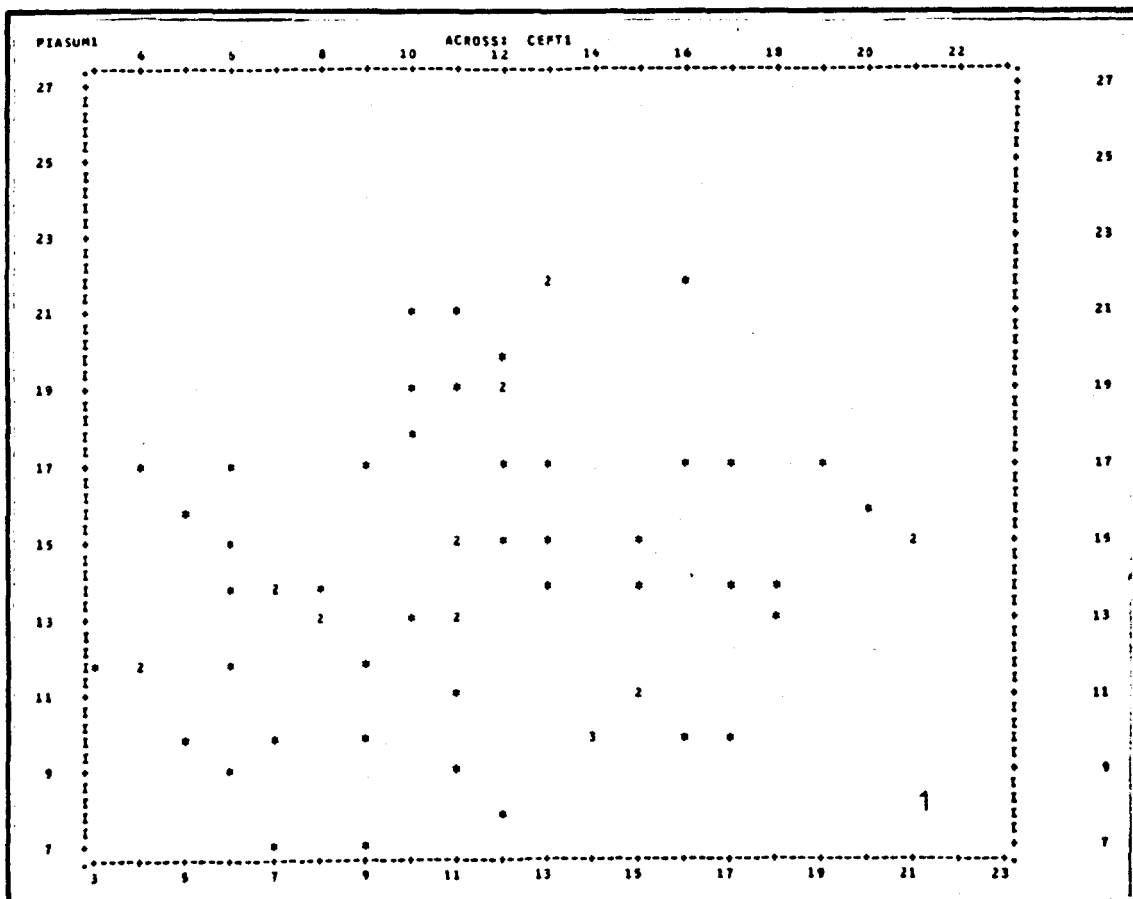
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1. Scattergrams of Four Longitudinal Testings Showing Relationship of First CEFT and Piagetian Task Scores for the Four Testings - Produced by SPSS ^x Programme	1
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A P P E N D I X 1

Scattergrams of four longitudinal
testings produced by SPSS^x Programme

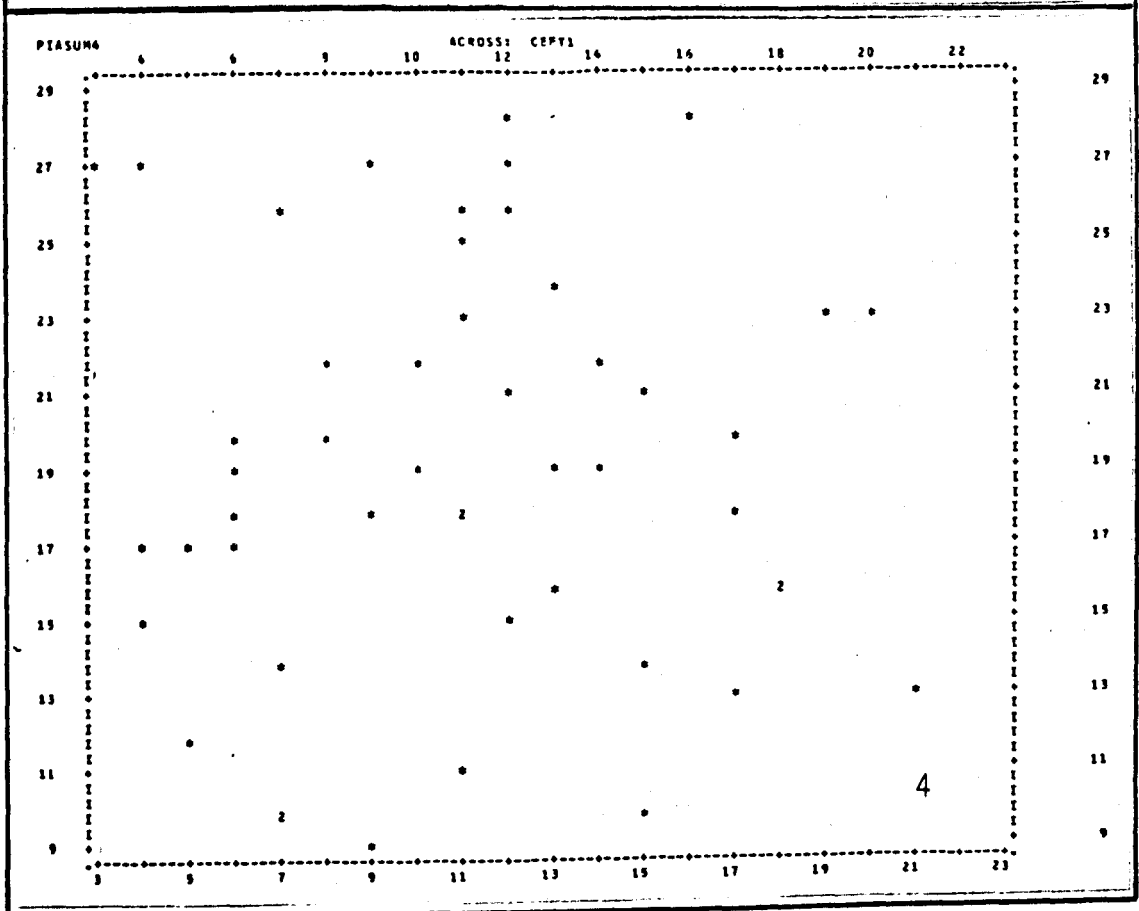
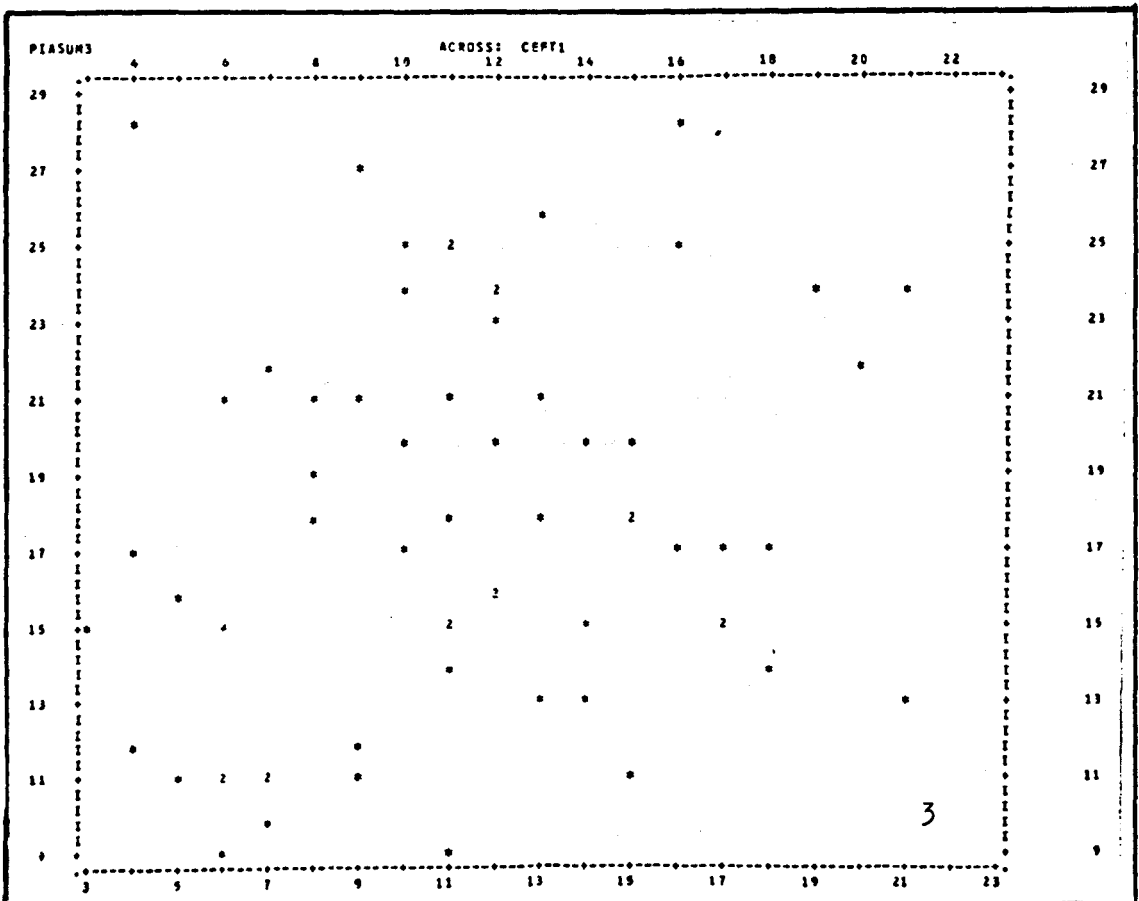
SCATTERGRAMS OF FIRST AND SECOND TESTINGS (N = 64)

Showing Relationship of Piagetian Total and the First CEFT Score



SCATTERGRAMS OF THIRD AND FOURTH TESTINGS (N = 64)

Showing Relationship of Piagetian Total and the First CFT Score



A P P E N D I X 2

Sample drawings - DAF and Piagetian H/V
Co-ordinate task (House-on-hill) produced
by subjects 45 - G, 46 - G, 35 - B and
42 - B

A P P E N D I X 3

Copy of article 'Children's Drawings as an
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