A COGNITIVE STYLE STUDY OF NATIVE INDIAN CHILDREN

by

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ABSTRACT

This study examined the issues of culture, measurement and development involved in field-dependent-independent cognitive style research with Native Indian and Non-Indian students. Two cultural groups were tested, and each group consisted of 75 students from ages 8 to 12. One of the cultural groups was composed of Tsimshian Indians living in villages outside of Prince Rupert, and the other was composed of non-Natives living in Prince Rupert. Four measures of field-dependent-independent cognitive style were individually administered to students. One test (Embedded Figures Test) was established as the criterion measure of cognitive style, and the potential of the other three tests as measures of cognitive style was investigated. Five ages were included so that differences in developmental trends could be determined.

Results showed that the non-Natives scored significantly closer to the field-independent end of the continuum than the Natives on two of the four measures of cognitive style. These results indicated that cultural differences do exist between the two cultural groups for two of the measures. The four cognitive style measures were found to inter-correlate highly, which indicated that they form a reasonable battery to use for measuring field-dependence-independence. Results also showed no interaction between age and culture, thereby indicating that no significant differences in development existed between the two cultural groups. In both groups, cognitive style developed in the same linear sequence, and reached the same level of development by age 12.

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Chapter I

PROBLEM

A. INTRODUCTION

Man's cognitive functioning has been the topic of scholarly debate for centuries. Cognitive psychologists today continue to differ over the components of, and processes involved in, cognitive functioning. Views of cognitive processing range from defining it by a single I.Q. score, to defining it by 120 separate scores (Guilford, 1980).

Cognitive style, as one of the many aspects of cognitive functioning (Berry, 1984), has been the focus of numerous empirical studies in the last 25 years. An individual's cognitive style was proposed to develop according to the ecological and cultural demands of the environment in which he or she lived (e.g., Berry, 1966, 1971; Berry & Witkin, 1975; Dasen, 1975; Kleinfeld, 1973, 1974; MacArthur, 1973; Vernon, 1972). It was to further investigate the notion of cognitive style development in cross-cultural situations that this study was undertaken.

B. BACKGROUND

Werner (1948) and Witkin (1952) held the belief that an individual progressed from viewing his environment in a relatively undifferentiated manner to viewing his environment in a relatively differentiated manner. Witkin empirically investigated the differentiation hypothesis, and his findings led him to formulate the theory of psychological differentiation. This theory proposed that progress toward greater differentiation occurred as an individual developed.

The theory also held that greater differentiation in one psychological domain "goes with" a similar tendency in other domains (Witkin & Berry, 1975).

This quality of generalizability of differentiation in one domain to all other psychological domains was referred to as, 'self-consistency' (ibid., p. 20). According to the theory, if an individual easily differentiated figures hidden or "embedded" in an organized background, the individual would also easily carry out an intellectual differentiation task. The basic assumption of self-consistency across all domains allowed cognitive psychologists to make inferences about an individual's 'cognitive style' on the basis of his/her 'perceptual style'. Witkin and Berry (1975) spoke of self-consistency in this way:

> With this extension of the picture of self-consistency from the perceptual to the intellectual domains the label of 'cognitive styles' becomes appropriate as a more comprehensive concept than 'perceptual styles'. (p.9)

Thus, the theory supported the notion that an individual is an integrated system, and the individual's development involves the whole organism, not its separate domains. In other words, differentiation in one domain mirrors differentiation in another domain, and the degree of differentiation across all domains is an individual's 'cognitive style'. [Cognitive style refers specifically to field - dependent - independent (FD/FI) cognitive style throughout this study.]

However, the question could be posed as to whether people from different cultures have different cognitive styles. Berry and Witkin (1975) hypothesized that ecology and culture were important variables in the developmental process of psychological differentiation, therefore, variances in differentiation across cultures were expected. Using their own research, as well as research by others (MacArthur, 1973; Vernon, 1972), Berry and Witkin (1975) confirmed the notion that psychological differentiation development differed according to the demands of the environment and the cultural group inhabited by the individual. Individuals within cultures, and whole cultural groups, could have similar levels of psychological differentiation.

According to Berry and Witkin (1975), an ecology suited for migratory hunting and gathering encouraged a relatively high level of perceptual differentiation. Since hunters and gatherers must have keen visual discrimination skills to locate their food, Berry and Witkin suggested that these people would also differentiate between other visual stimuli quite readily. Conversely, eco-cultures requiring less visual discrimination for survival might display relatively less visual differentiation. This variability of differentiation led Berry and Witkin to theorize that to study a particular culture's 'cognitive style', culture and ecology must be considered (ibid., p. 11).

Perceptual tests were used to determine the level of differentiation, or cognitive style of individuals in different eco-cultures. These tests required visual-spatial skills. The self-consistency construct in the psychological differentiation theory allowed for the use of the perceptual tests to explore differentiation in other domains. Some perceptual tests required the subject to differenatiate a part from within a whole. On these tests, an individual's perception might have been dominated by the organization of the field to the extent that he was unable to "disembed" the parts from the whole. (Separation or extracting the figure from the background was referred to by Berry and Witkin as 'disembedding'.) Such a mode of perception was labeled 'field-dependent' (FD). The contrasting mode of perception in which the individual readily separated out (differentiated) the parts from within the field, was labeled 'field-independent' (FI). Regarding these two modes of perception, Berry and Witkin (1975) said:

> Relatively field-dependent and relatively field-independent perceptual styles may be taken as indicators of greater or lesser differentiation in the perceptual domain. (p.8)

Field-dependent or field-independent performance in the perceptual domain, based on the theory of psychological differentiation, could then be extrapolated to the

cognitive domain.

According to the results of developmental cross-cultural studies using FD/FI measures, all cultures develop from a less to more differentiated state. Berry and Witkin addressed the issue of cross-cultural development by stating:

> ...the available cross-cultural evidence suggests that the development of psychological differentiation follows a sequence in other cultures similar to that originally observed in Western cultures. (p.39)

Although development is reported to progress in the same sequence across cultures, the overall level of development might vary.

C. STATEMENT OF THE PROBLEM

The role culture plays in an individual's development of cognitive style is an issue deserving further attention. Due to the variability of cognitive style development with eco-cultural setting, each cultural group requires individual investigation. For example, the results of Berry and Annis' cognitive style study (1974), involving Cree Indians, could not be applied to all Indians in North America because of individual differences within and between cultural groups. Due to individual differences, it is important that cultural groups be studied separately and that generalizations across cultural groups be avoided.

The numerous different measures used to determine field-dependent-independent cognitive style has led to problems with comparisons of cross-cultural studies. Some of the tests are modified versions of originals, and they have been used either singly or as batteries. Some of the most frequently used instruments have been Kohs Blocks, Rod-and-Frame Test (RFT), Raven's Progressive Matrices, Witkin's Embedded Figures Test (EFT), Porteus Mazes, and Weschler's Block Design (BD). Regarding the findings obtained from FD/FI measures, Vernon (1972) cautions that, "...inconsistent findings may often have arisen from the use of single, simplified versions of RFT or EFT or other

spatial tests" (p. 379). Vernon was concerned that investigators have used modified versions of EFT too freely and that they have reported the results as if each test measured everything that was implied by FD/FI. Vernon also suggested that at least three measures be combined to form a battery of FD/FI because no one test is valid as a measure of all the different kinds of spatial ability (ibid., p. 368). Similarly, Berry (1966) suggested that four tests be used to ensure reliability (p. 218).

Another aspect of FD/FI cognitive style which requires further study is the development of cognitive style with age. Using the EFT, Berry (1966) studied Eskimo and Scottish individuals from age 10 to 40. In another cross-cultural study, Berry's (1971) age ranges were 10-15, 16-20, 21-30, and 31-40. Weitz (1971), using the EFT, looked at Native Indians and Euro-Canadians aged 17-55. MacArthur (1973) using EFT, along with thiry-four other tests, studied individuals aged 9-40. In these studies, developmental trends were looked at for individuals from age 10 to 50 and minimal attention paid to the younger ages. Studies involving age spans of one and two years and involving children at ages below 10 would be useful. By studying the early development of cognitive style in yearly increments, rather than in five to ten year increments, a better uncerstanding of the developmental process might occur.

The issues of cross-cultural differences in cognitive style, the accurate measurement of cognitive style, and the developmental trends of cognitive style require much further investigation. To deal with these three issues, researchers need to: focus on differences between cultural groups by studying them individually, use a number of the same FD/FI measures consistently, and study developmental patterms in young children.

D. PURPOSE

This study examines three issues in the investigation of field-dependent-independent cognitive style:

1. FD/FI cognitive style is unique to each cultural group, thus it is necessary that it be studied in individual cultures.
2. Numerous measures of FD/FI cognitive style have been used, but the diversity of measures, and the limited number used per study, has made comparisons within and across cultural groups difficult. It is therefore important that three or more measures of cognitive style be used.
3. Developmental studies of FD/FI cognitive style have involved ages ten through adulthood, and the ages were grouped into five and ten year categories. It is important that further studies involve children at each age, from eight to twelve years.

E. DESCRIPTION OF TERMS

The following terms are used throughout the present study:

Perception refers to visual and spatial abilities.

Cognitive Style refers to the characteristic method by which an individual processes perceptual, cognitive, and social information (Berry, 1980).

Field-Dependent-Independent Cognitive Style (FD/FI) refers to one approach to studying cognitive styles. Field-independence (Vernon) involves the spatial ability required to perceive and hold in mind the structure and properties of a figure, and "disembed" it from the whole (Vernon, 1972, p. 370). Field-dependence is the inability to disembed figures from the background in a relatively easy manner. Field-independence and field-dependence are relative terms existing along a continuum from a field-dependent state to a more field-independent state. Since the present study deals with only the

field-independent-dependent dimension of cognitive style, the term 'cognitive style', unless otherwise noted, refers only to FD/FI cognitive style.

Native Indian refers to people of aboriginal Indian ancestry in North America who live either on or off reserves.

Non-Native refers to those individuals living in Canada whose ancestors are not of Native descent.

Culture refers to "group-shared patterns of behavior which are adapted to the group's habitat" (Berry, 1974, p. 175).

Chapter II

REVIEW OF THE LITERATURE

This literature review addresses the issues of: field-dependent-independent cognitive style in different cultures, the measurement of cognitive style, and the development of cognitive style.

A. FIELD-DEPENDENT-INDEPENDENT COGNITIVE STYLES AND THEIR CROSS-CULTURAL DIFFERENCES

The construct of cognitive style, based on the theory of psychological differentiation, has been the basis of much empirical research for the past 25 years. Werner's definition (1948) presented the concept of psychological differentiation to be like a psychological umbrella which explained or "covered" all functions of human activity. Based on Werner's original hypothesis, Witkin (1962, p. 18) described psychological differentiation as the process of change from a global (not internally separate) structure of functioning, to a more differentiated system that is separated into all its component parts. According to the differentiation hypothesis, individuals function psychologically as one system composed of many domains, rather than each domain functioning in isolation. The whole system becomes capable of greater differentiation as development occurs. Within the system, a certain level of functioning in one psychological domain is indicative of the same level of functioning in another domain.

Witkin expanded on Werner's original differentiation hypothesis by investigating it empirically. To investigate the level of differentiation, Witkin used perceptual measures, and then made inferences to psychological domains other than perception. The perceptual tests consisted of geometric figures hidden within a field of similar shapes. Subjects were required to disembed the figures from the context within which they were hidden. If an individual could readily perform

the task, he was labeled 'field-dependent'. Depending upon where an individual performed along the continuum from field-dependent to field-independent, inferences could be made about all of his other psychological functions. Concerning the 'dependent-to-independent' continuum, Berry (1984) stated:

> No interpretation is made about levels of (field-independent) development, given that no assumptions are made about the absolute value of a particular style; indeed, such work assumes that differing positions on a cognitive style dimension will best meet the requirements of living in differing ecological and cultural contexts. (p.344)

In other words, the field-dependent-independent continuum must be viewed in relative terms. Individual culture groups hold different positions along the scale, and no position is any better that any other. It is a relative form of measurement, with more or less field-independence varying between individuals and across cultures, and one source of this variance is suggested to be due to culture (More, 1984).

Witkin's all encompassing theory (1962) was intended to explain psychological development and the interrelationship of all the domains. It was therefore of considerable scientific importance. However, the all inclusive nature of the theory, which was based on results obtained from measures of field-independence, bordered on exaggeration. Vernon (1972, p. 366) pointed out that Witkin could be criticized for exaggerating the significance of his "style" and that he (Witkin) may have been "empire building". To include all parameters of human activity under one theory was certainly a questionable procedure. Vernon's comments serve as valuable cautionary notes to remind cross-cultural researchers that cognitive style is only one small component of cognitive functioning. His comments remind researchers that using perceptual measures to describe abilities in all psychological functions can lead to inaccurate conclusions.

Another area of cognitive style research which requires further study is the area of definition of terms. Due to the use of inconsistent, poorly defined

terminology, it is difficult to understand what is actually being measured in cognitive style studies. For example, in his 1971 study of eight samples of subsistence level peoples, Berry used the words 'spatial', 'perceptual', 'visual' and 'discrimination' interchangeably. Gaddes (1968) was also guilty of promoting ambiguity of terms by using 'spatial imagery', 'visual-spatial ability', 'spatial aptitude' and 'perceptual habits' as though they were one term, and he failed to give any definition of these terms.

Clear explanations of the terms used, and consistency in their use would enhance the cross-cultural comparison of cultures. Attention to these areas would also facilitate replication of studies across and within cultures.

Regardless of its flaws, Berry's (1966) research has become the basis for a cross-cultural research tradition. By adding the eco-cultural dimension to Witkin's psychological differentiation theory, Berry provided researchers interested in other cultures with a very useful guide for investigation. Berry (1966, p. 208) hypothesized that ecological factors contributed to particular cultural qualities, which consequently led to certain cognitive adaptations. For instance, people who relied on hunting as their mode of sustenance, developed visual and spatial skills adapted to that particular ecology. Likewise, a culture based on agriculture developed visual and spatial skills to exist in that particular ecology. Berry speculated that cultural characteristics, such as cognitive styles, were adaptive behaviors which allowed people to develop and maintain the skills required for their particular ecology. In 1980, Berry continued to support his original theory about the role of eco-culture in determining cognitive style. However, he chose to limit the interpretation of FD/FI measures to the 'perceptual-cognitive' and 'social domains' (ibid., p. 95). This choice helped to provide some limitation to the very broad theory of psychological differentiation.

After Berry's work (1966), many researchers did cross-cultural studies which supported the notion of the interrelationship of ecology, culture and cognitive development (Dasen, 1975; Kleinfeld, 1973; MacArthur, 1973; Shade, 1981; Vernon, 1969). As a result of these studies, cognitive style was identified as being influenced by specific eco-cultural demands. Thus, Berry's eco-cultural dimension, added to Witkin's psychological differentiation theory, provided a substantial base for cross-cultural comparisons of cognitive style.

A result of numerous cross-cultural studies, is that cognitive psychologists have come to agree that cultural groups develop their own methods of solving perceptual problems, and that varying degrees of field-independence help to indicate levels of cognitive development (Goodenough, 1976).

An individual's degree of field independence or dependence, or cognitive style may be affected by his experiences with child-rearing practices, socio-cultural practices and ecological factors (Berry, 1971, p. 326). Child-rearing practices, which foster the development of greater psychological differentiation, hence a more field-independent perception, are the practices which encourage autonomy and allow for flexibility in parental authority. Such a culture might be termed "loose" in its social structure, because it allows flexibility in behavior, thereby encouraging a relatively field-independent perceptual response. In regard to the ecological factor of cognitive development, Berry (1980) stated:

> Both the ecological and cultural factors to be found cross-culturally among subsistence-level peoples are predictive of greater field-dependence among agriculturalists and greater field-independence among hunters and gatherers. (p.97)

In support of this statement, Berry and Annis (1974) found Native Indians who were migratory hunters and gatherers in northern British Columbia to be more field-independent than the Native Indians in that area who relied more on agriculture. The more sedentary, agricultural group disciplined their children more strictly, interacted socially in a "tighter" manner, and relied more

on agriculture than the migratory hunters and gatherers. Hunting and gathering subsistence lifestyle required the ability to visually extract key information from the hunting area. Therefore, acute visual and spatial perception were necessary skills in a traditional hunting and gathering culture (Witkin & Berry, 1975).

However, Witkin (1967) noted that the contribution of ecology to cognitive development, in a person-environment interaction sense, was not readily separable from the contribution of socialization. Ecology, Witkin and Berry (1975) noted, "...is the characteristic relationship between man and the land he occupies and it may be a major factor in the kind of behavior he develops" (p.15). They concluded that social arrangements and child-rearing practices evolve in close relation to ecology. The interrelationship of ecology, culture and cognitive style is indeed complex. At any time these three factors are in continuous interaction, and the question of their independent contributions remains to be explained.

The following is a summary of the characteristics that researchers (Goodenough, 1976; Vernon, 1972; Witkin, 1977) have found to be associated with field-independent and field-dependent individuals or cultures:

Field-independent
- articulated or analytical (able to find discrete parts in a complex background)
- imposes structure on unstructured situation
- spontaneous response to stimulus material
- able to keep body upright while environment is rotating
- impersonal social orientation
- individualistic
- intrinsically motivated
- learns best by going from general to specific
- active learner
- has experienced loose discipline and adult authority not enforced

Field-dependent
- does not separate figure and ground, global approach to tasks
- does not impose structure on unstructured material but leaves material as it is
- needs external structure
- socially oriented
- superior memory for social information
- externally motivated (heavily infuenced by situation and other people)

- passive learner
- no difference in learning when presented general to specific or reversed
- has experienced relatively strict discipline and conformity to adult authority is enforced

The investigation of field-dependent-independent cognitive style across cultures is enhanced by a theory such as psychological differentiation. However, as Berry discovered, the variables in an eco-culture, which can affect cognitive style, require each cultural group to be studied separately. Child-rearing practices, social structure and ecology vary from one cultural group to the next, and these are critical variables in the determination of cognitive style (Berry, 1966, p. 327).

B. MEASUREMENT OF COGNITIVE STYLE CROSS-CULTURALLY

Researchers have used a variety of field-dependence-independence measures to identify individuals' cognitive style. Vernon (1972) suggested that a measure of field-independence, "involves the spatial ability required to perceive and hold in mind the structure and properties of a figure and disembed it from the whole." Some of the measures of field-dependent-independent cognitive style are Witkin's Embedded Figures (Berry, 1966; MacArthur, 1973), Rod-and-Frame Test (Case, 1977), Kohs Blocks (Berry, 1966), Gestalt Closure test (Berry, 1966), Porteus Mazes (Gaddes, 1968), WISC-R Block Design, WISC-R Picture Completion, WISC-R Object Assembly (McShane, 1982), Draw-A-Man (Vernon, 1972), Raven's Progressive Matrices (Berry, 1966) and Morrisby Shapes (Berry, 1966).

These perceptual tests are reported to measure visual discrimination and spatial ability. Spatial ability is the factor considered as distinctive to field-independent perception. Several studies (Kleinfeld, 1971; MacArthur, 1973; Shade, 1981, Witkin, 1966, 1971) note in their cross-cultural research, that the cognitive functioning required to do a field-dependent-independent task primarily involves spatial skill. Concerning the spatial skills or spatial abilities involved in

FD/FI and the tests used to measure it, Vernon (1972) wrote:

> Despite the considerable unitariness of spatial and perceptual abilities, they are also complex, and many have tried to break them down into distinctive spatial, orientation, visualization, or other factors. It follows that any single test such as RFT or EFT, and even any one battery, is only partially representative, and may show different correlations with cognitive or personal characteristics from any other single test or battery... It is unfortuanate that agreement can not be reached on some single representative battery. (p. 368)

Vernon suggests that because different tests measure somewhat different things, a battery of measures should be used in cognitive style studies (ibid., p. 368).

Witkin's Embedded Figures Test, Children's Embedded Figures Test and WISC-R Block Design subtest are three of the perceptual measures which have been used most frequently to test for field-dependent-independent cognitive style. Children's Embedded Figures Test (CEFT) is a version of Witkin's test to be used for children age 6 to 12. These tests have been used by: Berry and Witkin, 1975; Dawson (1967); MacArthur, 1974; Shade (1981); Vernon, 1969; and Weitz, 1971. The inter-correlation of these tests has been recorded to be as high as .82 by Shade (1981) and as low as .66 by Robinson (1983).

The Embedded Figures Test and the Children's Embedded Figures Test, which is a version of EFT modified to use with children aged 6 to 12, requires a subject to locate a previously presented simple geometric figure within a complex figure designed to embed it. The whole picture in EFT (and CEFT) forms a gestalt (Robinson, 1983). Some subjects quickly break up the complex figure in order to find the simple figure; this is a field-independent performance. At the opposite end of the continuum, the subject sees the simple figure remaining fused with the complex design and a good deal of time is required to detect the simple figure. The EFT and CEFT are scored on a continuum with field-dependent individuals receiving relatively lower scores than field-independent individuals. In the reported research, individuals in the sample studied are separated according to their relative performance within that particular group. For

example, a score of 14 might be in the middle range between field-dependent (global) and field-independent (analytical) in one study, but in another study it might be considered in the field-dependent range. The scale is a sliding scale, with individuals scoring the highest being labeled as the most field-independent and with the lowest scoring individuals being labeled field-dependent. The middle range would supposedly be determined by the experimenter using his best judgement.

Berry (1966) found Eskimo scores to significantly exceed Temne scores, and to come close to matching Scottish scores on four spatial tests (EFT, Kohs Blocks, Morrisby Shapes, Raven's Progressive Matrices). These scores were taken as indicators of the Eskimo being relatively more field-independent than the Temne and slightly more field-dependent than the Scottish.

Witkin (1967) found that the Block Design (BD) test also provided an excellent measure of field-dependence-independence (FD/FI), since it required perceptual organization and reproduction of a spatial design fused within a more complex design (p. 237). Determination of an individual's FI/FD based on the BD score would be based on a continuum just as EFT and CEFT scores are.

As Vernon (1972) pointed out, a number of tests should be used to determine FI/FD because "any single test such as RFT or EFT, and even any one battery, is only partially representative and may show different correlations with cognitive or personal characteristics from any other single test or battery" (p. 368). An example of a study involving a number of measures was done by Berry (1966). To measure perceptual skills of the Temne of Sierra Leone and the Eskimos of Baffin Island, Berry, used a test for closure to assess visual discrimination skill, and Kohs Blocks, EFT, Morrisby Shapes and Raven Matrices as tests of spatial ability. Berry (1966) selected these measures "for their ability to discriminate fine degrees of ability at both ends of the (spatial ability) scale:

(p. 218). He also chose to use four tests rather than a single one "partly to ensure reliability of measurement and partly to gauge their relative usefulness in a cross-cultural setting" (ibid., p. 218).

Examples of studies which did not include at least three tests were Grimes (1971), Shade (1980), Siebens (1973) and Taylor and Skanes (1976). Although these studies were not with Native students, cognitive style was used primarily as a blocking variable, and students were initially divided into FI/FD groups. Such categorization of students, based on a 10 minute group administered measure is a questionable procedure given the ambiguity of any single FI/FD test. Berry (1966) and Vernon (1972) both noted that at least three FI/FD cognitive style measures should be used and that these three should be highly correlated and reliable.

The Wechsler Intelligence Test - Revised (WISC-R) has been used cross-culturally in the United States and Canada. A few of the subtests have been identified as cognitive style measures because of their spatial ability measurement (Kaufman, 1979). Bannatyne's recategorization of WISC-R subtests included a Spatial category. The Spatial category, which is comprised of three subtests (Picture Completion, Block Design, Object Assembly), is of primary interest, as it has been shown to load substantially on the same factor as the field-independent measures, Rod and Frame Test and Embedded Figures Test (Kaufman, 1979). Bannatyne's recategorizations however, are based primarily on clinical experience (Kaufman, 1979).

A number of researchers such as Browne (1984), Connelly (1983), McCullough (1985), McShane & Plas (1984, 1982) and Scaldwell (1984) have done WISC-R studies with Native Indian children. They have found these children to score significantly higher on the WISC-R subtests included in Bannatyne's spatial category than on subtests in any of the other three categories (Verbal

Conceptual, Sequencing, Acquired Knowledge).

McShane and Plas (1982), when studying 142 Ojibwa children, found WISC-R Spatial scores (using Bannatyne's recategorization framework) to be significantly higher than Sequential scores, which were in turn, significantly higher ($p < .05$) than Acquired Knowledge scores.

However, in McShane and Plas' (1984) review of WISC-R research involving Native Indian students, it was noted that Block Design, Object Assembly and Mazes form a spatial processing factor in which Indian children demonstrate relative strength. These researchers speculated that this recategorization might be unique to Indian children. Browne, using factor analysis, found a Perceptual Organization factor for 197 Native American children (age 6-16) in Nebraska. Her perceptual factor consisted of Block Design and Object Assembly in all groups. Also, Mazes and Picture Arrangement appeared to have a clear relationship to the spatial factor, but Picture Completion was consistently absent. Connelly (1983) investigated patterns of WISC-R scores using Bannatyne's recategorization. In a study of 146 Tlingit children in southeastern Alaska, Connelly found the Spatial score (9.46) to be significantly higher than the Sequential (7.04) score. Connelly (1983) stated,

> The mean Spatial scores of both groups (age 6-10 and 11-16) were close to the expected (10.0) of the normative population, while all the other mean recategorized scores were from 2.05 to 4.11 points lower than those that would be expected.... (p.275)

He suggested that McShane's (1984) notion of a pattern for Indians persisted across his sample.

McShane (1982) and Browne (1984) drew different conclusions about which subtests form a spatial factor. Neither of them found the tests in Bannatyne's Spatial factor to be included in their spatial category. However, Connelly (1984) did find results similar to Banatyne's. Conclusive evidence to support the formation of one WISC-R Spatial factor for all Native children has not been

demonstrated. The use of the WISC-R with the various Indian children certainly suggests relative strength on the subtests measuring spatial skill. Yet no single cluster of subtests seem to measure spatial skill for all children. The suggestion that certain WISC-R subtests form an "Indian pattern" of processing (McShane, 1984) seems premature and unwarranted. Chrisjohn (1984) questions the use of Bannatyne's categorization with Native Indians on the grounds that the categories were formed without a statistical rationale. He does admit that some exploratory factor analytic results have revealed some factors that resemble Bannatyne's clusters.

Krywaniuk and Das (1976), using the WISC, in addition to other cognitive tests, noted the relative spatial strength of 40 (Grade 3-4) Native Indian children (Performance Mean 93, Verbal Mean 78) in Hobbema, Alberta. The children were not a representative sample, as they were low achievers. However, Krywaniuk and Das hypothesized that this cognitive strength might reflect an holistic, simultaneous, non-verbal method of processing information. They equated high WISC Performance scores and Raven scores with relatively well-developed spatial abilities (Krywaniuk & Das, 1976, p. 273). Browne (1984) and Scaldwell (1984) also mention the relatively high spatial skill performance of Indian children. These two researchers suggested that educators extensively examine the relationship of spatial skill scores to simultaneous processing.

The WISC-R studies and Krywaniuk and Das' WISC study (1976) indicate a tendency on the part of Indian children to perform relatively higher on spatial tests than on sequential or verbal tests. Also, the Indian children who have been exposed to less Western acculturation tend to score significantly higher on spatial skill tests than the more acculturated children (Berry, 1980; McShane, 1982).

It is possible that a relationship exists between WISC-R Spatial category scores and FI/FD cognitive style scores, which primarily involve spatial ability.

Further substantiation of this relationship could link current WISC-R studies involving Indian children, with the FD/FI studies which were done in the 1970's.

Kaufman (1979) discussed the value of the WISC-R spatial subtests as measures of FD/FI (p. 41). He also suggested that a significant difference between Performance and Verbal Scales signified a field independent cognitive style. Before making decisions about a student's FD/FI, Kaufman (1979) suggested that for a purer measure of field-independence, the EFT should be administered along with the WISC-R. He noted that continued investigation of cognitive style across many populations is necessary, as the majority of studies have been done with Westernized populations.

Studies using the WISC-R with Native Indian children have discussed its potential as a cognitive style measure (McShane, 1984). Yet, to validate WISC-R spatial tests as cognitive style measures, EFT or RFT should also be used. Without using the original FD/FI tests, a thorough measurement of cognitive style is impeded (Vernon, 1972). Comparisons across all cognitive style studies would be facilitated if at least some of the FD/FI tests were consistently used.

Another test which has potential as a measure of cognitive style is the Kaufman Assessment Battery for Children (K-ABC). The K-ABC is based on Das, Kirby and Jarman's (1976) Simultaneous-Successive model of information processing. The K-ABC is designed to assist educators in identifying students' styles of solving problems. One type of problem solving tested by the K-ABC involves linear, analytic, temporal processing which is labeled sequential processing. The other type involves gestalt, holistic, spatial processing and is labeled simultaneous processing (Kaufman & Kamphaus, 1984). The selection of either or both modes of processing depends on the individual's habitual mode of processing information. This processing mode is determined primarily by the individual's socio-cultural background, and by the demands of the task (Das,

Kirby, & Jarman, 1975).

In observing that Native Indian children are frequently strong on the WISC-R Performance scale, Browne (1984), Scaldwell (1984) and Krywaniuk (1976) speculated that a simultaneous processing strength might also prevail. This simultaneious processing strength could possibly be measured by the simultaneous subtests of the K-ABC.

Three K-ABC subtests which are measures of Simultaneous processing, and which also show a similarity to other previously used measures of field-independence, are Triangles, Gestalt Closure and Spatial Memory. It is Kaufman's contention that they are measures of field-dependent-independent cognitive style. In his K-ABC Interpretive Manual (1983), Kaufman stated that the Triangles subtest is a modification of the WISC-R Block Design test and Koh's Block Design test. Both Block Design tests have been consistently used as measures of field-independence (Berry, 1966; Gaddes, 1968; Kleinfeld, 1971; Witkin, 1967). They have been shown to have a strong correlation with EFT. Kaufman claims that Triangles are a good measure of field-independent cognitive style, which in addition measure simultaneous processing, perceptual organization, spatial ability and synthesis of part-whole relationships.

The Gestalt Closure test was used by Berry (1966) as a measure of visual discrimination. He stated that "the formation of closure...appears to different extents in societies with differing ecologies" (ibid., p. 217). The use of closure tests to measure perceptual differences between cultures is supported by Berry's statement. The Gestalt Closure subtest in the K-ABC is a descendent of various Gestalt Completion Tests. It was based on the Gestalt psychology concept of closure, which depends on an independent perceptive and cognitive style to complete it (Kaufman, 1983). In addition, the K-ABC Gestalt Closure subtest is reported to be a measure of simultaneous processing, part-whole relationships,

spatial ability and perceptual organization.

The K-ABC Spatial Memory subtest measures short-term recall via simultaneous processing (Kaufman, 1983). Because the subject is required to use visual-spatial skills and recall the organization of the stimuli, it can be speculated that the Spatial Memory subtest requires similar skills to the EFT. Kaufman suggests that Spatial Memory is a measure of FD/FI cognitive syle, as well as a measure of simultaneous processing, perceptual organization, spatial ability and short-term visual memory. Vernon (1972) defined a measure of FD/FI cognitive style as a measure requiring the spatial ability to perceive and hold in mind the structure and properties of a figure (p. 370). The K-ABC Spatial Memory subtest would seem to qualify as such a measure.

Recent research which explored the relationship of all WISC-R scaled scores to K-ABC scaled scores has found interesting patterns of subtest performance (Naglieri, 1985). A summary of Naglieri's findings are in Table 1.

The results are presented by rank ordering of WISC-R and K-ABC subtest profiles for 3 groups: borderline mentally retarded, learning disabled and normal. [Naglieri's (1985) 'LD', 'MR' and 'normal' samples were defined by State of Ohio guidelines for placing students in special programs.] The subtest patterns were ranked, using Spearman rank difference correlational analyses. Picture Arrangement, Object Assembly and Picture Completion were ranked as the WISC-R subtests of best performance for the MR and LD children. Normal children performed best on Object Assembly, Picture Arrangement and Block Design. K-ABC subtest profiles showed the MR and LD children to perform best on Gestalt Closure, Photo Series, and Triangles/Spatial Memory.

Table 1
Means, SDs, and Rank Order of WISC-R and K-ABC Subtests

	Subtest Scores by Group								
	Borderline Mentally Retarded			Learning Disabled			Normal		
Tests	M	SD	RK	M	SD	RK	M	SD	RK
WISC-R									
Verbal Scale									
Information	4.7	(2.3)	10	7.8	(2.4)	10.0	10.9	(2.4)	8.0
Similarities	5.8	(2.7)	7	8.9	(3.4)	6.0	11.0	(3.0)	6.5
Arithmetic	5.3	(2.0)	8	8.2	(2.8)	9.0	10.5	(2.7)	10.0
Vocabulary	5.0	(2.9)	9	8.8	(2.8)	7.0	11.1	(2.3)	5.0
Comprehension	5.9	(2.2)	6	10.4	(2.8)	4.0	11.2	(2.2)	4.0
Digit Span	4.5	(2.4)	11	6.8	(3.3)	11.0	9.7	(2.5)	11.0
Performance Scale									
Picture Completion	7.8	(2.9)	3	10.9	(1.9)	3.0	10.8	(2.2)	9.0
Picture Arrangement	9.3	(3.5)	1	11.6	(1.7)	1.0	11.7	(2.4)	2.0
Block Design	6.3	(3.1)	4	9.9	(2.7)	5.0	11.6	(2.5)	3.0
Object Assembly	8.5	(2.9)	2	11.2	(2.6)	2.0	12.4	(3.3)	1.0
Coding	6.0	(2.9)	5	8.6	(3.3)	8.0	11.0	(3.0)	6.5
K-ABC									
Sequential Scale									
Hand Movements	6.9	(2.3)	5	8.6	(1.8)	7.0	11.1	(2.3)	6.0
Number Recall	6.0	(2.8)	8	8.7	(2.4)	6.0	11.7	(2.5)	1.0
Word Order	6.1	(2.9)	7	9.1	(2.6)	5.0	11.4	(2.2)	2.0
Simultaneous									
Gestalt Closure	8.2	(2.7)	1	11.4	(2.8)	1.0	10.8	(2.5)	7.0
Triangles	7.1	(3.0)	3	9.9	(2.5)	3.5	11.2	(2.3)	5.0
Matrix Analogies	6.4	(1.7)	6	8.5	(2.7)	8.0	10.7	(2.9)	8.0
Spatial Memory	7.0	(2.4)	4	9.9	(2.6)	3.5	11.2	(2.3)	5.0
Photo Series	7.4	(2.0)	2	10.5	(1.8)	2.0	11.3	(2.0)	3.5
Achievement									
Faces & Places	78.9	(9.4)	1	91.6	(13.1)	2.0	102.2	(10.6)	4.0
Arithmetic	75.2	(8.0)	3	90.4	(11.6)	3.0	101.6	(13.8)	5.0
Riddles	78.5	(11.6)	2	96.9	(12.2)	1.0	106.9	(11.4)	1.0
Reading/ Decoding	70.8	(12.5)	4	81.2	(12.6)	4.0	104.7	(11.9)	2.0
Reading/ Understanding	68.0	(11.1)	5	80.8	(10.8)	5.0	102.5	(9.0)	3.0

from Naglieri, J. (1985). Use of the WISC-R and K-ABC with learning disabled, borderline mentally retarded, and normal children. Psychology in the Schools, 22, 138.

Normal children performed best on Number Recall, Word Order and Photo Series of the K-ABC. Varying performances on the subtests, designated by Kaufman to be FD/FI measures, may indicate variance in cognitive styles across the three groups tested. Further research is necessary to substantiate this idea.

The primary function of Naglieri's study was to show a relationship between WISC-R and K-ABC tests. Future research is needed to show correlations of the tests across a variety of samples and to show how specific subtests on both tests may correlate. This information would allow researchers to see if suggested cognitive style subtests on the WISC-R correlate with the cognitive style subtests on the K-ABC. Cognitive style research involving these two achievement tests should involve further investigation of the correlation of Block Design, Object Assembly, and Picture Arrangement with Triangles, Gestalt Closure and Spatial Memory.

The results of Naglieri's study, with the varying profiles for the three groups of children, show the complexity of the exceptional children's performance. They also show that simultaneous-sequential differences, which are the basis of the K-ABC, do not necessarily describe the performances of the three groups (Naglieri, 1985).

On testing 35 Navajo children with the WISC-R and K-ABC, Naglieri (1984) also failed to find a simultaneous-sequential discrepancy in performance scores. The Navajo children performed virtually the same on each scale, and because the Simultaneous Processing Scale scores did not correlate more strongly with the WISC-R Performance scores than with the Verbal scores, Naglieri felt interpretation needed to be carried out cautiously. It is unfortunate, in his article, that specific subtest correlations were not provided, as this descriptive information would have been useful. Naglieri (1984) stated:

> The present findings offer general support for use of the K-ABC with Navajo children. However, much more research is needed to determine

> the stability of the present findings. In addition, the generalizability of these results to other Native Americans as well as other bilingual/bicultural children warrants investigation. (p. 378)

Likewise, to understand how stable Kaufman's FD/FI subtests are across Indian cultures in British Columbia, many more studies using the K-ABC are necessary.

In summary, the measurement of FD/FI cognitive style, particularly across cultures, is a debatable issue. Witkin primarily used two tests (EFT and RFT) to determine cognitive style. Vernon (1969) subsequently questioned the use of so few FD/FI measures. He doubted whether psychological inferences of the magnitude Witkin (1962) and others intended could be accurately made from so few tests. The WISC-R studies have found some subtests (Block Design, Picture Completion, Object Assembly) to be effective measures of FD/FI cognitive style. These subtests were found to load highly on the same factor as RFT and EFT.

According to Kaufman (1983), the K-ABC also has subtests which are believed to be FD/FI measures. The K-ABC subtests which are expected to measure FD/FI, are expected to correlate with the WISC-R, FD/FI subtests, if the K-ABC are in fact measures of FD/FI. However, when using the WISC-R, K-ABC or any one of Witkin's FD/FI measures, researchers would be wise to include at least three cognitive style measures. This practice would insure more accurate measurement of individual and cultural differences in cognitive style.

C. DEVELOPMENT OF COGNITIVE STYLE

Berry and Witkin (1975) wrote: "Intraculturally, psychological differentiation shows a clear developmental sequence" (p. 37). In other words, individuals within cultures develop field-independence in the same sequence. Berry (1966), using EFT, found Eskimos age 10-40 to increase in field-independence until age 30, but a reduction of field-independence occurred after 30. Weitz (1971), when studying Native Indians (17-55), also found the older group, 30-55, to be more

field-dependent than the 17-29 group. The older group had stopped moving toward the field-independent end of the continuum and were moving more toward field-dependence. MacArthur (1973) similarly found Eskimos, in a study involving 9 to 40 year olds, to display a decrease in field-independence at the oldest level (27-40). This decrease in field-independence, Berry and Witkin (1975) suggested, may be due to the fact that older people in many non-Western settings are less exposed to acculturation influences (p. 40).

Witkin and Berry (1975) found in their review of the cognitive style literature, that the cognitive style of an individual is stable relative to his age group. However, the research has been limited to age 10 and over, and the ages have been grouped together (e.g. 27-40). A progressive increase in field-independence was found to occur from age 10 up to the late 20's, and from ages 30 to 50, a leveling off of differentiation occurred. Further research is necessary for some understanding of cognitive style in the years before age 10 and the years after age 30.

There is a scarcity of studies which investigate the FD/FI cognitive style of Native Indian children from ages 6-12. Of the research on cognitive styles, most has been done with Western cultures. Although WISC-R Spatial scores of young Indian children are available, it is difficult to determine cognitive style patterns without one of the original FD/FI measures to correlate with the WISC-R scores. Another problem with studies of Native Indian cognitive styles is that researchers have grouped subjects into age brackets of five or more years (e.g. 10-25 or 29-55). This practice of grouping makes it difficult to look at yearly developmental trends of cognitive style. Looking at 1 or 2 year increments, from ages 6 through 12, with particular attention paid to cultural group differences would be of value to teachers and educational researchers.

Dasen (1978) a developmental psychologist, contended, after reviewing numerous cross-cultural studies, that the basic processes of cognitive development are universal. Dasen felt that cultural differences in performance were due more to situations in which particular cognitive processes are applied, than to the existence of a process in one cultural group and its absence in another. When doing cross-cultural developmental studies, Dasen warned researchers to keep in mind that: 1) cognitive theories are often based on the cognitive development of a Western scientist; 2) 'logic' has been assumed as better than 'primitive' thinking and this view may hinder cross-cultural communication; 3) there may be a time lag in development due to socio-economic bias in developmental theories; 4) if individuals display a certain reasoning structure it does not necessarily prove this is their customary mode of functioning.

Dasen's four points are valuable for all researchers of developmental behavior to consider. No absolutes for perceptive-cognitive development have been shown through cross-cultural investigation. More specifically, development of cognitive style in Native Indian cultures demands much further exploration before conclusive statements can be made.

D. CHAPTER SUMMARY

This literature review addressed the issues of cultural differences, measurement problems, and developmental questions, which are associated with the study of field-dependent-independent cognitive style.

The theory of psychological differentiation employed in cross-cultural studies has been found to provide a valuable basis for inquiry. With the guidance of this theory, individual differences in perceptual and cognitive style were found to be related to differences in child-rearing, culture and ecology. Whether an individual processed information in a field-independent (analytical) manner or in a

field-dependent (holistic) manner could be determined by perceptual measures. Berry and Witkin (1975) suggested that from an individual's level of field-dependence-independence, which is determined by perceptual measures, predictions could be made about the individual's cognitive style. Two primary sources for individual differences in perceptual and cognitive ability, Berry and Witkin (1975) suggested, are ecology and culture. Studies of individual cultural groups are necessary to confirm the role of ecology and culture in determining cognitive style.

A number of studies involving Native Indian children found them to perform relatively high on measures of perceptual and spatial ability, such as Embedded Figures Test (Berry & Annis, 1974; Gaddes, 1968), as well as on the spatial subtests of the WISC-R. Witkin's Embedded Figures Test was one of the original perceptual tests used to measure field-dependent-independent cognitive style, but numerous other measures also became known as indicators of FD/FI. Four of the subtests of the WISC-R were found to measure spatial ability, and also to correlate significantly with the EFT. The Native spatial processing strength, as identified by WISC-R scores, was hypothesized to indicate a simultaneous processing strength (Browne, 1984). One scale of the K-ABC test, which was designed to measure simultaneous processing, has three subtests which are thought to measure spatial ability. Naglieri's K-ABC studies (1984, 1985) revealed that there is a significant correlation of the WISC-R Performance scale and K-ABC Simultaneous Scale, but identification of any spatial factor within the K-ABC is premature. Further studies correlating the K-ABC with reliable measures of spatial ability are necessary.

Development from a field-dependent to a field-independent cognitive style is theorized to follow the same sequence across cultures. However, the number of studies involving young (6-12 year old) Native Indian children are so few that

confirmation of this theory is not yet possible.

It is with concern for the cultural differences, the accurate measurement of field-dependence-independence and the developmental trends in cognitive style in mind, that this study of Native Indian children's cognitive style development was undertaken.

Chapter III

METHOD OF STUDY

This chapter contains: a description of the sample, the instruments used in the study, the procedures followed, the design of the study, and the statistical hypotheses.

A. DESCRIPTION OF THE SAMPLE

The sample consisted of 75, 8-12 year old Tsimshian Native Indian children living in Indian villages near Prince Rupert, British Columbia, and 75, 8-12 year old non-Native children living in Prince Rupert. The native sample was taken from 2, of the possible 3 isolated Indian villages in the Prince Rupert school district (see Appendix A, Figure 1). The non-Native children of Euro-Canadian descent were taken from 2, of a possible 8 elementary schools in Prince Rupert.

Only the children whose parents had signed letters of consent were tested; approximately 10% of the parents refused permission. Where more consent forms than necessary were returned, randomization was used for selection.

The village schools: A description. The two village schools are located in Hartley Bay and in Port Simpson. The population is approximately 235 people in Hartley Bay and 920 in Port Simpson. Transportation to Prince Rupert from Hartley Bay is 1 hour by plane. From Port Simpson to Prince Rupert it is a 15 minute plane ride, a 1 hour ferry ride, or a three hour boat ride.

These two villages are part of the Tsimshian Indian cultural group. They traditionally speak Sm'algyax and the language is being revived in the schools. Elementary students receive 20 minutes Sm'algyax instruction per day.

The primary source of income for the villages is fishing. Unemployment ranges from 25% in the summer to 90% in the winter.

Electricity in Hartley Bay is provided by a generator, and television is available in all the homes. Hartley Bay is a village without vehicles. Access to the approximately seventy homes in the village is provided by cedar plank boardwalks. One small store operates out of a home, and a nurse is permanently stationed in the village.

A cannery is located in Port Simpson. There is also a cafe, two small grocery stores, and a full-time doctor sponsored by the United Church. Elecricity and television are also available to all the homes in Port Simpson. In both villages, groceries are flown in from Prince Rupert. But fishing, hunting and gathering are also common methods of obtaining food in these villages.

The art of the Tsimshian culture is displayed within the schools. In Port Simpson, an Indian artist is hired by the school to teach carving, as well as to provide counselling. Basket making is taught by the Sm'algyax language teacher in Hartley Bay.

Hartley Bay School has 72 students with 6 teachers, and the Port Simpson school (Lax Kwalaams Community School) had 186 students with 16 teachers. Both schools go from kindergarten to grade 10. The percentage of native students in Hartley Bay and Port Simpson schools was 99%.

The Prince Rupert schools - A description. Both schools included native and non-native students, and went from kindergarten to grade 7. Conrad Elementary had 311 students and Roosevelt had 380. The number of Native Indian students in Conrad was 137 (44%); the number in Roosevelt was 164 (43%).

Prince Rupert is a town of approximately 18,000 people. Its primary sources of income are fishing, pulp and paper and harbour services. An airport with national flights operates daily, and a bus system operates within the city. (see Appendix A for location of Hartley Bay, Port Simpson and Prince Rupert)

B. INSTRUMENTATION

The K-ABC is an individually administered measure of mental processing and achievement (Kaufman, 1983, p. 1), for children from ages 2 years 5 months to 12 years 5 months. It was normed on 2000 children selected from 34 test sites across the United States. The sample was stratified by age, sex, geographic region, socioeconomic status, ethnic groups, community site and educational placement (regular or special class). It is organized into two major scales: a Mental Processing Scale (Simultaneous and Sequential) and an Achievement Scale. The entire test is composed of 16 subtests. For children age 8-12, only 3 subtests in the Sequential scale, 5 subtests in the Simultaneous scale and 5 subtests in the Achievement scale are used (Kaufman, 1983). This study involved 3 of the Simultaneous subtests (Gestalt Closure, Triangles, Spatial Memory) because of their potential as measures of FD/FI cognitive style.

The Children's Embedded Figures Test was normed on 160 children ranging in age from 5 to 12. The children were randomly selected from two elementary schools in Brooklyn, New York. It is a version of Witkin's (1962) Embedded Figures Test (EFT), but is designed for younger children. The reliability estimates for ages 7-12 range from .71 for 9-10 year olds to .85 for 11-12 year olds. "...studies suggest that the CEFT is related to the same measure of psychological differentiation as the EFT" (CEFT Test Manual, 1976, p. 26).

The 'Test for Colour-Blindness' is a standardized screening test for colour blindness (Ishihara, 1964). This screening was necessary because performance on the CEFT and the K-ABC subtests depends on a normal perception of colour.
(see Appendix B for samples of scores sheets for the K-ABC, CEFT, and Test for Colour-Blindness)

C. PROCEDURE

Subjects in each school were selected randomly from a list composed of all the students in their particular age level, and whose permission slips were complete. Children were placed in the age categories according to their age on the day they were tested. For example an 8 year old, for the purpose of this study, was a child 8 years ± 6 months on the day of testing. An effort was made to include an equal number of boys and girls. Recent immigrants to Canada and Native Indians who had recently moved into town were not included in the sample. Each child chosen was individually administered the ' K-ABC Mental Processing subtests (Triangles, Gestalt Closure, Spatial Memory), The Test for Colour-Blindness and the Children's Embedded Figures Test. A male doctoral student, qualified as a school psychologist, administered the K-ABC subtests as part of a larger study. The CEFT and colour-vision tests were administered by the author, who is qualified to administer restricted tests.

Approximately 30 minutes were required to administer all the tests to each child in this study.

The administration of the K-ABC and CEFT followed procedures from each test manual. The CEFT administrative manual was unclear about test procedures, therefore the method most likely intended was used (see Appendix C for the Protocol). The tests for Colour Blindness were administered prior to the K-ABC and CEFT since colour discrimination is an important factor in performance on both tests. Six plates, No. 1, 2, 4, 9, 10 and 14 were used to test for colour blindness. If 5 or more were incorrect, the whole test was administered, and the student was not given the K-ABC subtests or CEFT. Another student was randomly selected to replace any student who was thought to be colour-blind. This replacement procedure applied for only one 11 year old boy.

D. THE DESIGN OF THE STUDY

The present study can be categorized as a 2 x 5, Fixed Effects, Fully Crossed, Factorial design. The independent variables were the ethnicity and the age of the students. Ethnicity involved 2 groups, Indian and non-Indian. Age was divided into 5 age categories to provide a developmental perspective of field-dependent-independent cognitive style. The dependent variables were the scores on the four tests: K-ABC Gestalt Closure, K-ABC Triangles, K-ABC Spatial Memory and Children's Embedded Figures Test.

E. HYPOTHESES

Ecology and culture have been shown to be determining factors in cognitive styles. Some Indian cultures have been shown to have a relatively field-independent cognitive style. The more traditionally they lived, the more field-independent they were found to be (Berry, 1980).

Hypothesis I.

There is therefore a need for field-dependent-independent cognitive style to be studied in individual Indian cultures to see if Berry's findings occur across many Indian cultures. Will individuals living in a more traditional culture be more field-independent? This question lead to hypothesis number one.

There will be significant differences between the Native Indian and Euro-Canadian groups in scores on the K-ABC Gestalt Closure, Triangles, Spatial Memory subtests and on the Children's Embedded Figures Test. The Native Indian group will have scores on all the measures which are significantly higher than those of the non-Native group.

Stated in the null form, scores of the Native Indian and scores of the non-Native on the K-ABC Gestalt Closure, Triangles, Spatial Memory subtests and on the Children's Embedded Figures Test will not differ.

Hypothesis II.

Numerous measures of field-dependence-independence have been used in cognitive styles studies, but the variety of measures and the limited number of measures used in any one study, have lead to problems in the comparison of test results between and within cultures. A battery of tests which are highly correlated would be advantageous in cross-cultural studies of cognitive style. Could the K-ABC, like the WISC-R have a number of subtests which would complement each other to form a battery? These measurement questions lead to hypothesis number two.

There will be significant intercorrelations between scores on Gestalt Closure, Triangles, Spatial Memory, and Children's Embedded Figures Test for the Native and non-Native groups.

Stated in the null form, there will be no significant intercorrelations between the scores on Gestalt Closure, Triangles, Spatial Memory, and Children's Embedded Figures Test for the Native and non-Native groups.

Hypothesis III.

Developmental studies of field-dependent-independent cognitive style have been primarily limited to Western cultures. The developmental stages have been grouped into 5 or more years (e.g. 10-15, 30-55) and have not, to any extent, involved the younger ages (e.g. 6-12). These problems lead to the third hypothesis.

There will be significant differences between Native and non-Native scores for 8, 9, 10, 11, and 12 year olds on Gestalt Closure, Triangles, Spatial Memory, and Children's Embedded Figures tests.

Stated in null form, scores for the 8, 9, 10, 11, and 12 year old Natives and non-Natives, on GC, TR, SPM, and CEFT will not differ; that is, the developmental trend will be the same for both cultural groups.

F. STATISTICAL ANALYSIS

Analyses of the data were carried out using a Multi-Factorial Analysis of Variance and a Canonical Correlational Analysis by using the BMDP computer program. The multi-factorial design was used due to its ability to detect inter-correlations of variables. The Canonical Correlational analysis was used because it functions as an extended version of the multi-factorial analysis and provided computations for the more complex inter-correlations required in this study.

Chapter IV

ANALYSIS AND RESULTS

Cultural differences in cognitive style, intercorrelation of cognitive style tests and development of cognitive style were the three issues considered in this study. To explore cultural differences in cognitive style, Native and non-Native scores were compared on four tests. The relationship between K-ABC Gestalt Closure, Triangles, Spatial Memory subtests and Children's Embedded Figures Test were investigated by analyzing the intercorrelation of the test scores. Developmental patterns of cognitive style were examined by trend analysis.

Data were analyzed using the computing facilities of the University of British Columbia. The four cognitive style tests were individually hand scored and coded on fortran sheets in raw and scaled scores. The data entered into the computer was analyzed by the BMDP4V program for Multivariate Analysis of Variance (MANOVA) and by the BMDP6V program for Canonical Correlation Analysis.

A. HYPOTHESIS I - CULTURAL DIFFERENCES IN COGNITIVE STYLE

The first hypothesis dealt with cultural differences in cognitive style. The null hypothesis stated that there would be no significant difference between Native and non-Native scores on the four dependent variables. This hypothesis was analyzed using a 2x5 Fully Crossed, Fixed Effects MANOVA for the two ethnic groups, Native and non-Native, and five age levels from 8 to 12. The dependent variables were scores on: Gestalt Closure (GC), Triangles (TR), Spatial Memory (SPM), and Children's Embedded Figure Test (CEFT). Both raw and scaled score means were computed to make comparisons with test norms easier. The assumptions of normality, independence, homogeneity of variance, linearity and multicollinearity were satisfied.

The results of the analysis are presented in Tables 2, 3, 4, 5, 6 and 7.

Table 2

Manova Summary Table

Source of Variation	Λ	F	DF	P
Age	0.0868	24.62	20,452	.00*
Ethnicity	---	4.91†	5,136	.00*
Age x Ethnicity	0.8738	0.94	20,452	.53

T^2=4.91†

Table 3

Means of Raw Scores

Ethnicity	Age	Cell Size	Dependent Variables GC	TR	SPM	CEFT
	8	15	16.13	11.93	12.73	9.93
	9	15	16.40	11.80	12.07	10.53
Native	10	15	18.07	14.00	14.53	14.53
	11	15	18.20	13.81	15.27	15.27
	12	15	20.07	15.53	15.87	15.60
Grand Mean		75	17.77	13.42	14.09	13.17
	8	15	16.60	13.40	12.73	11.20
	9	15	18.20	14.47	13.13	10.93
Non-Native	10	15	19.00	14.93	14.07	12.60
	11	15	19.53	15.27	15.67	16.40
	12	15	20.40	15.67	15.80	16.80
Grand Mean		75	18.74	14.74	14.28	13.58

Table 4

Standard Deviations of Raw Scores

Ethnicity	Age	Cell Size	Dependent Variables GC	TR	SPM	CEFT
	8	15	2.26	1.90	1.94	4.11
	9	15	2.79	2.20	2.31	4.54
Native	10	15	2.91	1.89	1.35	3.31
	11	15	2.42	1.92	3.32	4.74
	12	15	2.08	1.24	3.20	3.04
	Grand Mean	75	2.49	1.83	2.42	3.94
	8	15	2.55	1.95	1.79	3.82
	9	15	2.39	1.45	2.26	5.31
Non-Native	10	15	2.85	1.83	1.38	4.08
	11	15	1.76	1.71	2.28	4.68
	12	15	1.84	1.67	1.85	5.06
	Grand Mean	75	2.27	1.72	1.91	4.59

Table 5

Means for Scaled Scores

Ethnicity	Age	Cell Size	Dependent Variables GC	TR	SPM
	8	15	9.80	10.13	10.33
	9	15	9.00	8.87	8.47
Native	10	15	9.80	10.33	9.80
	11	15	9.00	9.53	9.40
	12	15	10.53	11.00	9.93
Grand Mean		75	9.63	9.97	9.59
	8	15	10.53	12.00	10.13
	9	15	10.80	11.80	9.33
Non-Native	10	15	11.00	11.67	9.40
	11	15	10.87	11.27	9.60
	12	15	11.20	11.13	9.67
Grand Mean		75	10.88	11.57	9.63

Note: CEFT not available in scaled scores

Table 6

Standard Deviations of Raw Scores

Ethnicity	Age	Cell Size	Dependent Variables GC	TR	SPM
	8	15	2.43	1.96	1.80
	9	15	2.73	2.38	2.07
Native	10	15	3.50	2.19	1.14
	11	15	2.93	2.29	3.40
	12	15	2.85	1.83	3.24
Grand Mean		75	2.88	2.20	2.50
	8	15	2.62	2.27	1.60
	9	15	2.54	1.52	2.06
Non-Native	10	15	3.50	2.29	1.24
	11	15	2.88	1.98	2.82
	12	15	2.54	2.17	2.02
Grand Mean		75	2.81	2.04	1.99

Table 7

Univariate Tests for each Dependent Variable

	SS	MS	DF	F
AGE				
GC	265.29	63.32	4,140	11.31*
TR	167.70	41.92	4,140	12.95*
SPM	269.77	67.44	4,140	13.16*
CEFT	867.77	216.97	4,140	11.58*
ETHNICITY				
GC	35.52	35.52	1,140	6.06*
TR	65.34	65.34	1,140	20.18*
SPM	1.30	1.30	1,140	.25*
CEFT	6.40	6.4	1,140	.34*
AGE & ETH				
GC	11.10	2.77	4,140	.47
TR	25.49	6.37	4,140	1.97
SPM	10.09	2.52	4,140	.49
CEFT	55.29	13.82	4,140	.74

*p < .05

The significant main effects of age and ethnicity are demonstrated in the Manova Summary Table (see Table 2). No interaction between the main effects was found. In Table 3, the raw score means on the four cognitive style measures for the Natives and non-Natives increased consistently from age 8 to 12. The standard deviations in Table 4 were greatest on CEFT, and that the deviations diminish in size from Gestalt Closure to Spatial Memory, and finally to Triangles. Scaled score means and standard deviations on Tables 5 and 6 show no difference in performance between both ethnic groups. Univariate tests of each dependent variable (see Table 7) show that age significantly affects all the dependent variables. Also, univariate tests show that ethnicity is significantly related to Gestalt Closure and Triangles, but Spatial Memory and Children's Embedded Figures Tests are not significantly related to ethnicity. No significant

interaction of age and ethnicity was found on any of the dependent variables.

The non-Native group scored higher than the Native groups on each of the four measures. However, the differences achieved statistical significance on two of the four; Gestalt Closure and Triangles. That is, the null hypothesis was rejected for Gestalt Closure and Triangles.

A number of t-tests were carried out to determine the ages at which the significant cultural differences occurred on Gestalt Closure and Triangles. The results of the t-tests are presented in Table 8.

Table 8

t-Tests of Mean Differences between Native and Non-Natives on Gestalt Closure and Triangles

Age	GC	Triangles
8	-2.08*	-8.26*
9	-7.53*	-15.43*
10	-3.50*	-5.47*
11	-6.85*	-8.19*
12	-1.83	-0.7

*p < .05

At all age levels, except 12, the Native and non-Native children were found to be significantly different on Gestalt Closure and on Triangles.

Comparisons of the CEFT and K-ABC norms, with scores obtained in this study are presented in Tables 9, 10 and 11.

Table 9
Comparison of CEFT Norms to Prince Rupert Samples

Age	Native		Non-Native		CEFT Norms		
	$\bar{X}$	SD	$\bar{X}$	SD	Age	$\bar{X}$	SD
8	9.93	(4.11)	11.20	(3.82)	(7-8)	10.6	(5.6)
9	10.53	(4.54)	10.93	(5.31)			
10	14.53	(3.31)	12.60	(4.08)	(9-10)	16.4	(5.5)
11	15.27	(4.74)	16.40	(4.68)			
12	15.60	(3.04)	16.80	(5.06)	(11-12)	18.0	(5.1)

Table 10
Comparison of K-ABC Raw Score Norms to Prince Rupert Samples

	Age	Standardization Mean	SD	Native Mean	SD	Non-Native Mean	SD
	8	16.5	(2.9)	16.1	(2.2)	16.6	(2.5)
Gestalt	9	17.7	(3.0)	16.4	(2.7)	18.2	(2.3)
Closure	10	18.2	(2.7)	18.0	(2.9)	19.0	(2.8)
	11	19.1	(2.7)	18.2	(2.4)	19.5	(1.7)
	12	19.2	(2.4)	20.0	(2.0)	20.4	(1.8)
	8	12.4	(2.8)	11.9	(1.9)	13.4	(1.9)
	9	13.4	(2.7)	11.8	(2.2)	14.4	(1.4)
Triangles	10	13.8	(2.7)	14.6	(1.8)	14.9	(1.8)
	11	14.4	(2.5)	13.8	(1.9)	15.2	(1.7)
	12	14.5	(2.6)	15.5	(1.2)	15.6	(1.6)
	8	13.3	(3.1)	12.7	(1.9)	12.7	(1.7)
	9	14.4	(3.2)	12.0	(2.3)	13.1	(2.2)
Spatial	10	15.4	(2.8)	14.5	(1.3)	14.0	(1.3)
Memory	11	15.7	(2.8)	15.2	(3.3)	15.6	(2.2)
	12	16.4	(2.8)	15.8	(3.2)	15.8	(1.8)

from Kaufman & Kaufman, 1983a, p. 101

Table 11

Comparison of Navajo and Sioux Scaled Scores to Prince Rupert Scaled Scores

	Gestalt Closure		Triangles		Spatial Memory	
	Mean	SD	Mean	SD	Mean	SD
Navajo	10.30	(2.6)	10.90	(2.3)	11.10	(2.8)
Sioux	10.60	(2.2)	10.20	(2.6)	10.80	(2.2)
Native	9.63	(2.8)	9.97	(2.2)	9.59	(2.5)
Non-Native	10.88	(2.8)	11.57	(2.0)	9.63	(1.9)

Note: Means represent ages 8-12 combined from Kaufman & Kaufman, 1983a, p. 151

Data in Table 9 presents a comparison of raw score means for the Native and non-Native groups against the standardization sample used in the Children's Embedded Figures Test. In Table 10, the Prince Rupert Native and non-Native raw score means are shown to be close to the standardization sample mean. Similarly, in Table 11, the Prince Rupert sample scaled scores are shown to be close to the standardized mean of 10.

B. HYPOTHESIS II - INTERCORRELATIONS BETWEEN THE COGNITIVE STYLE MEASURES

The relationships between GC, TR, SPM, and CEFT were analyzed by determining their intercorrelations, and by a canonical analysis of the four measures and the two independent variables: age and ethnicity.

Intercorrelations. The null hypothesis was that there would be no intercorrelations between the four dependent variables. The intercorrelations between the four measures are presented in Table 12.

Table 12

Correlation Matrix of Gestalt Closure (GC), Triangles (TR), Spatial Memory (SPM) and Children's Embedded Figures Test (CEFT)

	GC	SPM	TR
SPM	.46**		
TR	.37**	.54**	
CEFT	.43**	.46**	.47**

**p < .01

All intercorrelations were significant beyond the .05 level; that is, the null hypothesis was rejected for all intercorrelations.

Canonical Analysis. The intercorrelation of the tests was further explored using Canonical Correlational Analysis. This form of analysis determined the "best" linear combination of the dependent variables and the independent variables. The assumptions required to perform this linear relationship are normality, linearity, and multicollinearity. These assumptions were met after deletion of four outliers.

Two new constructs or canonical variates were found to underlie the two sets of variables. The results of the Canonical Analysis are presented in Tables 13 and 14.

The first canonical variate was responsible for approximately 42% of the variance of all the variables and the second was responsible for approximately 9% of the variance. Age, an independent variable, correlated highly (r = .95) with the first canonical variate, ethnicity, the second independent variable, correlated highly (r = .95) with the second canonical variate. Canonical Variable loadings are presented in Table 14.

On the first construct the dependent variables all load fairly high (from .71 to .84) and only one independent variable, age, loads very highly (.95). Evidently, this construct is one which is specific to age or development.

On the second construct, only three dependent variables load moderately high (from .41 to .47), the independent variable, ethnicity, loads very highly (.95). It would appear that this construct has primarily to do with ethnicity.

Table 13

Bartlett's Sequential Test

Eigen value (Rc_1^2)	Canonical Correlation (Rc_1)	p
0.4237	0.6509	0.00
0.0884	0.2973	0.00

Bartlett's test indicates the number of statistically significant canonical variates necessary to express the dependency between the two sets of variables. In this case two variables were identified as significant.

Table 14

Canonical Variable Loadings (Structure Coefficients)

(Correlations of Canonical Variables with Original Variables for Independent Variables)

	CNVRF1	CNVRF2
Age	0.949	-0.315
Ethnicity	0.315	0.949

(Correlations of Canonical Variables with Original Variables for Dependent Variables)

	CNVRS1	CNVRS2
GC	0.784	0.058
TR	0.838	0.465
SPM	0.742	-0.411
CEFT	0.714	-0.368

Results from the intercorrelational analysis indicated the null hypothesis could be rejected. All dependent variables were shown to be highly intercorrelated. The canonical analysis showed the extent of the variables correlation with the underlying constructs involving age and ethnicity.

C. HYPOTHESIS III - DEVELOPMENT OF COGNITIVE STYLE

The development of cognitive style from age 8 to 12 was the subject of this hypothesis. The null hypothesis stated that there would be no significant difference in the development between the Native and the non-Native scores from 8 to 12 on any of the dependent variables. MANOVA results, presented in Tables 2 through 7, show the four dependent variables to be significantly related to age. Age differences were significant, but ethnic differences and interactions between age and ethnicity were non-significant (see Table 7). Therefore, the null hypothesis was rejected for all the dependent variables, that is, there are no differences in the development of cognitive style for the Natives and non-Natives. The developmental similarities between the two groups are shown in Figures 1 and 2.

The two ethnic groups were combined to find the best fitting trend line for age on GC, TR, SPM, and CEFT. Trend analysis assessed whether the relationship between the five age levels was linear on nonlinear. The results of the Trend Analysis are presented in Table 15.

Figure 1: Raw Score Means for Native and Non-Native Groups

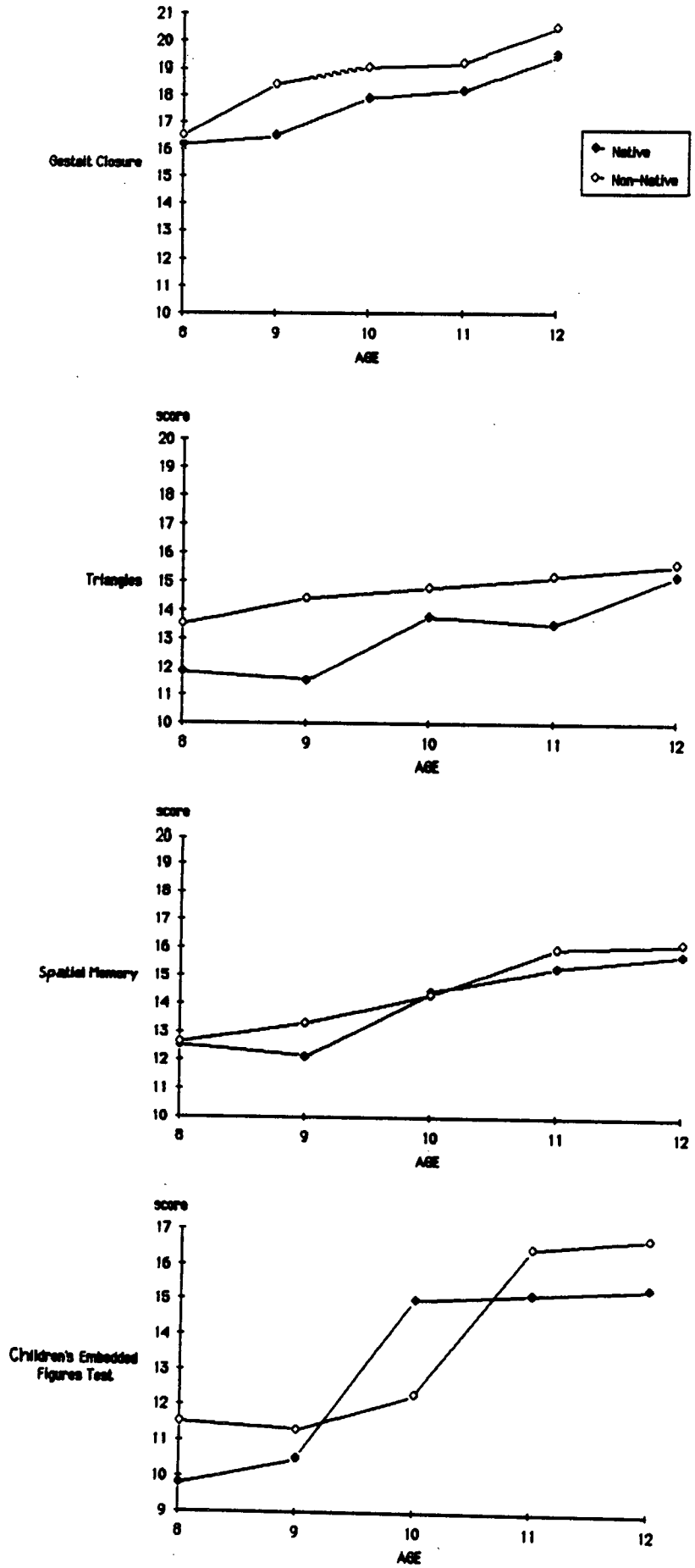

Figure 2: Scaled Score Means for Native and Non-Native Groups

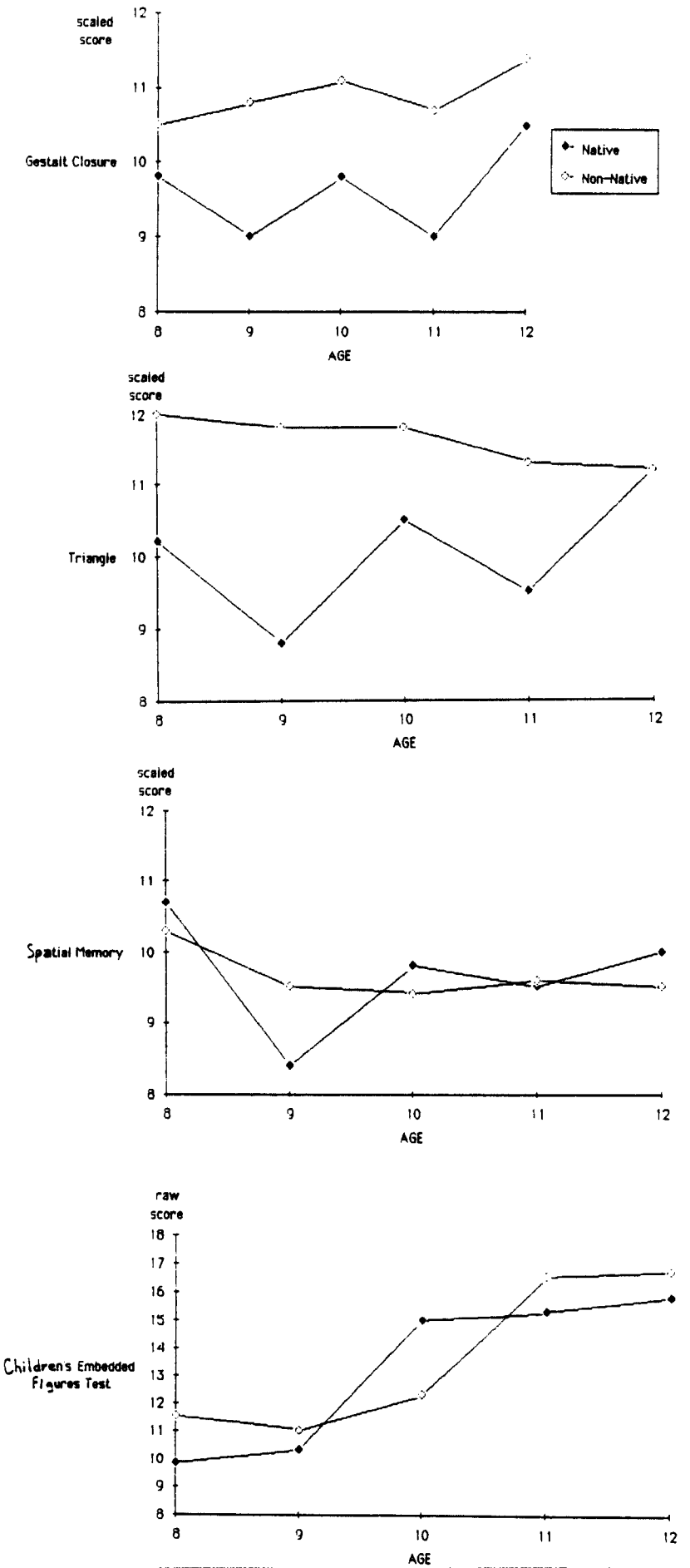

Table 15

Higher Order Trend Analysis

GC	T^2†	4.00*
TR	T^2	4.48*
SPM	T^2	4.31*
CEFT	T^2	4.66*

*Significant at $p < .05$
Note: ($T^2 = F$)†

The results show that the relationship was linear for the four dependent variables.

Summary. The results of testing the three hypotheses show that cultural group makes a significant difference on Gestalt Closure and Triangles, but not on Children's Embedded Figures Test or Spatial Memory. The four tests were found to be moderately to highly intercorrelated and the developmental trends of the four tests were found to be linear and to not be significantly related to culture.

Chapter V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

Witkin's (1964) theory of psychological differentiation has long served as a model for exploring the cross-cultural development of field-independent cognitive style (Berry & Witkin, 1975). Cross-cultural researchers, as well as researchers involved in other fields, have come to accept the notion that environment and culture contribute to individual differences, particularly in the area of cognitive style.

To explore the variance of field-dependent-independent cognitive style across cultures, each culture must be studied individually. The individual culture investigated in this study was the Tsimshian Native Indian culture in Northwestern British Columbia. For comparative purposes a non-Native group living in Prince Rupert was studied along with the Tsimshian sample.

To measure the cultural differences in cognitive style, the Children's Embeddded Figures Test (CEFT), a well recognized measure of field-dependence-independence (FD/FI) was used. In addition to the CEFT, three Kaufman Assessment Battery for Children (K-ABC) subtests (Gestalt Closure (GC), Spatial Memory (SPM), and Triangles (TR)) were included for their similarity to other field-dependence-independence tests.

The developmental aspect of cognitive style was studied for the reason that younger children have not been included in many of the previous cross-cultural studies. It was believed that a cross-cultural developmental study of cognitive style would provide valuable information to educators of children from age 8 - 12.

The results of this study showed the non-Native Prince Rupert children performed higher than the Native children on Gestalt Closure and Triangles. These differences were significant for ages 8 to 11, but not at age 12. These findings indicated that cultural differences in performance existed on these two tests. This is consistent with other research on older people as referred to in Chapter Two. No intercultural difference on Spatial Memory or CEFT was displayed at any age level.

Moderate inter-correlations indicated the four tests form a battery useful in developmental studies of cognitive style. A canonical correlational analysis showed high intercorrelation of all four dependent variables. Vernon (1972) and Berry (1966), as noted Chapter 2, suggested the use of a highly correlated battery of tests to ensure the accurate measurement of cognitive style, and it appears that these four tests could form such a battery.

When ethnicity, rather than age, was the only independent variable considered in the canonical correlation, a moderate intercorrelation of three of the tests was found (TR, SPM, CEFT). This intercorrelation suggested the three tests could form a battery useful in cross-cultural studies of cognitive style.

No interaction between age and ethnicity was found, which suggested the Native and non-Native samples follow the same developmental sequence. Results from trend analysis indicated a linear development occurred on all four dependent variables, form age 8 to 12.

B. LIMITATIONS OF THE STUDY

This cognitive study was limited to 150 subjects, aged 8 to 12, from two cultural groups. The cultural groups were Native Indians living in island villages outside of Prince Rupert, and non-Native living in Prince Rupert. An in-town sample of Native children, and a village sample of non-Native children would

have enriched the study.

The assignment of the Native children to each age level was not a purely random process. In the Indian villages, availability of children at all age levels was limited, therefore random selection was not always possible, and in these instances all the available children were used to fill the cells.

The study was limited to four measures of FD/FI: K-ABC Gestalt Closure, Spatial Memory, Triangles and the Children's Enbedded Figures Test.

C. CONCLUSIONS

Conclusions about the three hypotheses investigated in this study are presented in the following order: the effect of culture on the four dependent variable scores, the intercorrelation of the dependent variables, and the effect of age on the dependent variables.

The Effect of Culture on the Dependent Variables.

It was hypothesized that there would be no significant differences between the Native and non-Native samples on each of the four dependent variables. Significant differences were found on two of the four dependent variables and the null hypothesis was rejected for them. The non-Native sample was found to score significantly higher than the Native sample on Gestalt Closure and Triangles at each age from 8 to 11. There was no significant difference between the Native and non-Native samples on Spatial Memory or Children's Embedded Figures Test, and the null hypothesis was accepted.

CEFT, the dependent variable most recognized as a measure of FD/FI, showed the Native and non-Native samples to be equally FD/FI. Cultural differences did not appear to be related to FD/FI for this measure. This is contrary to the theory proposed by Berry and Witkin. However, Berry and Annis (1974), failed to find significant dfferences in FD/FI in a study they conducted in

the same geographical area as this study.

The non-significant differences between the Native and non-Native children on the CEFT may be explained in a number of ways. It may be that different factors, or sources, in each culture and ecology contributed to FD/FI. Berry (1974) suggested that traditional cultural sources may exist for FD/FI skills, but alternative or different sources may exist during acculturation (p. 188). Non-significant differences in FD/FI performance do not necessarily mean that the source of the FD/FI was the same. Another possibility to consider in explaining the similar performance scores of the Native and non-Native samples is the reliablity of the CEFT to adequately measure the differences. The comparison of means, presented in Table 9 show both Native and non-Native groups were considerably less than one standard deviation below the CEFT norms. This result could be interpreted to mean the two cultures are equally field-dependent-independent, although as Berry noted (1974), the source of the cognitive style might be different. Another possible explanation for the similar performance of the Native and non-Native groups, is that the test lacks precision in measurement of FD/FI.

The results on the Spatial Memory measure show the mean differences between the Native and non-Native groups to be non-significant. This indicates culture had no differential effect on performance. Spatial Memory, being a measure of short-term memory requires recall of the positions of a number of objects arranged in a grid. CEFT, similarly, requires memory of a figure and the figure must be recalled and identified within a picture. Both tests require recall of shapes and their positions. Thus, the same explanation for the non-significance of CEFT score differences should hold for SPM: different factors from each culture contribute to a similar outcome, the test may not be reliable, the test may not have adequately measured FD/FI.

The difference between scores of the Native and non-Native samples on Gestalt closure was significant. This type of task, according to Berry (1966), measures visual discrimination as well as spatial ability. Kaufman (1982) held that the GC subtest measures processing of part-whole relationships. The significant difference might indicate that what the GC subtest actually measures is not only FD/FI, but also part-whole relationships and previous exposure to the object pictured. The non-Native sample may have scored higher than the Native sample for the simple reason that the non-Natives were more familiar with the objects displayed in the test (Berry, 1966). Both the Native and non-Native groups were within one standard deviation of the GC test norms (Table 10). This inconsistency with Berry's results (1971, 1966) may be due to Gestalt Closure measuring skills other than those involved in FD/FI, and due to differences in familiarity with the objects shown in the test.

The results on Triangles show the non-Native means to be significantly higher than the Native means. Further analyses found significant differences between the scores of the Native and non-Natives from age 8 to 11. This inconsistency with Berry's results might be explained by four factors: adminstration time, something other than FD/FI was measured, strategy differences, and cultural factors.

Triangles required approximately 15 minutes to adminster, whereas the other three tests combined required 15 minutes. The time factor may have contributed to a significant difference in scores on this subtest and not the other three (GC, SPM, CEFT). The Native children may have responded to the pressure of time differently than the non-Native children. The strictly controlled time limit of the test (two minutes per item),or the duration of the test may have been a source of group differences.

The Triangles subtest, like the Block Design test it is modeled after, is reported to measure complex thought processing, as well as FD/FI (Bracken, 1985; Kaufman, 1983). Although TR appears to measure FD/FI, as its correlation with CEFT in Table 12 shows, some more complex processing may have contributed to the significant difference between the Native and non-Native scores.

A difference in performance strategy may also have contributed to the significant difference in Triangle scores between the Native and non-Native groups. The examiner noted that the Native children appeared to rely on memory to complete the task. They glanced at the picutre to be replicated and proceeded to put the triangular shapes together, without looking at the picture again. Memory seems to serve as the primary strategy used by the Native children. The predominant use of memory also helps to explain the Native children's relatively higher performance on CEFT and SPM which are largely based on memory. Memory and the manner it is used in different ecocultures may have contributed to the differences in the performances of the two groups.

The final explanation for the significant difference in TR scores may be what Berry and Witkin suspected (1975). Some environmental or cultural factor which was present in Prince Rupert, but not present in the villages, might explain the significant difference between the Native and non-Native mean scores.

When comparing the two samples' scores to the norms provided in the test manuals, no definitive picture of cognitive style can be observed. In comparison to the CEFT norms, both the Native and non-Native groups in this study were relatively field - dependent (Table 8). Assuming the three K-ABC are measures of FD/FI, and assuming the FD/FI scale is a continuum of relative scores, the Native and the non-Native samples in this study, were more field-dependent on Spatial Memory than the general norming sample or the Sioux

and Navajo norming samples used for the K-ABC (see Tables 9 and 10, Chapter 4). On GC, the Prince Rupert Native scores indicated relatively more field-independence than all the norming sample. On Triangles, the Prince Rupert Natives were higher, or more field-independent than the scaled scores of the Navajo and Sioux. The Prince Rupert non-Natives were more field-independent on Triangles than the K-ABC scaled and raw score norms. The results show that the Prince Rupert Natives are slightly more field-dependent than the Prince Rupert non-Natives and the norms of the K-ABC. These results are in disagreement with Berry and Witkin's theory of psychological differentiation. The relative field-dependence of the Prince Rupert Natives supports the hypothesis that the more sedentary Tsimshian (Berry & Annis, 1974) are more field-dependent than the Sioux and Navajo (Kaufman, 1983), who rely more on hunting and gathering. However, additional research is required to further substantiate the validity of the K-ABC subtests as measures of FD/FI and to reinforce the notion of field - dependence as a characteristic of sedentary life-styles.

Intercorrelations and Canonical Correlation of the Dependent Variables.

It was hypothesized that there would be no intercorrelation between the four dependent variables. The null hypothesis was rejected beyond the .05 level. The intercorrelation matrix showed all tests were moderately correlated.

The canonical correlation analysis showed significant intercorrelations of the three K-AC subtests with CEFT. When age was the independent variable, all four tests correlated very highly. When only ethnicity was considered in the intercorrelation, three of the tests correlated significantly, but GC did not. Gestalt Closure is not affected by ethnicity to the degree the other measures are.

These canonical results suggest the K-ABC subtests are potential measures of FD/FI, but their true value as cognitive style measures remains to be confimed by further study. Vernon (1972) and Berry (1966) suggested researchers

use a number of tests, which combined, form a reliable measure of FD/FI, since what the individual tests actually measure is uncertain. It can be concluded that Gestalt Closure, Spatial Memory and Triangles correlate significantly with CEFT, therefore the three Kaufman subtests can be considered as measures of FD/FI. It could also be suggested from the intercorrelation of the CEFT with the three K-ABC simultaneous processing measures, that CEFT involved simultaneous processing.

Effects of Age on the Dependent Variables.

It was hypothesized that the Native and the non-Native sample would not display the same developmental pattern on the four dependent variables. The null hypothesis was not rejected, that is, no interaction was found between ethnicity and age, consequently, the Native and non-Native samples were combined to do a trend analysis. This analysis was performed to determine if the relationship between the test scores and age (8-12) was linear. The relationship was found to be linear on all four dependent variables. It can be concluded from the MANOVA results and subsequent linear analysis results, that the Native and non-Native samples develop FD/FI cognitive style in the same linear manner, on all four dependent variables. The skills required to do the three K-ABC samples reached the same level by age 12, although a ceiling effect may be operating here. Bracken (1985) suggested that the Gestalt Closure tests might not include adequate simple items at the lower end of the test or adequate complex items at the upper end of the test.

The Intercorrelation Matrix and Canonical Correlation Analysis indicate that some skills required to perform each test are common to all four measures. Field-dependent-independent cognitive style may be the common factor most responsible for these developmental results.

D. RECOMMENDATIONS FOR FURTHER RESEARCH

It was hypothesized in this study that culture and environment affect the development of FD/FI cognitive styles. Cultural group differences were found on two of the four tests used to measure cognitive style. The source of these differences, however, is not known. Future studies should employ a greater number of reliable measures of FD/FI to facilitate comparison to less well known measures such as the K-ABC. A combination of WISC-R subtests, which have been shown to be consistent across Native cultural groups, K-ABC subtests, reported to measure spatial skills, the Children's Embedded Figures Test, and the Rod and Frame Test would form a battery of FD/FI measures. The importance of using a battery was presented by Berry (1966) and Vernon(1972). Also, by including a number of measures previously used in cross-cultural studies of FD/FI cognitive style, comparability of results would be fostered. Use of the original FD/FI tests employed by Berry, along with the WISC-R and K-ABC FD/FI measures, would serve to bridge the gap between 1970's cognitive style studies and present day WISC-R studies.

Further investigation of the role of memory in the Native children's cognitive style might reveal a source of individual and cultural differences. Goodenough (1976), discussed studies which provided evidence to support the relationship of FD/FI cognitive style with memory and learning. Although Goodenough (1976) and Witkin (1977) suggested teaching strategies to accommodate field-dependent and field-independent styles, implementation of these techniques with the samples of this study is premature. Much further research is required to provide more conclusive evidence about the Tsimshian children's cognitive style.

Studies of other cognitive styles, such as Impulsivity/Reflectivity, along with FD/FI would be of value to educators. More developmental studies involving

school age children would increase the possiblity of research findings being utilized in an educational setting.

This study has served to show that culture makes a difference on two of the K-ABC subtests; there is an intercorrelation of CEFT and the three K-ABC subtests, and development of the skills required on these tests follow the same sequence for Native and non-Native children. However, conclusive evidence showing the Native sample as more field-dependent or more field-independent than the non-Native sample in Prince Rupert was not found. Further research is necessary before any conclusions can be drawn, or instructional changes can be suggested.

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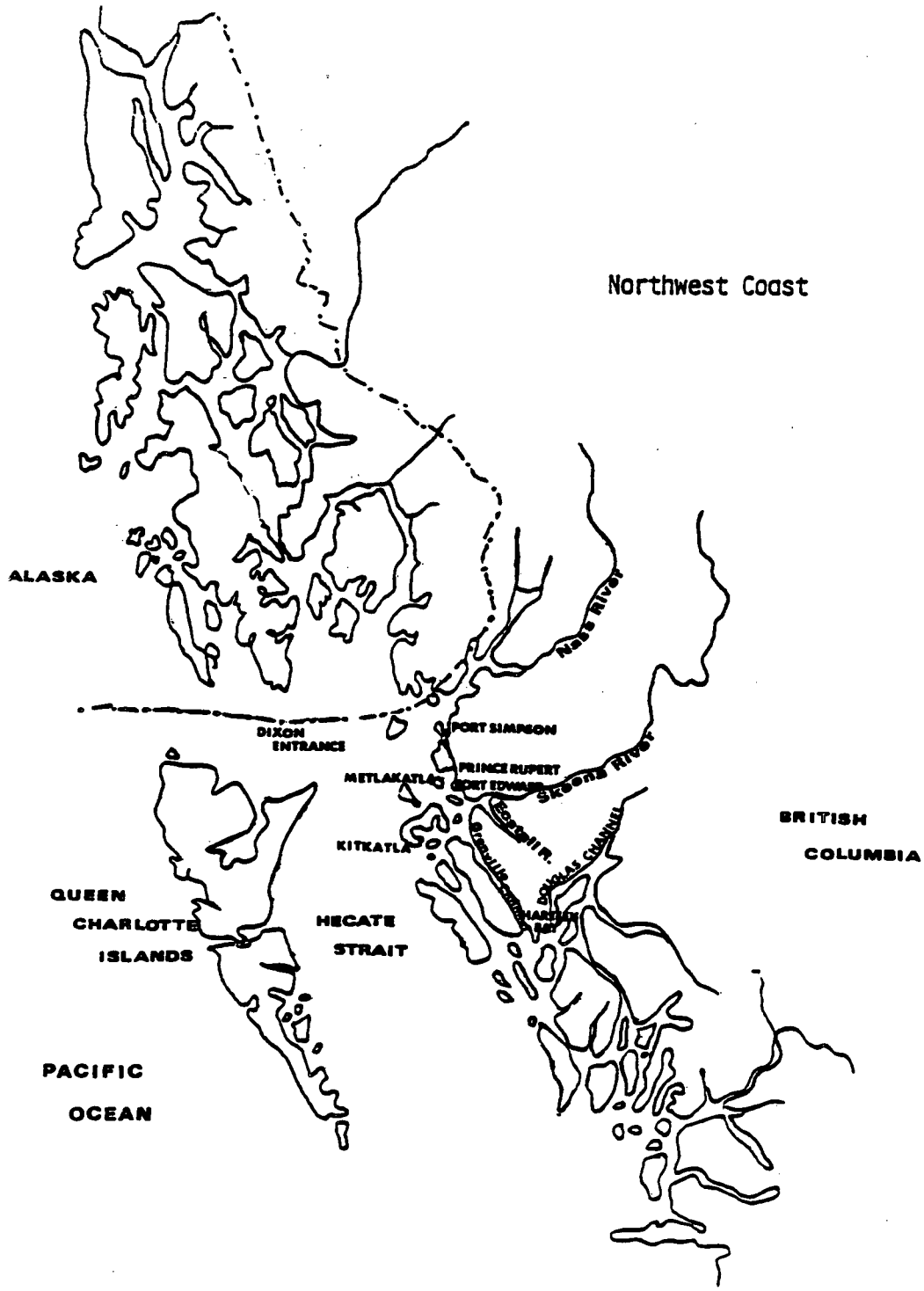
APPENDIX A

Geographical Location of Hartley Bay, Port Simpson and Prince Rupert



from Foods of Port Simpson. Prince Rupert School District Publication, 1984, p. 93.

APPENDIX B

Samples of Score Sheets for the K-ABC, CEFT, and Test for Colour-Blindness

K-ABC Kaufman Assessment Battery for Children

Number _____

Group _____

	YEAR	MONTH	DAY
Test date			
Birth date			
Chronological age			

4. Gestalt Closure

Simultaneous Processing Scale
Ages 2-6 through 12-5

	Item	Response	Score
All ages ☛	Sample: bird		
2½-6 ☛	1. face		
	2. dog		
	3. pig		
	4. TV		
	5. camera		
7-9 ☛	6. chair		
	7. camel		
	8. hammer		
	9. fish		
		2½	✋
10-12½ ☛	10. ship		
	11. frog		
	12. dinosaur		
	13. fork		
	14. elephant		
		3	✋
	15. crown		
	16. jet		
	17. stove		
	18. typewriter		
	19. gymnast		
	20. sailboat		
		4-7	✋
	21. five		
	22. guitarist		
	23. mountain climber		
	24. violinist		
	25. teapot		
		8-12½	✋

Ceiling Item ____
minus Errors ____
equals Raw Score ____

4. Gestalt Closure Scaled Score ____

9. Spatial Memory

Simultaneous Processing Scale
Ages 5-0 through 12-5

	Item	Score
All ages ☛	Sample	
5-7 ☛	1.	
	2.	
	3.	
	4.	
8-12½ ☛	5.	
	6.	
	7.	
	8.	
	9.	
	10.	
	11.	
	12.	
	13.	
	14.	
	15.	
		5-6 ✋
	Age 5 go to 12. Faces & Places	
	16.	
	17.	
	18.	
		7 ✋
	19.	
	20.	
	21.	
		8-12½ ✋

Ceiling Item ____
minus Errors ____
equals Raw Score ____

9. Spatial Memory Scaled Score ____

6. Triangles

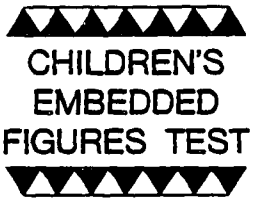
Simultaneous Processing Scale
Ages 4-0 through 12-5

	Item	Score
All ages ☛	Sample	
4-5 ☛	1.	
	2.	
	3.	
6 ☛	4.	
	5.	
	6.	
7 ☛	7.	
	8.	
	9.	
		4-5 ✋
8-12½ ☛	10.	
	11.	
	12.	
		6 ✋
	13.	
	14.	
	15.	
		7 ✋
	16.	
	17.	
	18.	
		8-12½ ✋

Ceiling Item ____
minus Errors ____
equals Raw Score ____

6. Triangles Scaled Score ____

SCORE SHEET FOR



NAME _____

CLASS _____

BIRTH DATE _____ SEX: M__ F__

DATE _____ EXAMINER _____

TENT	DESCRIPTION	SCORE
P_1		
P_2		
T_1		
T_2		
T_3		
T_4		
T_5		
T_6		
T_7		
T_8		
T_9		
T_{10}		
T_{11}		
	Total Score TENT	

HOUSE	DESCRIPTION	SCORE
P_3		
H_1		
H_2		
H_3		
H_4		
H_5		
H_6		
H_7		
H_8		
H_9		
H_{10}		
H_{11}		
H_{12}		
H_{13}		
H_{14}		
	Total Score HOUSE	
	TOTAL TEST SCORE	

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TEST FOR COLOUR-BLINDNESS

by

Dr. Shinobu Ishihara

ANSWER SHEET

Plate	Normal Person	Person with Red-Green Deficiencies				Person with Total Colour Blindness
1	12	12				12
2	8	3				x
3	29	70				x
4	5	2				x
5	3	5				x
6	15	17				x
7	74	21				x
8	6	x				x
9	45	x				x
10	5	x				x
11	7	x				x
12	16	x				x
13	73	x				x
14	x	5				x
15	x	45				x
		Protan		Deutan		
		Strong	Mild	Strong	Mild	
16	26	6	(2) 6	2	2 (6)	
17	42	2	(4) 2	4	4 (2)	

The mark x shows that the plate cannot be read. Blank space denotes that the reading is indefinite. The numerals in parenthesis show that they can be read but they are comparatively unclear.

APPENDIX C

Children's Embedded Figures Test - Protocol

Tent Discrimination Series (D1-D4)

Subject was shown D1-D4 and the tent cut-out. Examiner said, "This looks like a tent; the black line shows where the tent rests on the ground. Find a tent like this on the card. Point to it please." The cut-out was placed over the student's choice whether it was correct or incorrect to indicate to the student why it was the right or wrong choice. Examiner said, "This is not like our tent because it is too small", or "this is not like our tent because it is upside-down." The child was shown all the D1-D4 cards until he got two successive items correct. If he failed to reach this standard of two correct on the first trial, the series was repeated two additional times. If the child could not achieve two successive correct discriminations on the third repetition, testing was discontinued.

Tent Practice Series (P1-P2)

P1 was presented and Examiner said, "A tent like this one is hidden somewhere in this picture. The idea of the game is to find the hidden tent. Point to where the tent is." The child's choice then verified or refuted by placing the cut-out tent over the area where the child had pointed. P2 card was then presented without displaying the cut-out form. The child was asked to find the tent in the picture by pointing to where he thought it was. The response was verified with the cut-out tent.

Tent Test Series (T1-T11)

Age 8 children began testing at T1; age 9-12 children began with T6 and were automatically credited with having passed T1 through T5. If the child failed three or more of the tent items from T7-T11 he was required to do T1-T5. On the first three test items the child was helped, but it was scored as a failure. If after the first 3 items the child got 3 in a row incorrect the cut-out tent was shown to him, otherwise the cut-out tent was not in view. If 3 items from T7-T11 were incorrect, items T1-T5 were administered. If even one of T7-T11 was correct the house series was administered.

House Discrimination Series (D1-D4)

Instructions followed the same routine as the tent discrimination series.

House Practice Series (P3)

With the cut-out house still in view, the child was asked to find the house hidden in the picture. Verification of child's correct or incorrect response followed.

House Test Series (H1-H14)

On the first three items the child was helped if necessary, but a failure was marked down. If three items were consecutively wrong at any time throughout H4-H14 the house cut-out was shown to the child. If 5 consecutive failures occurred testing was terminated.

Timing

No specific time limit was imposed. The 'open' procedure was adopted since, within a moderate period of time, most children either pointed out the simple form they had selected or gave signs of wanting to discontinue the search.

Scoring

Responses were scored 1 or 0. A score of 1 was given only when the first choice the child made was correct or if he corrected his choice before the cut-out was seen. The maximum total score for the test was 25.