Cognitive controls and field-dependence-independence: an investigation of their development in 6-, 9- and 12-year-old normal and retarded readers.

S. Maureen Joyce
University of Windsor

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COGNITIVE CONTROLS AND FIELD-DEPENDENCE-INDEPENDENCE: AN INVESTIGATION OF THEIR DEVELOPMENT IN 6-, 9- AND 12-YEAR-OLD NORMAL AND RETARDED READERS

by

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B.A. St. Patrick's College, 1966
M.A. University of Windsor, 1969

A Dissertation Submitted to the Faculty of Graduate Studies through the Department of Psychology in Partial Fulfillment of the Requirement for Doctor of Philosophy at the University of Windsor

Windsor, Ontario, Canada 1974
ABSTRACT

The purpose of the present study was to investigate the development of three cognitive controls and one cognitive style in normal and reading disabled children.

Two hundred and twenty five children were tested with the Reading and Word Knowledge subtests of the Metropolitan Achievement Test to obtain 60 subjects: 30 of whom were classified as retarded readers and 30 as normal readers. The 30 subjects in each group were chosen such that 10 from each group were 6-7, 9-10 and 12-13 years old. All Ss were given a short form of the WISC to assure that their estimated Full Scale Intelligence Quotient (FSIQ) score fell roughly within the normal FSIQ range (90-115). Each S was presented with four tests: three devised by Santostefano (1969) to measure the cognitive controls of focal attention, field articulation and leveling-sharpening and an Embedded Figures Test developed by Benton and Spreen (1969) to measure field-dependence-independence.

Performance improved as a function of age on tests of field articulation, leveling-sharpening and field-dependence-independence. No age-group differences were found for the test of focal attention. These results raised some question regarding the validity of the Circles Test as a measure of focal attention. Both field articulation and field-dependence-independence were implicated in reading ability.
PREFACE

The impetus for this research came principally from previous published articles concerning the development of cognitive controls and cognitive styles and their relationship to reading ability. Ascertaining the processes critical for the activity of reading seemed important to the establishment of remediation programs.

I wish to express my appreciation to Dr. Byron Rourke under whose direction this research was completed and to Drs. Frank Auld and Martin Morf who were ever ready with expert advice, criticism and encouragement. I am indebted to the following for their assistance: Mr. Z. Veres and his principals for providing access to schools for subjects; Mr. Alan Finlayson who was available for consultation about the statistical analyses and interpretation of the resultant data; and to my husband, Shukri Amin, for his assistance in administering the criterion tests and for his encouragement and support during the various stages of this study. Lastly, I would like to express my grateful appreciation to the parents of the subjects and to the subjects for volunteering their time and effort.
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CHAPTER I

INTRODUCTION

The current trend in education is towards individualization of the instructional process. Coop and Sigel (1971) indicated that this is evidenced by such instructional, administrative, and curricular innovations as learning activity packages, nongraded programs, work-week units, teacher-student contracts and flexible scheduling (p. 152).

In their opinion, however, these programs have not considered inter-individual variability of the learners, particularly the information-processing variables. The consideration of these variables would seem to be at least as, if not more, important in the education of children with reading disabilities. Clymer and Robinson (1961) concluded in a review of the literature that little attention had been given to the cognitive mechanisms and processes involved in reading activity. Two theoretical models which investigated information-processing variables were the cognitive control model proposed by Klein and developed by Gardner, Santostefano and others and the cognitive style model proposed by Witkin. It was the purpose of this study to investigate the development of cognitive controls and one cognitive style in normal and reading disabled children and to shed some light on the processes critical for the activity of reading.
The introductory section will deal with the historical background of cognitive style and cognitive control research, experimentation in the area of cognitive controls with children and adults, some of the research on reading disabled children and a statement of the purpose and expectations of this investigation.

Historical Background

Prior to the late 1940s, the attention of perception and cognition investigators had been on the nature of and variations in the stimuli which affected these important psychological processes. In the late 1940s, a "New Look" in perceptual theory emerged. The focus of these latter theorists was the perceiver and individual differences between perceivers in perception. One of the approaches discernible within the New Look was the view that the study of perception was of interest not necessarily per se but as an approach to understanding and perhaps even the diagnosis of personality. Witkin, Kagan and Klein were among those who formulated typological approaches to personality through perception. In each, perception was viewed as being governed by structures or principles which determine the amount and organization of information which becomes available to the perceiver. These structures were considered (1) to be related to and determined by life experiences and personality traits and (2) to play a role
in the adaptation an individual makes to his environment. The investigation of these "structures" or "principles" have given rise to labels such as "cognitive style" and "cognitive controls".

The construct "cognitive style" has been used by numerous investigators to denote diverse referents. Some have used the term to denote individual differences in modes of cognitive functioning in children and adults. Others have used the term to refer to levels of cognitive development. Another aspect is that of conceptual tempo. In addition, specific labels have been used by writers to refer to different dimensions of their particular construct of style. Thus, it is found that one measure of cognitive style may not correlate highly with other measure (Coop & Sigel, 1971). The dimension of cognitive style to be considered in this study is the mode of conceptual functioning. This dimension is represented by Witkin, Kagan and Klein.

Witkin (1954) formulated the cognitive style of "field-dependence-independence" to account for individual differences. His research suggested to him that these tendencies were not limited to the individual's perception, but that they manifested themselves in congruent form also in the individual's intellectual activities, behavioral modes and in all areas of his functioning (Witkin, Lewis, Hertzman, Machover, Meissner and Wapner, 1954). Individuals
whose cognitive functioning was characterized as field dependent tended to submit passively to influences of the prevailing background and had difficulty in keeping an item separate from its surroundings; field independent individuals tended to overcome the context in which information was embedded.

As Field-Dependence-Independence was found to be related to an ever-increasing number and range of variables, he reformulated his cognitive style construct and proposed a "global versus articulate" style which defined a continuum.

At one extreme, there is a consistent tendency for an experience to be global and diffuse; the organization of the field as a whole dictates the manner in which its parts are experienced. At the other extreme, there is a tendency for experience to be delineated and structured; parts of the field are experienced as discrete and the field as a whole organized (Witkin, 1965, p. 319).

Witkin (1959) noted that the field dependence mode was identified with early stages of development and was in this sense more primitive.

Kagan and his associates followed a similar line of thinking, proposing a construct which they called an analytic-nonanalytic style which was almost identical to that of Witkin (that is, articulate, active cognitive behavior versus global and passive cognitive behavior) and which was based on an individual's performance on a series of sorting tasks. Lee, Kagan and Rabson (1963)
noted that the tendency to analyze a stimulus into differentiated meaningful elements increased with age and, at any one age, there appeared to be stable individual differences in this tendency.

Kagan (1963) and Witkin (1954, 1962, 1965, 1967) have both conceptualized a single underlying common denominator to explain consistencies in various perceptual tasks and personality assessments. Santostefano (1969) considered that "cognitive style", as used by Witkin and Kagan, had the conceptual properties of a trait, that is, a stable, unchanging stylistic attribute of an individual's general cognitive behavior. In the opinion of Klein, there was not one principle which operated in many and varied situations. Rather, he suggested that there were several ego controls or mechanisms, each dealing with particular informational requirements while remaining inactive in other situations. The cognitive style of the individual, in Klein's opinion, referred to the total configuration of the different cognitive controls. To differentiate between these two theoretical positions, the orientation of Witkin and Kagan will be referred to as the Cognitive Style model, and that of Klein, the Cognitive Control model.

There were at least two other discrepancies in the approaches of these two models. First of all, Klein and his associates made explicit use of the psychoanalytic framework to formulate laws of perceivers in accounting
for individual differences in perception and perceptual consistencies within different individuals. Specifically, he drew from two major sources: (1) the psychoanalytic proposition that an individual represents a self-regulative dynamic system of ego mechanisms of defense which attempt to bring impulses into harmony with environmental limitations and opportunities and which organize experiences of the individual giving them a unique individual stamp; and, (2) Hartmann's theoretical advances regarding adaptation and the "conflict-free" sphere of the ego (cited in Santostefano, 1969, p.75). Witkin and Kagan did not have a theoretical basis from the beginning. Finally, the cognitive control researcher's goal is to show how cognitive principles serve the individual in his efforts to adapt to his environment. The goal of the cognitive style approach is to merely demonstrate an individual's consistent style across many situations.

It should be noted that Witkin's concept of Field-Dependence-Independence was considered to be quite similar to one of the cognitive controls isolated by Gardner, Holzman, Klein, Linton and Spence (1959). Considering that Gardner and his associates investigated a variety of cognitive principles rather than isolating one general principle as Witkin did, the Cognitive Control model appeared to have a wider scope and to be more differentiated.
Cognitive Control Research

Santostefano (1969) referred to cognitive controls as having the status of intervening variables which defined principles of organizing perception, memory and other cognitive processes as the individual adapted to his environment. He defined cognitive controls specifically as mechanisms or principles which:

1. "govern and determine the amount and organization of information which become available to an individual perceiver;"
2. are activated by specified classes of stimuli which cause the individual to experience some intention to use and adapt to the information;
3. vary in the extent to which they operate in the cognitive functioning of the individual;
4. evolve in part as a function of maturation and life experiences and become independent of their origin of development;
5. mediate the influence of personality and motivation in the individual's cognitive encounters with the environment;
6. become enduring aspects of an individual's cognitive functioning and adaptive style and, thus, give shape to his subsequent cognitive experiences (p.76)."

The main assumption of this concept was that a cognitive control was triggered both by the content of the information presented and by the adaptive intentions of the individual taking in the information.

In the opinion of the cognitive control researchers, such as Klein and Gardner (Gardner et al., 1959), the simplest behavior involved more than one cognitive control. They had tried to identify specific cognitive controls, to demonstrate their stability and to clarify the processes
and activating stimuli unique to each. Over the last fifteen years, four cognitive controls have been isolated and subjected to empirical test. They are as follows:

focal attention (which concerns individual differences in directing attention actively);
field articulation (which concerns individual differences in directing attention selectively in the face of distraction); leveling-sharpening (which concerns individual differences in managing information changing over time); and equivalence range (which concerns individual differences in categorizing information) (Santostefano, 1971, p.14).

Most of the research conducted by Klein and by Gardner and their associates has been with adults. The only research done with children was conducted by Santostefano and his associates.

1. Experimental Studies of Focal Attention

Some researchers have suggested that there was considerable individuality in the extensiveness of scanning which persons engaged before making decisions about stimuli. Piaget (1958) and Gardner and Long (1962a,b) have noted that an individual who devoted considerable attention or prolonged centrations to a standard stimulus will tend to overestimate the size of that stimulus. On the other hand, those who distributed their attention extensively between a standard and a comparison object will show little of this tendency to overestimate and, therefore, will make more accurate size estimations. Gardner (1961) and Gardner and Long (1962a) lent support to the contention that extensiveness of scanning had
predictable consequences for performance under certain conditions. They also showed that other cognitive controls, such as field articulation, have predictable consequences under related but different conditions. In the opinion of Gardner and his associates, performance on the size estimation task was a measure of the focusing-scanning cognitive control. One example of a size estimation task was the Delboeuf illusion task, in which the person determined which was larger: the stimulus circle or the standard circle which was surrounded by another circle. In the positive illusion condition, the person tends to overestimate the size of the standard; in the negative illusion condition, the person tends to underestimate the size of the standard.

Piaget, Lambercier, Boesch and Albertini (1942-3) hypothesized that positive and negative Delboeuf illusions decreased with age. Santostefano (1963) compared the performance of six-, nine- and twelve-year old boys and girls to test this hypothesis. Results with the positive illusion were not statistically significant but gave some support for the hypothesis. The negative illusion, however, increased with age, and the results indicated a significant interaction between sex and age. Santostefano and Paley (1964) added support to the contention that the cognitive control of focusing-scanning operated in children and followed a developmental course. The youngest (six years) deployed attention unsystematically; the oldest (12 years),
relatively more systematically; whereas the nine-year-olds functioned at a level in-between the two.

Two other studies are relevant here. Santostefano (1964), using the Circle's Test (a size estimation task designed by him), found that brain-damaged Ss (age range: 6-13; mean: 11.0) showed the poorest size estimation, orphaned Ss next poorest and public school Ss the best. He hypothesized that these results suggested that brain-damaged children have the least efficient cognitive structures of the three populations. He suggested that populations having different life experiences would differ significantly on the cognitive control of focusing-scanning. Santostefano, Rutledge and Randall (1965) indicated that the performance of poor readers (age range: 8-13; mean: 10.94) and controls (age range: 8-12; mean: 10.91) on the test of the focusing-scanning principle was quite similar, suggesting that the systematic deployment of attention between two objects was not implicated critically in the reading process.

In summary, there appeared to be some support for the contention that the cognitive principle of focusing-scanning could be placed in a developmental framework. In addition, there was the suggestion that populations having different life experiences, i.e., brain-damaged, orphaned, and public school children, differed significantly with respect to this cognitive principle.
2. Experimental Studies of Field Articulation

The cognitive control of field articulation is quite similar to the field-dependence-independence concept of Witkin. However, Gardner et al. (1959) felt that this latter concept was too limited if defined as the ability to extract items from the surround. They indicated that an additional aspect was that the individual must selectively attend to relevant versus irrelevant cues. However, some of Witkin's results should be considered.

Gardner and his associates used some of the Witkin tests, e.g., The Embedded Figures Test (EFT), to test for the cognitive principle of field articulation. In the opinion of Gardner and Long (1961), the speed with which persons identify embedded figures in the EFT was significantly related to the number of items correct in recall under conditions of interference. Thus, they concluded that performance on this test was related to individual differences in the capacity to attend selectively to relevant and irrelevant material.

In the opinion of Gardner (1961), the refinement in ability for selectively attending to relevant and irrelevant material was a developmental phenomenon. He cited Piaget's studies of perceptual development as providing evidence of a progression from "passive" and "global" perception and perceptual activity to more refined patternings. Witkin's
(1959) studies suggested that younger children tended to be governed by the cognitive process of field dependence (i.e., the tendency to submit passively to the influence of the prevailing background and the inability to keep an item separate from its surroundings) while older children showed a predominance of field independence (i.e., the capacity to differentiate objects from their background). Santostefano and Paley's (1964) results using the Fruit Distraction Test as a measure of field articulation lent support to this hypothesis. Younger children (six years) had significantly more difficulty withholding their attention from the interference objects (constricted control) with the older children showing progressively less difficulty in selectively devoting attention to the central stimulus (flexible control).

Two other studies were relevant. The first, Santostefano (1964) indicated that orphaned children (age range: 6-12) have the greatest difficulty handling stimuli containing intrusive or contradictory information, public school children, the least and brain-damaged children fell between these two groups. He indicated that the difference in life experiences resulted in the orphan Ss being more disrupted by intrusive information than brain-damaged children were. The results were viewed as support for the contention that perception and cognition should be studied and conceptualized in terms of an individual's personality
organization and life experiences. The second study, Santostefano et al. (1965) suggested that of the three cognitive principles, focusing-scanning, leveling-sharpening and field articulation, the latter was critical in reading. Thus, poor readers (age 8-13) tended to have difficulty limiting their attention to elements of the stimulus field defined as critical and relevant while a control group (age 8-12) did not have this difficulty. The poor readers were not significantly different from the control group with respect to extensiveness of scanning or handling information gradually changing over time. Thus, there was evidence that, in both orphan Ss and children with reading difficulties, the cognitive principle of field articulation had been disrupted.

3. Experimental Studies of Leveling-Sharpening

Leveling-sharpening referred to the degree to which an individual perceived and made adaptive use of gradual changes in sequentially experienced stimuli. Levelers tended to assimilate or merge new experiences with memories of earlier experiences and, therefore, constructed relatively undifferentiated and contaminated memories, impressions and imagery of ongoing experiences. Sharpeners, however, tended to maintain discrete impressions and memories of sequentially presented stimuli so that elements did not lose their individuality (Klein, 1954).
Gardner and his associates conducted numerous experiments into the cognitive principle of leveling-sharpening with adults. Holzman and Gardner (1959) were interested in the similarity between this cognitive control and the defense of repression. Leveling-sharpening had been related to various cognitive behaviors. Gardner and Long (1960) found that levelers were more inefficient than sharpeners in a serial learning task. In other studies (Gardner, 1959 and Gardner & Lorhrenz, 1960), levelers lost more elements of the original story and showed more contaminations among difficult themes.

Santostefano (1964) devised a test called the Wagon Test where elements would either drop out or be added in order to study leveling-sharpening in children. Using three age groups (6, 9, 12) with ten boys and ten girls in each group, he found that the younger children appeared to be characterized by leveling and the older by sharpening. This was most noticeable on the Wagon Test where elements were subtracted. Thus, the results of this study suggested that this cognitive control also could be identified in the cognitive functioning of children and appeared to be related to age. It was also suggested that boys were characterized more by sharpening than were girls. This sex difference was not consistently noted with the other cognitive controls.
4. Overview of the Research

Santostefano (1963, 1964a,b,c, 1965,1969) offered some evidence that each of the three aforementioned cognitive controls operated in children and followed a developmental course. Thus, the younger child (6) was more passive and deployed attention to relatively few segmented aspects of the field, had difficulty withholding attention from intrusive information and tended to merge new experiences with earlier ones and to construct relatively undifferentiated impressions of ongoing experiences. The older child (13) could actively distribute attention systematically and equally between objects, could selectively withhold attention from disruptive information and could maintain discrete impressions and memories of sequentially presented stimuli. Thus, there was evidence of a continuum of psychological differentiation from a global, diffuse level towards an articulate differentiated level within each cognitive control.

Santostefano (1969) administered a large battery of tests of cognitive functioning to 44 white children ranging in age from seven to twelve. A factor analysis suggested that there were four cognitive controls and that focal attention contributed to the definition of field articulation and that focal attention and field articulation contributed to the definition of leveling-sharpening. He
formulated a developmental model viewing the cognitive controls as forming a hierarchy (see Table 1) and assuming that field articulation developed next, subordinating and integrating focal attention. The next level was leveling-sharpening which was assumed to subordinate and integrate the first two. The final level, equivalence-range, would subordinate and integrate the first three cognitive controls. Thus, Santostefano hypothesized a developmental progression within each control and also between each control. He offered some experimental evidence for the former, as noted in the previous sections, and only a factor analysis for the latter. One of the purposes of this study will be to test out this developmental model.

Reading Disability

Reading disability had been researched from varied points of view. As was previously mentioned, Clymer and Robinson (1961), in a review of the literature, concluded that little was known about cognitive mechanisms and processes involved in reading activity. Since then, little progress had been made regardless of the theoretical model considered.

A number of researchers have used Witkin's concept of field-dependence-independence to look at reading activity. Stuart (1967) administered the Witkin EFT, Short Form to 83 Ss male and female in grades seven and eight, who were
TABLE I
Santostefano's (1969) Proposed Developmental Model of Cognitive Controls

<table>
<thead>
<tr>
<th>Developmentally</th>
<th>EQUIVALENCE RANGE</th>
<th>LEVELING-SHARPENING</th>
<th>FIELD ARTICULATION</th>
<th>FOCAL ATTENTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced</td>
<td>Process: Survey field; articulate relevant and irrelevant; subordinate irrelevant; maintain discrete impressions as objects are compared; construct commonalities among objects; label relationships.</td>
<td>Differentiated categories</td>
<td>Articulate present from past</td>
<td>Scanning selected information</td>
</tr>
<tr>
<td>Differentially Integrated</td>
<td>Few, global categories</td>
<td>LEVELING-SHARPENING</td>
<td>Process: Survey field; direct attention to relevant information and withhold attention from irrelevant.</td>
<td>FOCAL ATTENTION</td>
</tr>
<tr>
<td>Integrated</td>
<td>Many differentiated categories</td>
<td>FIELD ARTICULATION</td>
<td>Scanning all information</td>
<td>Process: Direct attention, actively; scan broadly versus passive attention deployment and narrow or fragmented surveying.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FOCAL ATTENTION</td>
<td></td>
<td>Passive, limited scanning</td>
</tr>
<tr>
<td>Early, Global Diffuse</td>
<td></td>
<td></td>
<td></td>
<td>Active, extensive scanning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Developmentally advanced</td>
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</tbody>
</table>

Developmentally
subdivided into two groups: "good" and "poor" readers. Although the results of the study indicated that successful readers were less field dependent \( p < .01 \), Stuart noted that lack of adequate control for IQ rendered the results suspect.

Fiebert (1967), studying the cognitive styles of deaf children at age levels 12, 15 and 18 noted a low level relation between cognitive measures (provided by Witkin's Rod and Frame Test and the Children's Embedded Figures Test) and reading ability for girls but not for boys. Wineman (1971) used the human figure drawing (DAP) as a measure of field-dependence-independence using the Witkin, Dyk, Paterson, Goodenough and Karp (1962) perceptual index score. He found only partial confirmation of the relationship between cognitive style and reading activity in fourth, fifth and sixth grades (30% in each of the nine, ten and eleven year categories). The product moment correlation for the DAP and the reading test score was significant for the fourth grade males and females and the sixth grade females but not for the sixth grade males or the fifth grade males and females.

Santostefano et al. (1965) with a sample of 24 boys ranging in age from 8 to 13 suggested that the cognitive control crucial for reading was field articulation and not focal attention or leveling-sharpening.
A final study of relevance was that of Kaplan (1970). He administered the Conceptual Styles Test, Embedded Figures Test and the Stroop Color Word Test to measure analytic conceptualization (Kagan), field independence (Witkin) and flexibility (Klein) to 100 fourth grade students. He noted that reading achievement correlated with each of the cognitive styles at the .01 level. Although the correlations were significant, they were of a moderate to low order and thus the results, while indicating a trend, actually accounted for little of the variance. The tests individually would be poor for predicting reading achievement. He concluded that the findings suggested that the cognitive principle important for reading achievement was concerned with processing information in the context of distractions and with the individual's ability to withhold attention from intrusive and misleading cues.

In summary, the aforementioned studies indicated that there was no clear evidence, merely suggestive evidence, of the cognitive principles important for reading achievement. In the Santostefano et al. (1965) study, where the clearest evidence was found, there were some methodological problems. Although previous research by Santostefano and his associates (Santostefano, 1964a, b, 1969, Santostefano & Paley, 1964) suggested that there was a difference in the performance of a six-year-old, nine-year-old and twelve-year-old on each of the cognitive controls, he ignored these age
group differences. Thus, it was difficult to conclude that field articulation was the crucial cognitive control in reading activity for all age groups because of the possibility that some of the age group differences have been cancelled out. Since the mean age for the Ss in this study was 10.94 for the poor readers and 9.91 for the good readers, the only feasible, if somewhat tentative, conclusion was that field articulation may be the crucial cognitive principle for reading activity for ten-year-olds. It was also noteworthy that those studies employing Witkin's concept of field-dependence-independence used Ss who were ten years old and above.

**Purpose**

As indicated in the above review of the literature, there had been little attention to the developmental aspects of cognitive principles and the cognitive principles involved in reading activity. In addition, although the studies provide some information, methodological limitations had resulted in suggestive results rather than clear-cut results.

The purpose of this study will be to investigate cognitive controls and one cognitive style in normal and reading disabled children, trying to eliminate some of the methodological problems of other studies. Some of the questions asked were:
1. Are there any differences for the NR and RR Groups on the three cognitive controls?

2. Are there any differences for the three age groups for the three cognitive controls?

3. What is the relationship of field-dependence-independence to reading achievement and age?

4. What is the relationship between the measures of field-dependence-independence and field articulation?
CHAPTER II

METHODOLOGY

Subjects

Two groups of male subjects (Ss) were employed: (1) a group of normal readers (NR), who were functioning at least at their actual grade placement or better, and (2) a retarded readers (RR) group. These two groups, consisting of 30 Ss each, were further divided on the basis of their age, forming three distinct age groups: 6-7, 9-10, and 12-13. The schools from which the sample was drawn were selected because of their geographical proximity and relatively homogeneous socio-economic make-up.

Normal readers were selected on the basis of the following criteria: a centile score of 50 or above on the Reading subtest of the Metropolitan Achievement Test (MAT) and a score of 60 or above on the Word Knowledge subtest of the MAT. Ss in the RR Group had a centile score of 25 or below on the Reading subtest of the MAT and 35 or below on the Word Knowledge subtest of the MAT. All Ss in both groups were given a short form of the Wechsler Intelligence Scale for Children (WISC) to assure that their estimated Full Scale Intelligence Quotient (FSIQ) score fell roughly within the normal FSIQ range on the WISC and that the six experimental groups were relatively equated for mean FSIQ for each group.
Glasser and Zimmerman (1969) reviewed a number of abbreviated forms of the WISC. They noted that there should be at least a correlation of .99 between the brief form FSIQ and the actual FSIQ of the complete test. A correlation of this magnitude resulted in a variance of no more than nine IQ points above or below the "true" IQ in two-thirds of the cases. They further reported that, as the number of subtest combinations were increased, the reliability tended to increase correspondingly.

Based on the Glasser and Zimmerman (1969) review of the abbreviated forms of the WISC, the following combination of WISC subtests was used to assess the intellectual functioning of the normal sample: Comprehension, Arithmetic, Vocabulary, Picture Arrangement, and Object Assembly. At age levels 7½, 10½ and 13½, this combination correlated with the Full Scale score .94, .96 and .96 respectively (Howard, undated, in Glasser and Zimmerman, 1969). Schwartz and Levitt (1960) reported that this combination for a retarded sample correlated with the actual Full Scale score .90.

Tests of Cognitive Control

In conjunction with the test of field-dependence-independence, three cognitive control tests were administered individually to each of the Ss in a counterbalanced order.
1. Circles Test

The cognitive principle, focusing-scanning, concerned the manner in which an individual distributed attention between objects which he was comparing. Focusers were assumed to actively distribute attention unsystematically and equally between objects, while scanners were more passive and deployed attention to relatively few segmented aspects of the field.

Piaget et al. (1942-1943), working on the Delboeuf illusion and varying the size ratio of the circles noted that a) the illusion was maximal (inner circle was seen as larger than the equal size stimulus) when the inner circle was three-quarters the size of the outer circle and b) the illusion became zero or negative as the ratio of the inner circle to the outer circle declined to one-quarter. Using this information, Santostefano (1963, 1964a, b) devised a size estimation test.

The Circles Test employed three standards in three conditions (one non-illusion and two illusion) requiring size estimations. In the non-illusion condition, the standard was a circle with a radius of 9mm. In one illusion condition, this standard was surrounded by an outer context circle with the radius of 12mm, the context circle causing the standard to appear larger than its actual size (positive illusion). In the second illusion
condition; this standard was surrounded by an outer context circle with a radius of 45mm, causing the standard to appear smaller than its actual size (negative illusion). Each of these three standards was paired with each of nine variable circles ranging in radii, in 1mm increments, from 7mm to 11mm. Each of the 27 pairs of circles was printed on a card and the S was asked to indicate which of the two stimulus circles seemed the larger or whether they seemed the same (Santostefano et al., 1965).

Performance was evaluated by assigning positive values to errors in size judgment that occurred in the expected direction and negative values to errors which occurred in a direction opposite from the expected direction.

a. No illusion condition: A high score indicated poor size estimation and interpreted as representing limited and unsystematic scanning.

b. Positive illusion condition: A high positive score indicated that the illusion was operating as expected. A negative score indicated that the illusion was operating in a direction opposite from the expected.

c. Negative illusion condition: A high positive score indicated that the illusion was operating as expected. A negative score indicated that the illusion was operating in a direction opposite from the expected.
2. Fruit Distraction Test

A number of tests have been devised to measure a S's ability to handle distracting information. Stroop (1935) conducted two experiments and noted that it was more difficult for undergraduate students to name the color in which an incongruent color name was printed (that is, read red when the word blue was colored red) than a color bar. Smith and Klein (1953) used the Stroop test in their initial investigations of the constricted-flexible control, known presently as field articulation.

Santostefano developed the Fruit Distraction Test in order to assess the manner in which a child dealt with a stimulus field containing information that was contradictory or intrusive in terms of the central task. Some individuals selectively withheld their attention from intrusive information and were not disrupted by it. These are called flexible control individuals. Constricted control persons had difficulty selectively withholding their attention and thus their performance was disrupted. The test, as described herein, was devised by Santostefano (1964). It made use of colored fruit and was in three parts.

Test Card 1: On Card 1 was arrayed 50 lined drawings of apples, bananas, grapes and heads of lettuce, each covering an area of approximately 1" x 1½" and randomly distributed in 10 rows with five fruit in each. The apples were colored
red; the bananas, yellow; lettuce, green; and the grapes, blue.

The S was initially given a practice card having five fruit and presenting each of the four fruit at least once. Once the S understood the task, Test Card 1 was given to him and he was asked to read aloud as fast as possible the colors of the fruit. E recorded reading errors and the time for each card.

Test Card 2: Card 2 contained apples, bananas, grapes and heads of lettuce colored and arranged identically to those on Card 1. However, to one side of each fruit were one of the following lined achromatic drawings: a cake, an ice cream cone, a bottle of milk, a spoon, a glass, a loaf of bread (food-related objects) and a chair, a car, an airplane, a shoe, a telephone, a clock (non-food-related objects). Each of these irrelevant and possibly distracting drawings covered an area approximately \( \frac{1}{2} \) " x \( \frac{1}{2} \) " . Each "irrelevant object" appeared four times on the card, one with each of the four colored fruit.

The S was not given a practice card but was given the test card immediately. He was again directed to read the colors as quickly as possible trying to withhold his attention from the irrelevant stimuli. E recorded the reading errors and time for each card. After completion of the task, he was asked to report any of the background pictures which he "happened to notice" and "remember".
Errors on this card were viewed as related to the management of information in the face of irrelevant distractions.

Test Card 3: On Card 3, the fruit were again in the same order or arrangement as Cards 1 and 2 but the color was incorrect. Thus, grapes were colored red, green and yellow (four times in each color) but not blue.

S was given a practice card with five fruit incorrectly colored. He then was given Test Card 3 and was asked to name as quickly as possible the colors that should have been on each fruit. S again recorded reading time and errors. Errors were viewed as related to the child's management of information in the face of contradiction.

Scoring: Three scores were computed:

A. Reading Time Distractibility Score:
   a. Reading time with Card 2 minus reading time with Card 1.
   b. Reading time with Card 3 minus reading time with Card 1.

B. Reading Error Distractibility Score:
   a. Reading errors with Card 2 minus reading errors with Card 1.
   b. Reading errors with Card 3 minus reading errors with Card 1.

C. Number of Recalled Peripheral Figures:
   a. The number of correct food related objects.
b. The number of correct non-food-related objects.

c'. The total number of correct objects recalled.

It was expected that the more an individual was distracted, the greater would be the two distractibility scores and the number of recalled peripheral figures.

3. Leveling-Sharpening House Test

The Leveling-Sharpening House Test was purported to assess the manner in which an individual processed ongoing, changing stimuli. Some individuals (levelers) tended to assimilate or merge new experiences with memories of earlier ones and thus, to construct relatively undifferentiated impressions of ongoing experiences. Others (sharpeners) tended to maintain discrete impressions and memories of sequentially-presented stimuli so that elements did not lose their individuality.

The test described here was devised by Santostefano (1964). The test material consisted of six practice cards and 60 test cards, 8" x 10". The former were used to train Ss in the requirements of the test. The test cards had lined achromatic pictures of a house scene, the main elements of which were: a house with a front door, two rectangular windows and a round window; a chimney and weathervane on the roof with smoke rising from the chimney; a sidewalk, fence, tree, cloud and sun. The first three displays contained all the elements; with the fourth, the doorknob was omitted
and remained absent for the fifth, sixth and remaining displays. With the seventh, the lower horizontal board on the fence was also dropped out and remained so in the subsequent displays. In this way, nineteen elements were omitted accumulatively; each new configuration was displayed three successive times.

The practice cards were administered to insure that the Ss understood the task. Each test card was displayed for five seconds; S was asked to look at each picture carefully and to stop the E if something had changed or looked different in terms of the first or previous pictures. If S asked that the presentation be stopped, E inquired as to what about the picture looked different, recorded the response and continued the display.

The test yielded three scores:

A. First Stop Score. This was the number of the card on which the first correct change was perceived. Early detection was assumed to reveal the operation of sharpening whereas the first detection coming late reflected leveling.

B. Number of Correct Changes. This was the total number of correct changes perceived. It was assumed that if few changes were detected, previous memories were blurred with ongoing stimulation (leveling).

C. Leveling—Sharpening Ratio. This score took into account which of the nineteen changes were not perceived, which
were perceived and how soon they were perceived. The formula was

\[
\text{L-S Ratio} = \frac{\text{For each change not detected, the number of opportunities to perceive each change}}{\text{For each change detected, the number of opportunities S had to detect before it was detected}}
\]

It was assumed that a high score reflected leveling.

It was apparent that the number of correct changes perceived was experimentally dependent on the first stop score and that the leveling-sharpening ratio was experimentally dependent on both the first stop score and the number of correct changes perceived.

**The Field-Dependence-Independence Test**

Witkin (1960) made use of the Gottschaldt figures in formulating his Embedded Figures Test. He found that this test, in which the S must find a simple figure within a complex one, was highly correlated with other measures of field-dependence-independence. Witkin et al. (1954) noted that this test was too difficult for eight and ten year olds. In order to study this cognitive style in younger children, Goodenough and Eagle (1963) formulated an embedded figures test for children from five to ten years of age. This was revised and called the Children's Embedded Figures Test (CEFT) by Karp and Konstadt (1963). In spite of its continued use with young children, Keogh and Ryan (1971)
have recently noted that the CEFT was too difficult and
time consuming for children to be useful in primary school
settings.

Benton and Spreen (1969) developed an Embedded
Figures Test which would span the age group used in this
study and which required the same type of response from the
Ss as Witkin's. There were norms for children (6 to 12 years)
and various adult populations.

The test consisted of 16 straight-line drawings
used as stimulus figures and presented in the left half
of 5½ x 8½ sheets of paper assembled into a test booklet.
The right half of each sheet contained a complex figure
drawing in which the stimulus figure was embedded. The Ss
were required to search for and trace the stimulus figure
in the embedded design. An ordinary soft pencil was used
for tracing the design. The test was preceded by two
demonstration items.

For left-handed Ss, placement of the stimulus
figure and embedded design was reversed, i.e., the stimulus
figure was shown in the right half and the embedded design
in the left half of the test booklet.

With respect to scoring, one point was given for
every design correctly completed within 30 seconds. One
additional credit point was given if the design was completed
within 20 seconds. Maximum credit score for all 16 items
was 32 points. It was assumed that the higher the score,
the more field independent the individual.

The Statistical Analyses of the Results

In order to investigate the development of cognitive controls in children, to determine if there are any differences for the NR and RR Groups on the three cognitive controls and to ascertain if only one cognitive control is related to reading achievement across age groups, a number of analyses of variance were carried out. Taking each test separately, there was a $2 \times 3 \times 3$ analysis of variance with repeated measures on the last factor (that is, the three scores on the test) for the Circles Test (focal attention). The Fruit Distraction Test, the measure of field articulation, yielded five scores: two time scores, two number of error scores and a score of the number of recalled peripheral items. Because of the differences in the types of scores, three separate analyses were carried out: 1) a $2 \times 3 \times 2$ analysis of variance with repeated measures on the last factor for the time scores; 2) a similar analysis of variance for the error scores and 3) a $2 \times 3$ analysis of variance for the recall scores. Three separate $2 \times 3$ analyses of variance were carried out for each of three scores on the Leveling-Sharpening House Test.

Using only the data from the NR Group, the method used to look at the question of the hierarchical arrangement of the cognitive controls was the Scheffé test. This
involved a comparison of the pairs of means for each of the age groups for each of the measures of the cognitive controls. In addition, in order to test the hypothesis of ordered means, the Jonckheere procedure and linear trend procedure were used.

The final analyses involved the scores on the Benton and Spreen EFT. A 2x3 analysis of variance of the scores provided answers about the relationship of the field-dependence-independence measure to reading achievement. An investigation into the relationship between the measures of field-dependence-independence and the measure of field articulation involved the calculation of Pearson product-moment correlation coefficients.

The .05 level of confidence was chosen as the critical level for the analyses of variance and the Scheffé test.
CHAPTER III

RESULTS

The pre-selection tests given to the subjects consisted of a short form of the WISC and the Word Knowledge and Reading subtests of the Metropolitan Achievement Test (MAT). The MAT was administered to 225 children in order to obtain the Ss who fit the criteria for age, IQ, and reading level. The means, standard deviations, ranges, and t values for age, WISC Full Scale IQ and MAT subtest scores are contained in Table 2. The NR and RR Groups for each age level did not differ significantly in age or WISC Full Scale IQ. Also, the RR Group at each age level differed significantly (p < .01) from the NR Group in performance on the MAT subtests.

The means and standard deviations for the NR and RR Groups for the Circles Test, Fruit Distraction Test, Leveling-Sharpening House Test, and the Embedded Figures Test are presented in Table 3. What follows are the results of the analyses conducted for each test.

Circles Test

An analysis of variance for the effect of reading level, age, and illusion condition on the error scores for the Circles Test, a test of focal attention, indicated that there were no significant differences in performance for
<table>
<thead>
<tr>
<th>AGE (mos)</th>
<th>Six-year-olds</th>
<th>Nine-year-olds</th>
<th>Twelve-year-olds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>80.0</td>
<td>114.9</td>
<td>151.0</td>
</tr>
<tr>
<td>S.D.</td>
<td>3.74</td>
<td>2.43</td>
<td>4.24</td>
</tr>
<tr>
<td>Range</td>
<td>74-87</td>
<td>111-118</td>
<td>145-158</td>
</tr>
<tr>
<td>t</td>
<td>-0.99</td>
<td>-0.30</td>
<td>-0.10</td>
</tr>
<tr>
<td>WISC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>104.3</td>
<td>106.0</td>
<td>106.8</td>
</tr>
<tr>
<td>S.D.</td>
<td>6.39</td>
<td>3.35</td>
<td>4.98</td>
</tr>
<tr>
<td>Range</td>
<td>94-115</td>
<td>92-112</td>
<td>101-113</td>
</tr>
<tr>
<td>t</td>
<td>-0.37</td>
<td>-1.26</td>
<td>-1.28</td>
</tr>
<tr>
<td>MAT Word Knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>85.6</td>
<td>78.2</td>
<td>75.9</td>
</tr>
<tr>
<td>S.D.</td>
<td>12.46</td>
<td>10.16</td>
<td>10.88</td>
</tr>
<tr>
<td>Range</td>
<td>60-98</td>
<td>65-90</td>
<td>60-90</td>
</tr>
<tr>
<td>t</td>
<td>11.82**</td>
<td>10.93**</td>
<td>10.61**</td>
</tr>
<tr>
<td>MAT Reading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>78.9</td>
<td>77.6</td>
<td>77.4</td>
</tr>
<tr>
<td>S.D.</td>
<td>9.33</td>
<td>13.32</td>
<td>9.83</td>
</tr>
<tr>
<td>Range</td>
<td>60-90</td>
<td>65-92</td>
<td>60-92</td>
</tr>
<tr>
<td>t</td>
<td>16.66**</td>
<td>12.62**</td>
<td>15.22**</td>
</tr>
</tbody>
</table>

** p < .01
<table>
<thead>
<tr>
<th></th>
<th>Six-year-olds</th>
<th></th>
<th>Nine-year-olds</th>
<th></th>
<th>Twelve-year-olds</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal Readers</td>
<td>Retarded Readers</td>
<td>Normal Readers</td>
<td>Retarded Readers</td>
<td>Normal Readers</td>
<td>Retarded Readers</td>
</tr>
<tr>
<td><strong>CIRCLES TEST (errors)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Illusion</td>
<td>18.7 (3.38)</td>
<td>17.9 (1.87)</td>
<td>20.1 (3.14)</td>
<td>19.8 (3.49)</td>
<td>18.2 (2.32)</td>
<td>18.0 (1.75)</td>
</tr>
<tr>
<td>Positive Illusion</td>
<td>22.6 (3.23)</td>
<td>22.8 (3.84)</td>
<td>22.8 (2.27)</td>
<td>22.8 (3.09)</td>
<td>22.6 (2.76)</td>
<td>21.3 (2.79)</td>
</tr>
<tr>
<td>Negative Illusion</td>
<td>17.5 (5.84)</td>
<td>20.7 (2.28)</td>
<td>20.1 (2.39)</td>
<td>18.5 (4.70)</td>
<td>20.7 (2.15)</td>
<td>17.8 (5.34)</td>
</tr>
<tr>
<td><strong>FRUIT DISTRACTION TEST</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time Difference</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Card 2 - Card 1</td>
<td>12.7 (5.75)</td>
<td>19.7 (8.57)</td>
<td>11.0 (3.07)</td>
<td>11.1 (4.77)</td>
<td>9.9 (2.21)</td>
<td>13.0 (6.05)</td>
</tr>
<tr>
<td>Card 3 - Card 1</td>
<td>60.0 (20.3)</td>
<td>72.0 (32.0)</td>
<td>37.4 (11.9)</td>
<td>39.5 (11.9)</td>
<td>28.9 (5.20)</td>
<td>40.9 (12.3)</td>
</tr>
<tr>
<td>Error Difference</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Card 2 - Card 1</td>
<td>9.8 (1.40)</td>
<td>10.5 (3.07)</td>
<td>11.0 (1.10)</td>
<td>9.7 (2.28)</td>
<td>9.9 (1.64)</td>
<td>8.9 (2.07)</td>
</tr>
<tr>
<td>Card 3 - Card 1</td>
<td>12.3 (2.37)</td>
<td>11.8 (3.79)</td>
<td>10.8 (2.23)</td>
<td>10.1 (3.24)</td>
<td>10.0 (1.10)</td>
<td>10.1 (1.01)</td>
</tr>
<tr>
<td>Recall Scores</td>
<td>1.8 (0.87)</td>
<td>1.7 (1.00)</td>
<td>2.0 (1.34)</td>
<td>2.5 (1.69)</td>
<td>1.7 (0.90)</td>
<td>2.1 (1.37)</td>
</tr>
<tr>
<td><strong>HOUSE TEST</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Stop Score</td>
<td>20.4 (10.9)</td>
<td>16.2 (7.37)</td>
<td>16.2 (6.94)</td>
<td>11.8 (2.48)</td>
<td>11.8 (4.53)</td>
<td>13.2 (5.19)</td>
</tr>
<tr>
<td>Number of Correct Changes</td>
<td>8.5 (3.64)</td>
<td>7.5 (2.69)</td>
<td>10.6 (2.20)</td>
<td>9.3 (1.62)</td>
<td>11.5 (1.63)</td>
<td>12.0 (1.95)</td>
</tr>
<tr>
<td>Ratio</td>
<td>20.1 (5.60)</td>
<td>20.8 (3.92)</td>
<td>16.1 (2.77)</td>
<td>18.1 (2.11)</td>
<td>14.9 (2.69)</td>
<td>14.8 (2.83)</td>
</tr>
<tr>
<td><strong>EMBEDDED FIGURES TEST</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(# correct + time credits)</td>
<td>19.8 (3.43)</td>
<td>16.8 (6.42)</td>
<td>25.3 (2.83)</td>
<td>24.0 (3.26)</td>
<td>30.8 (1.60)</td>
<td>28.0 (2.24)</td>
</tr>
</tbody>
</table>
age or reading level. The illusion condition effect was significant beyond the .01 level, with the error score greater for the "positive illusion" than for the "negative" and "no" illusion conditions ($F[2, 102] = 21.63, p < .01$).

There were no significant interactions. The results indicated that there was no significant difference between the NR and RR Groups at any age level for the cognitive control of focal attention.

**Fruit Distraction Test**

There were a number of scores on the Fruit Distraction Test, a measure of field articulation. Each score was analyzed separately.

1. **Time Difference Scores**

The summary of the analysis of variance for the effect of reading level, age and distractibility conditions on reading time differences (see Table 4 and Figures 1 and 2) indicated the following:

   a) The reading time differences were significantly greater ($p < .05$) for the RR Group than for the NR Group.

   b) There was a highly significant difference ($p < .001$) in the reading time difference scores for the three age groups. The multiple comparisons of the means at each level (by means of the Scheffe procedure) indicated that the mean time difference scores of the six-year-olds were
**TABLE 4**

Analysis of Variance for the Effect of Reading Level, Age, and Distractibility Conditions for Reading Time Differences on the Fruit Distraction Test

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between Subjects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A (Reading Level)</td>
<td>1</td>
<td>1098.08</td>
<td>5.78*</td>
</tr>
<tr>
<td>B (Age)</td>
<td>2</td>
<td>3940.73</td>
<td>20.74**</td>
</tr>
<tr>
<td>AB</td>
<td>2</td>
<td>193.28</td>
<td>1.02</td>
</tr>
<tr>
<td>Subjects within groups</td>
<td>54</td>
<td>189.98</td>
<td></td>
</tr>
<tr>
<td><strong>Within Subjects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C (Distractibility Conditions)</td>
<td>1</td>
<td>33768.08</td>
<td>173.17**</td>
</tr>
<tr>
<td>AC</td>
<td>1</td>
<td>210.68</td>
<td>1.08</td>
</tr>
<tr>
<td>BC</td>
<td>2</td>
<td>2019.48</td>
<td>10.36**</td>
</tr>
<tr>
<td>ABC</td>
<td>2</td>
<td>29.93</td>
<td>0.15</td>
</tr>
<tr>
<td>C x Subjects within groups</td>
<td>54</td>
<td>194.99</td>
<td></td>
</tr>
</tbody>
</table>

* p < .05

** p < .01
Figure 1. Reading time difference scores on the Fruit Distraction Test for 6-, 9-, 12-year-olds across reading level and distractibility conditions (constant of 10 added).
Distractibility Condition 1

Distractibility Condition 2

Reading Time Difference Scores

6-year-olds  9-year-olds  12-year-olds

Figure 2. Mean time difference scores for the 6-, 9-, 12-year-olds for the two distractibility conditions (constant of 10 added).
significantly different from those of the nine-year-olds (F[2, 57] = 25.55, p < .01) and the twelve-year-olds (F[2, 57] = 31.05, p < .01). There was no significant difference in reading time difference scores between the nine- and twelve-year-olds (F[2, 57] = 0.27).

c) The reading time difference scores were significantly greater (p < .001) for the condition in which the Ss were presented with contradictory information than for the condition in which the Ss were presented with distracting peripheral information.

d) A number of individual comparisons of the mean time difference scores for the three age groups for the two distractibility conditions indicated the following: (i) for condition 1, there was no significant age effect; and (ii) for condition 2, the mean time difference score for six-year-olds was significantly different from the score obtained by the nine-year-olds (F[2, 54] = 78.86, p < .001) and the twelve-year-olds (F[2, 54] = 100.49, p < .001). There was no significant difference between the mean time difference scores of the nine- and twelve-year-olds (F[2, 54] = 1.31).

Within the three age groups, there was a significant effect (p < .01) for the distractibility condition. The F-ratios (df = 2, 54) for the six-, nine- and twelve-year-olds were 127.18, 38.50 and 28.20, respectively. In summary, using the reading time difference score as a measure of field articulation, there were significant differences for reading
level, age, and distractibility condition.

2. Reading Error Differences

The analysis of variance of the reading error difference scores indicated that there was no effect of reading level or age on the reading error difference score. There was, however, a significant difference ($p < .05$) between the error scores for the distractibility conditions. There were greater reading error difference scores for the condition in which the subject was presented with contradictory information than for the condition in which the subject was presented with distracting peripheral information.

3. Recall Score

An analysis of variance of the Recall score (number of peripheral items recalled) was carried out. None of the F's were significant.

Leveling-Sharpening House Test

There were three scores for the House Test, a measure of leveling-sharpening, as follows:

1. First Stop Score: The analysis of variance for the first stop score, as presented in Table 5, indicated the following: (a) there was no effect for reading level on the first stop score; and, (b) there was a significant difference ($p < .05$)
TABLE 5

Analysis of Variance for the Effect of Reading Level and Age on the First Stop Score on the House Test

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (Reading Level)</td>
<td>1</td>
<td>86.40</td>
<td>1.70</td>
</tr>
<tr>
<td>B (Age)</td>
<td>2</td>
<td>181.27</td>
<td>3.57*</td>
</tr>
<tr>
<td>AB</td>
<td>2</td>
<td>54.20</td>
<td>1.07</td>
</tr>
<tr>
<td>Within Cell</td>
<td>54</td>
<td>50.71</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* P < .05
for age. The analysis of simple effects, as presented in Table 6, indicated that there was a difference for age for the NR Group ($p < .05$) but not for the RR Group.

2. Number of Correct Changes: The analysis of variance for the number of correct changes, as presented in Table 7, indicated that there was no effect for reading level on the number of correct changes perceived. However, there was a significant difference ($p < .01$) for age. The analysis of simple effects (see Table 8) indicated that there was a significant difference for both the RR Group ($p < .01$) and the NR Group ($p < .05$).

3. Leveling-Sharpening Ratio: The summary of the results of the analysis of variance, presented in Table 9, indicated that there was no effect for reading level on the Leveling-Sharpening Ratio. However, the effect for age was significant beyond the .001 level. The analysis of simple effects (see Table 10) indicated that these differences were significant for both the RR Group ($p < .01$) and the NR Group ($p < .01$).

In summary, the results indicated that, for the three measures of leveling-sharpening, there was a difference among the age groups in their ability to manage information changing over time. Younger children were characterized more by leveling, tending to merge new experiences with earlier ones and constructing undifferentiated and contaminated memories. The older children were characterized by sharpening.
TABLE 6

Analysis of Variance for the Simple Effects Associated with the First Stop Score of the House Test

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A for $b_1$ (Reading level for 6-year-olds)</td>
<td>1</td>
<td>88.20</td>
<td>1.74</td>
</tr>
<tr>
<td>A for $b_2$ (Reading level for 9-year-olds)</td>
<td>1</td>
<td>96.80</td>
<td>1.91</td>
</tr>
<tr>
<td>A for $b_3$ (Reading level for 12-year-olds)</td>
<td>1</td>
<td>9.80</td>
<td>0.19</td>
</tr>
<tr>
<td>B for $a_1$ (Age for retarded readers)</td>
<td>2</td>
<td>50.53</td>
<td>1.00</td>
</tr>
<tr>
<td>B for $a_2$ (Age for normal readers)</td>
<td>2</td>
<td>184.93</td>
<td>3.65*</td>
</tr>
<tr>
<td>Within Cell Error</td>
<td>54</td>
<td>50.71</td>
<td></td>
</tr>
</tbody>
</table>

* $p < .05$
TABLE 7

Analysis of Variance for the Effect of Reading Level and Age on the Number of Correct Changes Perceived on the Leveling-Sharpening House Test

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (Reading Level)</td>
<td>1</td>
<td>5.40</td>
<td>0.85</td>
</tr>
<tr>
<td>B (Age)</td>
<td>2</td>
<td>70.35</td>
<td>11.04**</td>
</tr>
<tr>
<td>AB</td>
<td>2</td>
<td>4.65</td>
<td>0.73</td>
</tr>
<tr>
<td>Within Cell</td>
<td>54</td>
<td>6.37</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** p < .01
### TABLE 8

Analysis of Variance for the Simple Effects Associated with the Number of Correct Changes

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>( F )</th>
</tr>
</thead>
<tbody>
<tr>
<td>A for ( b_1 ) (Reading level for 6-year-olds)</td>
<td>1</td>
<td>5.00</td>
<td>0.78</td>
</tr>
<tr>
<td>A for ( b_2 ) (Reading level for 9-year-olds)</td>
<td>1</td>
<td>8.45</td>
<td>1.33</td>
</tr>
<tr>
<td>A for ( b_3 ) (Reading level for 12-year-olds)</td>
<td>1</td>
<td>1.25</td>
<td>0.20</td>
</tr>
<tr>
<td>B for ( a_1 ) (Age for retarded readers)</td>
<td>2</td>
<td>51.30</td>
<td>8.05**</td>
</tr>
<tr>
<td>B for ( a_2 ) (Age for normal readers)</td>
<td>2</td>
<td>24.70</td>
<td>3.88*</td>
</tr>
<tr>
<td>Within Cell Error</td>
<td>54</td>
<td>6.37</td>
<td></td>
</tr>
</tbody>
</table>

* \( p < .05 \)

** \( p < .01 \)
TABLE 9

Analysis of Variance for the Effect of Reading Level and Age on the Leveling-Sharpening Ratio on the House Test

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (Reading Level)</td>
<td>1</td>
<td>12.10</td>
<td>0.88</td>
</tr>
<tr>
<td>B (Age)</td>
<td>2</td>
<td>160.82</td>
<td>11.73**</td>
</tr>
<tr>
<td>AB</td>
<td>2</td>
<td>5.51</td>
<td>0.40</td>
</tr>
<tr>
<td>Within Cell</td>
<td>54</td>
<td>13.71</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** P < .01
<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A for b₁ (Reading level for 6-year-olds)</td>
<td>1</td>
<td>2.49</td>
<td>0.18</td>
</tr>
<tr>
<td>A for b₂ (Reading level for 9-year-olds)</td>
<td>1</td>
<td>20.62</td>
<td>1.50</td>
</tr>
<tr>
<td>A for b₃ (Reading level for 12-year-olds)</td>
<td>1</td>
<td>0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>B for a₁ (Age for retarded readers)</td>
<td>2</td>
<td>90.47</td>
<td>6.60**</td>
</tr>
<tr>
<td>B for a₂ (Age for normal readers)</td>
<td>2</td>
<td>75.87</td>
<td>5.53**</td>
</tr>
<tr>
<td>Within Cell Error</td>
<td>54</td>
<td>13.71</td>
<td>-</td>
</tr>
</tbody>
</table>

** P < .01
They maintained more discrete memories or impressions so that elements of the stimuli did not lose their individuality.

The Embedded Figure Test

The F ratios of the effect of reading level and age on the score on the Embedded Figures Test are presented in Table 11. The poor readers scored lower (p < .05) on the EFT than did the good readers. The subjects of different ages differed significantly (p < .01) in their EFT scores. The analysis of simple effects (see Table 12 and Figure 3) indicated that the age differences were significant for both the RR Group (p < .01) and the NR Group (p < .01).

Comparison of Fruit Distraction Test and Embedded Figures Test

Pearson product-moment correlation coefficients (Table 13) were calculated for the time difference scores on the Fruit Distraction Test (high score = poor performance) and the scores on the EFT (high score = good performance). The relationship between the performance on Condition 1 of the Fruit Distraction Test and the EFT score was not significant. For Condition 2, the correlation was significant for the normal readers. This relationship was accounted for by the nine-year-old readers (r = -.81, n=10).
TABLE 11

Analysis of Variance for the Effects of Reading Level, and Age on the Scores for the Embedded Figures Test

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (Reading Level)</td>
<td>1</td>
<td>84.02</td>
<td>5.74*</td>
</tr>
<tr>
<td>B (Age)</td>
<td>2</td>
<td>620.32</td>
<td>42.35**</td>
</tr>
<tr>
<td>AB</td>
<td>2</td>
<td>4.32</td>
<td>0.29</td>
</tr>
<tr>
<td>Within Cell</td>
<td>54</td>
<td>14.65</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* P < .05
** P < .01
TABLE 12

Analysis of Variance for the Simple Effects Associated with the Embedded Figures Test

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A for b₁ (Reading level for 6-year-olds)</td>
<td>1</td>
<td>45.00</td>
<td>3.07</td>
</tr>
<tr>
<td>A for b₂ (Reading level for 9-year-olds)</td>
<td>1</td>
<td>8.45</td>
<td>0.58</td>
</tr>
<tr>
<td>A for b₃ (Reading level for 12-year-olds)</td>
<td>1</td>
<td>39.20</td>
<td>2.68</td>
</tr>
<tr>
<td>B for a₁ (Age for retarded readers)</td>
<td>2</td>
<td>322.13</td>
<td>21.99**</td>
</tr>
<tr>
<td>B for a₂ (Age for normal readers)</td>
<td>2</td>
<td>302.50</td>
<td>20.65**</td>
</tr>
<tr>
<td>Within Cell Error</td>
<td>94</td>
<td>14.65</td>
<td></td>
</tr>
</tbody>
</table>

** P < .01
Figure 3. Mean scores on the Embedded Figures Test for 6-, 9-, and 12-year-old normal and retarded readers.
TABLE 13
Correlations of the Scores on the EFT and on the Fruit Distraction Test, Condition 2, Time Difference Score, for Normal and Retarded Readers

<table>
<thead>
<tr>
<th>Embedded Figures Test</th>
<th>Normal Readers (N=30)</th>
<th>Retarded Readers (N=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit Distraction Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal Readers</td>
<td>-.25</td>
<td></td>
</tr>
<tr>
<td>Retarded Readers</td>
<td></td>
<td>-.30</td>
</tr>
<tr>
<td>Condition 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal Readers</td>
<td>-.70**</td>
<td>.28</td>
</tr>
<tr>
<td>Retarded Readers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** p < .01
The correlations between the Fruit Distraction Test scores and the EFT scores were not significant for the six-year-old or twelve-year-old normal readers. For Condition 2, there was no significant relationship between the two scores for retarded readers.

**Age and Cognitive Controls**

For the data from the NR Group, the Scheffe procedure was used to analyze the comparisons of pairs of means for each measure of the cognitive controls. The results indicated the following:

1. On the Circles Test, there were no significant differences between the means for the three age groups for any of the three illusion conditions.

2. There were no significant differences in the mean time difference scores on the Fruit Distraction Test of the three age groups for Condition 1 (intrusive information).

3. For Condition 2 (contradictory information) of the Fruit Distraction Test, the six-year-olds had significantly higher time difference scores than did the nine-year-olds ($F[2, 27] = 11.56, p < .05$) or the twelve-year-olds ($F[2, 27] = 22.9, p < .01$). The difference between the scores of the nine- and twelve-year-olds was not significant ($F[2, 27] = 1.44$).

4. For the Leveling-Sharpening House Test, there were no significant differences between the means of the three age groups on either the first stop score or the number of
correct changes perceived. For the leveling-sharpening ratio, the six-year-olds had significantly higher scores ($F(2,27) = 8.07, p < .05$) than did the twelve-year-olds. There was no significant difference between the performance of the six- and nine-year-olds or between that of the nine- and twelve-year-olds.

In summary, using the Scheffe procedure to compare the means, it was found that most of the significant differences for age appear to be due to the difference between the six-year-olds and twelve-year-olds on the Fruit Distraction Test, Condition 2, and on the leveling-sharpening ratio.

The Jonckheere procedure is appropriate for determining the presence of a hierarchical arrangement of the scores on the measures of cognitive control regardless of whether there are significant differences between the mean scores taken pair by pair. It was hypothesized that the samples came from populations which are ordered in this way: the six-year-olds perform poorest, the twelve-year-olds perform the best, and the nine-year-olds perform at an in-between level. Because of the underlying assumption of the Jonckheere test that there are no ties in the scores, this procedure was only used to analyze performance on the Fruit Distraction Test and on the leveling-sharpening ratio of the House Test. The results of the analyses using this procedure, indicated that the scores of the subjects in the
three age groups departed significantly from a random
distribution toward the hypothesized ordering for the
overall performance on the Fruit Distraction Test ($t = 4.49,$
$p < .01$), for Condition 2 (contradictory information) of
this test ($t = 4.45, p < .01$), and for the leveling-
sharpening ratio of the House Test ($t = 2.00, p < .05$).

For the other measures on the Leveling-Sharpening
House Test, a trend analysis indicated a significant
linear trend for the first stop score ($F[1,52] = 7.2, p < .01$)
and for the number of correct changes ($F[1,52] = 7.1, p < .01$).
These results indicated that the older age groups performed
better than the younger age groups on the tests of field
articulation (Fruit Distraction Test) and leveling-
sharpening (House Test) but not on the test of focal
attention (Circles Test).
CHAPTER IV

DISCUSSION

The purpose of this study was to investigate the development of three cognitive controls and one cognitive style in normal and retarded readers at three age levels while eliminating some of the methodological problems of other studies. The questions posed in the introduction are discussed in the following sections in light of previous research and of the results of this study.

Cognitive Controls

One of the principal purposes of this study was to determine if there were any differences between the RR and NR Groups on the three cognitive controls. Of the three cognitive controls studied, there were differences found for only one, field articulation. The findings suggested that the cognitive control which may be important for reading is concerned with processing information in the context of distractions, particularly in the form of contradictory information. This finding supported that of Santostefano et al. (1965). In addition, there was no interaction between age and reading level for this cognitive control. This would seem to indicate that field articulation is important for reading performance regardless of age.

The results dealing with the effect of age on the
three cognitive controls indicated that there were differences in two of the controls as a function of age. It was demonstrated that performance improved as a function of age on the tests of field articulation and leveling-sharpening. That is, with an increase in age, the children showed trends from more disruption by intrusive information to less, and from blurring present with past stimulation to differentiating sequentially-presented stimuli. These results were in line with those of Santostefano (1964) and Santostefano and Paley (1964).

In the latter study, it was suggested that there is a developmental course from scanning to focusing as age increases. The results of the present study did not support this hypothesis. The manner in which attention and concentration are deployed by an individual when dealing with a stimulus field, as measured by the Circles Test, was not found to be related to age. Santostefano (1964) suggested the possibility of a relationship between performance on the size estimation task and some factors of "intelligence". By equating for "intelligence", the present study indicated that there were no differences in performance on the size estimation task as a function of differences in mental age. The absence of differences suggested that either a) children reached a plateau with respect to focal attention prior to age six, or b) the ceiling for the test was too low and thus, the items were too easy. Considering that the six-year-olds
did quite well on the test, the latter explanation appeared
to be the more reasonable one.

To explore the question of whether younger children
as compared to older children distribute their attention
more unevenly and more unsystematically, a study involving
eye movement measurements, an approach used by Gardner
and Long (1962), is required. In any case, the results of
the present study considered in conjunction with the
above-mentioned results of Santostefano (1964) raised
some question as to the validity of the Circles Test as a
measure of focal attention.

Field-Dependence-Independence

The results of the present study supported the
hypotheses derived from Witkin's research (Witkin et al.,
1954, 1962). The cognitive style of field-dependence-
independence appeared to have some bearing on reading
performance. That is, poor readers tended to be more field-
dependent, whereas good readers tended to be more field-
independent. These results were in line with the findings of
Stuart (1967) and Wineman (1971) who partially confirmed
the hypothesis that there was a relationship between field-
dependence-independence and reading achievement. Also there
was a significant difference in the EPT score among the age
groups. With an increase in age, the children were less
field-dependent. These results were in agreement with those
which would be predicted by Witkin's differentiation hypothesis. Witkin et al. (1962) indicated that, as children grow older, they tend to become more "differentiated."

Comparison of the EFT and Fruit Distraction Test

The correlation of the scores on the tests which reflected field articulation and field-dependence-independence indicated that they were not highly correlated. Knowing an individual's score on the test of field articulation did not permit one to predict the score on the EFT with much precision. This was contrary to the findings of Smith and Klein (1953) who found that resistance to interference on the Stroop test (similar to the Fruit Distraction Test) was significantly related to level of performance on perceptual organization tasks similar to the EFT. Denmark, Havlena, and Murgatroyd (1971), however, obtained results in line with those of the present study. They found no relationship between the three Stroop measures and both the EFT and the RFT test scores for all subjects. Using only the extreme scores for the tests, however, they found a closer relationship \( r = .68, \ p < .01 \) between the Stroop test and EFT than between the Stroop test and the RFT.

It was worth noting that Smith and Klein also used subjects who had extreme scores. The closer relationship between these two measures (Stroop test and EFT) obtained using extreme scores may be reflective of the perceptual speed of
the individual. The results of the present study indicated that field articulation and field-dependence-independence were not highly correlated for three of the four groups. Thus, these appear to be two separate principles which may have common elements but which are not synonymous.

Reading Disability

The concept of "developmental lag" in relation to reading difficulties implies that there is a delay in the acquisition of particular skills important to reading achievement. If there is a "lag" in development, the child, although initially delayed in the acquisition of particular skills, would be expected to eventually "catch up" to an age-appropriate level without remedial intervention. An opposing theory is that the child will fail to "catch up" without remediation. The child is not expected to reach a stage where he is functioning at an age-appropriate level for the skills important for reading achievement without some remedial training in these skills.

Satz, Friel and Rudgeair (1974) proposed that developmental dyslexia was due to a lag in the acquisition of skills as a result of a lag in the maturation of the cerebral cortex. In a longitudinal study, they tested a dyslexic group and a control group of average-superior readers at the beginning of kindergarten and at the end of grade two on a number of developmental and neuro-
psychological measures. They found that, on some measures, the children appeared to "catch up" but, on others they did not. They concluded that the results of their study neither proved nor disproved the concept of "developmental lag."

The results of the present study indicated that both the cognitive control of field articulation and the cognitive style of field-dependence-independence were important in the reading process. The findings suggested that two cognitive mechanisms crucial for reading were concerned (a) with processing information in the context of distractions and with an individual's ability to withhold attention selectively from irrelevant and intrusive information and (b) with dissociating a part from its congruent surroundings. In other words, poor readers tended to have difficulty processing information in the context of distractions, whereas good readers tended to have less difficulty; poor readers tended to be more field-dependent, whereas good readers tended to be more field-independent. The results also indicated that the delays in acquisition of these skills persisted, although there were significant developmental gains in these skills in both the NR and RR Groups over time. The results lend little, if any, support to the hypothesis that the deficits in these skills were due to "developmental lag." On the other hand, they did not rule it out. Two types of studies would be necessary in order
to determine this with respect to the above skills:
(a) a longitudinal study involving two three-year test-
retest intervals, and (b) a study using children older
than twelve years of age.

These findings may have some educational implications.
Since these two cognitive principles are important to
reading achievement, the rehabilitation of the child
with respect to these information-processing mechanisms
should be incorporated into remedial programs for retarded
readers. The next step would be the development of training
procedures that would facilitate the development of field
articulation and field-independence. Children who have
difficulty processing information in the context of
distractions could be placed in a learning situation that
would begin with learning a simple task with no distrac-
tions. Then distractions would be added gradually. In this
way, the child may be able to reach a level where he could
handle the increasing stimulation before he was presented
with additional distractions or before the task is made more
complex. With respect to the development of field-independence,
a number of test have been developed which involve the
location of a simple figure embedded in a complex figure.
Frostig designed a program for the development of visual
perception which included a subtest aimed at the develop-
ment of field-independence (Frostig and Horne, 1964).
Although the results of some preliminary projects (Maslow,
Frostig, Lefever, and Wittlesky, 1964) were encouraging, some recent research provided little support for the use of the Frostig program to improve the reading skills of children considered to possess a visual-motor problem (Rosen, 1966; Anderson and Stern, 1972). These authors indicated that the Frostig Program for the Development of Visual Perception appeared to merit further attention and study. Since the results of the present study supported Frostig's theory that the ability to find a simple figure embedded in a more complex figure was important to reading, further research should be conducted to design a training program that would improve both the child's ability to locate an embedded figure and his reading skills. The training program could be made quite meaningful and interesting for the child if, in addition to locating simple geometric figures, the child was asked to locate familiar household objects and animals. The background could be made more complex in order to increase the difficulty of the task. To some extent, this type of test could be used to train the child to be more field articulate. Research into the feasibility of training children in these two skills and into the transfer effect to reading is needed before remedial programs can be established.

Also, identification of an individual's information-processing mechanisms before reading instruction is initiated might prove useful. Kindergarten and primary grade teachers
could include measures in field articulation and field-
independence in their regular classroom curriculum, both
as a training procedure and as a means of early-detection
of potential poor readers.

Implications for Future Research

In the present study, an attempt was made to
investigate three cognitive controls and one cognitive
style of normal and retarded male readers at three age
levels. The retarded readers were defined as children of
average intelligence (90-115) having a centile score of
25 or below on the Reading subtest of the MAT and 35 or
below on the Word Knowledge subtest of the MAT. Thus, the
results of this study can only be generalized to this type
of retarded readers. In order to generalize to all
retarded readers, future research should investigate
various other kinds of reading disabled children. It may be
that different information-processing mechanisms are
crucial in different types of reading difficulties. If
recommendations are to be made with respect to remedial
reading programs, it is necessary to answer this question.

Santostefano and his associates (1964a, 1964b, 1964c,
1965, 1969) suggested that the development of cognitive
controls was related to particular life experiences. This
relationship should be investigated in order to determine
the role life experiences and personality development have
in the development of a reading disability.

In addition, in the interest of the establishment of remedial programs, a longitudinal study should be conducted to investigate the following: (a) the stability of these information-processing mechanisms; and, (b) the differential effects of training in the cognitive controls and field-independence for retarded readers.

Two final areas requiring investigation are those noted during the discussion: (a) the development of an adequate test for the measurement of the cognitive control of focal attention; and, (b) the contribution of perceptual speed of the individual to his performance on tests of field articulation and field-dependence-independence.
CHAPTER V

SUMMARY

The purpose of the present study was to investigate the development of three cognitive controls and one cognitive style in normal and reading disabled children.

Two hundred and twenty-five children were tested with the Reading and Word Knowledge subtests of the Metropolitan Achievement Test to obtain 60 subjects: 30 of whom were classified as retarded readers and 30 as normal readers. The 30 subjects in each group were chosen such that 10 from each group were 6-7, 9-10 and 12-13 years old. All Ss were given a short form of the WISC to assure that their estimated Full Scale Intelligence Quotient (FSIQ) score fell roughly within the normal FSIQ range (90-115). Each S was presented with four tests: three devised by Santostefano (1969) to measure the cognitive controls of focal attention, field articulation and leveling-sharpening and an Embedded Figures Test developed by Benton and Spreen (1969) to measure field-dependence-independence.

Performance improved as a function of age on tests of field articulation, leveling-sharpening and field-dependence-independence. That is, with an increase in age, the children showed trends from more disruption by intrusive information to less, from blurring present with past stimulation to differentiating sequentially-presented
stimuli and from being field-dependent to being more field-independent.

No age-group differences were found for the test of focal attention. These results raised some question regarding the validity of the Circles Test as a measure of focal attention. A re-evaluation of the test and the difficulty of the items was suggested.

One of the principal purposes of this study was to determine if there were any differences between the RR and NR Groups on the three cognitive controls and one cognitive style (field-dependence-independence). Of the three cognitive controls studied, there were differences found for only one, field articulation, the ability to process information in the context of distractions. The results indicated that field articulation was important for reading performance regardless of age. Field-dependence-independence also appeared to have some relationship to reading achievement. That is, poor readers tended to be more field-dependent, whereas good readers tended to be more field-independent. A correlation of the scores that the Ss obtained on the tests measuring field articulation and field-dependence-independence indicated that they were not highly correlated. Thus, these appeared to be two separate cognitive principles which may have common elements but which are not synonymous and which are both important in reading achievement. The findings were discussed with respect to their implications.
for educational remediation and the need for further research in order to establish training procedures which foster improvement in these two cognitive principles and which have a transfer effect on reading achievement.
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