DOCUMENT RESUME

ED 063 042 PS 005 677

AUTHOR Keogh, Barbara K.
TITLE Spatial Organization of Young Children.
INSTITUTION California Univ., Los Angeles. Center for Head Start Evaluation and Research.
SPONS AGENCY Office of Economic Opportunity, Washington, D.C.
PUB DATE Dec 70
NOTE 47p.

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS *Age Differences; Child Development; Lateral Dominance; Nursery Schools; Pattern Recognition; *Perceptual Development; *Preschocl Children; Problem Solving; Research; *Sex Differences; *Spatial Relationship; Task Performance; Testing
IDENTIFIERS Draw A Person Test; Pattern Drawing Test; Pattern Walking Test

ABSTRACT

This study was designed to consider effects of age, sex, intelligence, lateral usage, and lateral awareness on young children's performance of spatial organization tasks. The sample consisted of 79 Caucasian, middle socioeconomic status nursery school children (mean C.A. 57.80, S.D. 4.47 months), 44 boys and 35 girls. Spatial organization was operationally defined as ability to copy patterns by drawing and walking in an expended spatial field and to identify by verbal response the correct spatial position of objects in relation to each other and to self. No association of lateral awareness or lateral usage measures and the spatial organization tasks was identified. A clear sex difference favoring boys was found in pattern copying in an expanded spatial field. Boys had significantly higher objective scores in pattern walking than did girls; they also appeared markedly more task oriented. Findings were consistent with the field dependence-independence construct, and suggest that sex differences in styles of field organization are identifiable by the late preschool age period. Differences in task orientation, cue selection, and cue organization may well be keys to understanding children's strategies of problem solving; these warrant further study. (Author)

F-OE0
PS

SPATIAL ORGANIZATION OF YOUNG CHILDREN[1]

by

Barbara K. Keogh

University of California, Los Angeles

December, 1970

[1]The work reported herein was carried out at the Early Childhood Research Center, Dr. Carolyn Stern, Director. This Center is funded by Grant CG 9938 from the Office of Economic Opportunity.

Spatial Organization of Young Children

Barbara K. Keogh

University of California, Los Angeles

Abstract

This study was designed to consider effects of age, sex, intelligence, lateral usage, and lateral awareness on young children's performance of spatial organization tasks. The sample consisted of 79 Caucasian, middle socioeconomic status nursery school children (mean C.A. 57.80, S.D. 4.47 months), 44 boys and 35 girls. Spatial organization was operationally defined as ability to copy patterns by drawing and walking in an expanded spatial field and to identify by verbal response the correct spatial position of objects in relation to each other and to self. No association of lateral awareness or lateral usage measures and the spatial organization tasks was identified. A clear sex difference favoring boys was found in pattern copying in an expanded spatial field. Boys had significantly higher objective scores in pattern walking than did girls; they also appeared markedly more task oriented. Findings were consistent with the field dependence-independence construct, and suggest that sex differences in styles of field organization are identifiable by the late preschool age period. Differences in task orientation, cue selection, and cue organization may well be keys to understanding children's strategies of problem solving; these warrant further study.

Spatial Organization of Young Children[1]

Barbara K. Keogh

University of California, Los Angeles

Visuo-motor organization has been shown to be a rapidly accelerating developmental function during the preschool years. Such development is marked by change in consistency and coordination of fine and gross movement, including organization of motor action in three-dimensional space. Dramatic improvement in visual-spatial organization of movement may be observed during the middle preschool years; comparison of two-year-old and four-year-old children's efforts to seat themselves on a small chair or to copy simple designs are cases in point. Controlled voluntary action requires motoric coordination under some perceptual organization or system, in most cases visual organization (Birch & Lefford, 1967; Howard & Templeton, 1966). It seems likely that organization of visuo-motor functions underlies more complex educational and behavioral tasks. In this regard, it is of interest to note that delay and/or disturbance of visuo-motor organization have been associated with learning and developmental problems of atypical children (DeHirsch, 1957; DeHirsch, Jansky, & Langford, 1966; Kephart, 1960).

Recognition of the importance of visual-spatial organization has led to an increasing number of theoretical formulations and empirical research by investigators from various disciplines. Visual acuity and visual discrimination skills of infants have been clearly documented (Fantz, 1961). Interaction of visual-perceptual and motor functions have been demonstrated with human infants by White (1965, 1967) in studies of the effects of enriched visual stimulation upon infants' coordinated reach and grasp. Kagan (1969) has demonstrated marked individual differences in young children's visual sampling, a function he has hypothesized builds into later more complex behaviors. Wedell (1970) has described a scheme of perceptuo-motor organization which includes not only sensory and motor systems but also an interactive sensory-motor feedback system. Of particular interest for the present study is the inclusion in Wedell's system of "awareness of spatial coordinates" under motor organization; he apparently refers to what might be called body awareness or body schema, and considers this an aspect of motor organization.

It is clear that the process of development of sound visuo-motor organization is a complex one. The pervasive nature of visuo-motor functioning, and its importance in an exceedingly wide range of performances, has resulted in research efforts which range from the search for neural and neurophysiological mechanisms underlying visuo-motor functions (Friedman, 1968; Howard & Templeton, 1966) to descriptions of performance of normal and atypical children on standardized tests which presumably tap visuomotor and spatial abilities (Bender, 1938; Frostig, 1961; Wedell, 1968).

The work of Piaget (Piaget & Inhelder, 1956) has been proposed as a possible theoretical framework for analysis and understanding of development of visual-spatial organization. According to these authors, ability to deal mentally or abstractly with spatial information or to deal with higher order tasks requiring spatial directional understanding demands a highly complex system of three-dimensional spatial coordinates. Developmental stages ranging from topographic to Euclidean organization have been described. Piaget & Inhelder (1956) make clear their belief that motor activity, including manual manipulation of objects in space, provides critical input in the development of a system of conceptualization of representational space. Emphasis upon sensorimotor data as a basis for the conceptualization of space is partially challenged by the findings of Luria and his colleagues (Luria, 1961) who stress the importance of language in this regard. Other investigators (Delacato, M.B.,1963; Kephart, 1960) have focused upon the development of consistent lateral preference and usage as a fundamental to visuospatial organization.

In recent work Kershner (1970) attempted to determine the relative effects of movement, language, and laterality on children's ability in a spatial task. He interpreted his findings to suggest that neither of the experimental manipulations derived from the two theoretical positions, i.e., active motor participation or verbal knowledge of directional coordinates, contributed significantly to ability to solve a task requiring understanding of spatial relations. According to Kershner, "The essential element entering into a cognitive structure capable of representing conceptual space seems to be mixed intermodal laterality rather than consistent intermodal laterality, and the child's representation strategy can be classified as iconic in nature." (1970, p. 33)

Kershner's findings are of interest in that the role and function of lateral awareness and lateral preference in motor organization and in higher order learning are equivocal (Hecaen & Ajuriaguerra, 1964). Lateral preference has been used as an indicator of cerebral dominance (Mountcastle, 1962), and disturbances in lateral functions have been included as signs of neural impairment in children with developmental problems, particularly in learning disability cases (Benton, 1959; Clements & Peters, 1962; Silver & Hagin, 1960). Differences in proportions of fully lateralized subjects in normal and atypical populations have been cited in support of the hemispheric dominance theory (Hecaen & Ajuriaguerra, 1964). Recent work by Forness (1968), however, raises questions as to the direct relationship of neural dysfunction and lateral preference. Findings are, to say the least, inconsistent and confusing. Even studies of the development of lateral preference and awareness contain somewhat conflicting findings (Belmont & Birch, 1963; Gesell & Ames, 1946, 1947; Hecaen & Ajuriaguerra, 1969).

A useful distinction between lateral awareness and lateral preference has been made by Belmont & Birch (1963) based on normal white children ages 5-12. These investigators found that there were age-specific characteristics relating to lateral preference and to right-left discrimination or awareness. Most important was the finding that "....appearance of right-left discrimination on own body parts at an earlier age than the clear-cut establishment of handedness suggests that these two functions are independent" (p.270). Independence of awareness and usage obviously raises questions as to the significance of consistent lateral function as a prerequisite for or determiner of visual-spatial organization. Belmont & Birch's findings are somewhat inconsistent with those reported by Benton & Kemble (1960) who proposed a left-right usage gradient as underlying the development of left-right awareness. These latter investigators, in a study of normal and disordered readers, concluded that a left-right gradient is essential for consistent discrimination of lateral body parts, and that symbolic representation of lateral parts follows consistent discrimination according to use.

In short, evidence relevant to questions of the role and function of motor input, lateral preference and usage, and lateral awareness in the development of coordinated systems of visual-spatial organization is unclear. These questions may have intrinsic interest for investigators of child development, but have more practical or applied interest for those concerned with accomplishment or mastery of higher order educational tasks by school children. Study of these variables is of little value unless findings may be useful in modifying teaching strategies or instructional conditions that might improve learning. Tentative implications of other aspects of field organization for school learning have been proposed by Witkin (1965) and Messick (1969). Relationships between field independence-dependence and reading success have been demonstrated by Gill, Herdtner, & Lough (1968), and Watson (1969).

Examination of school children with serious learning problems, especially in reading, has frequently implicated visual-spatial functions (Bryan, 1964; Frostig et al, 1961; Kephart, 1960). Field dependence was shown to be characteristic of boys with severe learning problems (Keogh & Donlon, 1970). Characteristics described are correlates, however, and the functional nature of the interaction between spatial-perceptual organization and school learning is unclear. Careful review of the literature relating motor (Leydorf, 1970), perceptual (Wedell, 1970), cognitive (Faust, 1970), and affective (Call, 1970) characteristics of children at preschool ages with later school learning allows only cautious optimism about the utility of such predictive data. It seems likely that some of the confusion in the findings has to do with the nature of the variables under consideration, while other variance is a function of the kind of measurement instruments used. Age and sex of subjects studied may also influence findings. Visual-spatial organization may well be an important contribution to higher order learning and behavior, but at present the exact nature of the contribution is unclear.

Studies with traditional visuo-motor instruments and tests (e.g. Bender, 1938) have been conducted for the most part with older children or adults. Further, visuo-motor components of spatial organization have been evaluated with copying and drawing tests which require the child to reproduce a symbol of relatively small size within a limited spatial field. Normative studies have described kind and sequence of performance (Gesell & Ames, 1946, 1947; Vernon, 1960), and relationships with age, intelligence, and varying conditions of disturbance or delay in development have been demonstrated (Bender, 1938; Frostig, et al., 1961; Kephart, 1960). Findings suggest a developmental sequence of spatial organization, and support the importance of visual and motor components in this development (Piaget & Inhelder, 1956). However, space and size restrictions of stimulus and copy, and the relatively fixed body position of the copier, may affect characteristics of performance. Markedly differenct aspects of visuo-motor performance of children are elicited under conditions of pattern reproduction in an expanded spatial field (Keogh & Keogh, 1967, 1968; Keogh, 1969, 1970).

Reproduction of geometric figures by walking requires the subject to make gross motor representation of what is perceived. To reproduce a pattern by walking, a child must transpose the small, two-dimensional stimulus figure into a larger, three-dimensional spatial field; must define reference points within that field; and must adjust these reference points to the changing position of his own body as he moves through the sequence of design parts. Under the direction of this investigator, a series of studies has provided basic procedures and a reliable scoring system (Keogh, 1969) and have demonstrated marked individual differences in quality and style of pattern walking (Keogh & Keogh, 1967; 1968; Keogh, 1969, 1970). Steady improvement in pattern walking was observed for boys ages six through nine. Whereas most normal boys could walk accurate copies of the patterns by age eight, educable mentally retarded (EMR) boys evidenced striking disturbance of visuo-motor organization under conditions of an expanded spatial field (Keogh & Keogh, 1967; Keogh, 1969). In a later study, Keogh (1970) showed that for boys pattern walking varied as a function of the number of cues in the field: normal boys improved as the number of cues increased.

In contrast, girls' performance on the pattern walking task was found to be relatively independent of the number of cues in the field: girls performance did not improve as more cues were available. In terms of pattern drawing (paper and pencil) girls were better than boys; in terms of pattern walking, boys were better than girls. Sex differences were greatest when patterns were walked under conditions of increased number of visual cues (Keogh, 1970). In addition to differences in pattern walking performance of boys and girls which were reflected in objective scores, marked differences in styles of pattern reproduction were elicited. Distributions of scores obviously overlapped, as a few boys were poor walkers and a few girls good walkers. In general, however, boys tended to walk with a good deal of confidence; angles were made precisely with accurate starting and stopping points. Boys gave the subjective impression of knowing where they were in terms of the pattern and the space; they appeared to make the complex patterns in subunits or parts, completing one subsection before beginning another.

Girls, on the other hand, seemed less sure, more hesitant and considerably less precise when walking the patterns. Angles were rounded, starting and stopping points were not coordinated,and patterns were left unclosed or unfinished. Girls seemed to walk the patterns in one continuous line, as if the figure were perceived, and thus reproduced, in a global manner. Girls seemed considerably more investigator-oriented than did boys; they appeared to rely on the investigator to indicate when the pattern was complete, or the task finished.

These findings are consistent with other studies which report sex differences in spatial organization favoring boys (Howard & Templeton, 1966; Mellone, 1944; Lord, 1941). Other possible explanations include motivational and attitudinal differences. Sex differences in task orientation, sensitivity to adults, reactions to social reinforcement, and the like have been summarized by Maccoby (1966). Any of these factors might influence performance in pattern copying. The task was unique for all subjects, but because of its major motor component it may have been less familiar to girls than to boys. Girls may have been less comfortable in a situation which required gross motor response, while boys may have had more experience in motor activities.

The investigators were struck by the subjective differences in task attention, awareness of investigators, and the like. Motivation and attitudinal differences might contribute to the observed sex differences on this task but do not explain all findings, as there were no differences in performance between boys and girls in the most simple walking condition.

Sex differences in pattern walking, however, may reflect differences in strategies of organization of space. Because all children walked well, differences in pattern walking competence appeared to be more closely related to styles of perceptual organization than to motor components. Witkin, Byk, Paterson, Goodenough & Karp (1962) have presented extensive evidence that girls are more global than analytic in perceptual style, and that a sex difference in field organization is observable by age 10. Whereas global perception may be an adequate strategy for the organization of stimuli within a limited spatial field, an analytic perceptual style may be more effective than a global style for structuring three-dimensional space. Witkin et al. (1962) have conceptualized differences in perceptual style under a field dependence-independence construct. This investigator (Keogh, 1970; Keogh & Roth, 1970) has related pattern walking to Witkin's tasks which require abstraction and organization of parts from an embedding field. Pattern walking may well be a correlate of field dependence-independence as measured by these tasks. Current research investigates the relationship of performance on several field organization tasks to school learning, and attempts to identify aspects of spatial organization of importance in the etiology of learning disorders.

In summary, considerable evidence documents the importance of consistant perceptual-spatial organization as an underlying dimension in higher order learning and behavior. Differences in perceptual organization with age, intelligence, and sex have been noted, but the contribution of motoric experience, language, or lateral effects to the development of spatial organization are unclear. The investigation of development and functioning of spatial organization has been approached from a variety of viewpoints and with a variety of methods. On a behavioral level little work has been done with younger children, or with tasks which could be utilized by school personnel and which may have application in the school setting. Early identification of individual differences in styles or strategies of learning may allow implementation of appropriate teaching and instructional methods, and thus prevent, or at least minimize, learning problems. Spatial perceptual organization appears to be a dimension of individual differences important in this regard.

Purpose

This study was designed to investigate certain aspects of young children's perceptual spatial organization. In specific, it was concerned with preschool children's ability to copy two dimensional patterns by drawing and walking under restricted and expanded spatial fields. It assessed strength of relationship among measures of spatial organization, lateral preference, lateral awareness, and a global measure of body awareness. It extended the age range of normative data for the pattern reproduction tasks to include four and five year old children, thus allowing a consideration of these measures of spatial perceptual organization within a developmental frame of reference. Finally, it attempted to determine the effects of age, sex, intelligence, lateral usage and awareness on young children's performance of spatial organization tasks.

Method

Sample

Two preschools in a suburb adjacent to Los Angeles cooperated in this study and provided the basic sample. School A is a private, full day preschool which accepts children ranging in chronological age from 3 to 7 years, with a few children coming after regular elementary school for extended day care. This is a fee school and children represent middle to upper middle socioeconomic status (SES) homes. Children were white, English speaking, and for the most part from intact homes. The Director of the school estimated the parent occupational level as predominantly business and professional or semi-professional with the majority of children coming from homes where one or both parents had some college education. Atmosphere in the school was supportive and relatively unstructured. A wide variety of experiences and media were provided in what might be characterized as an enrichment program.

School B is a small parent cooperative preschool which draws from a predominantly middle (SES) population. The parent population appeared to be slightly younger than in School A, and overall the SES level was not as high, although almost without exception children were from white, English speaking, middle SES, intact families. Many parents were beginning professional careers or were in final stages of professional training. Atmosphere in the school was permissive and supportive. The program focus was also one of enrichment.

All children in both schools who were between the ages of 48 months and 71 months and who were in school on the days of testing were included in the sample. Only one boy and two girls, both four-year old children in School A, refused to participate. For the most part, therefore, the samples represent all children within the proper age range enrolled in these schools; within this age range the sample was non-selective. Means and standard deviations by total sample and subsamples are summarized in Table 1. No differences in chronological age of subsample groups were significant.

Procedure

All data were collected during regular school hours by the investigator and three graduate student assistants. The research team spent at least one day in each school before beginning the formal test program; during this pretest period team members became acquainted with pupils and teachers and interacted informally in the school setting. In the opinion of this investigator, cooperation of both pupils and teachers was exceptionally good. Data collection took six days in school A and three days in school B.

Children were tested individually in large private rooms in the two preschools. Two investigators worked at opposite ends of the room simultaneously, but each child was seated so that the other child could not be observed. All children in both samples received the Lateral

Preference, Lateral Awareness, and Spatial Position Inventories, Pattern Drawing, and Draw-A-Person (DAP) tests. Children in Sample A also took the Pattern Walking test. Tests were administered in the order described and, with the exception of Pattern Walking, all testing was done in one session. Test sessions ranged from 20-30 minutes per child. Great care was taken with each child to ensure that he understood the directions and that he felt comfortable in the situation. Means and standard deviations for chronological age and scores on the Draw-A-Person (DAP) test are summarized in Table 1. No differences on either of these measures were significant across the subsample groups.

Table 1

Means and Standard Deviations for Chronological Age and Scores on Draw-a-Person Test by School and Sex

Subsample			Chronological Age			Draw-a-Person		
School	Sex	N	Mean	S.D.	t	Mean	S.D.	t
A	Boys	27	58.7	4.1	1.13	92.8	15.3	0.85
	Girls	18	57.4	15.3		96.6	14.8	
B	Boys	14	58.5	4.7	1.11	89.9	13.2	1.05
	Girls	15	56.5	4.6		95.1	12.3	
Total		74	57.9	4.5		94.5	15.2	

Birthdate information was not available for four boys and two girls in Sample A.

Lateral Preference and Lateral Awareness

A copy of the Lateral Awareness and Preference Inventory is attached. Items were taken from the Lateral Awareness Inventory used by Piaget (1956) and the Lateral Preference measures used by Birch & Belmont (1963). It should be noted that lateral preference was tested in a variety of ways, and that functioning of hand, eye, and foot was tested at least twice. If there were questions of preferred usage, items were repeated at the discretion of the investigator. Preference and awareness items were scored at the time of testing. For lateral usage or preference, each item was scored right or left; for lateral awareness each item was scored correct or incorrect.

Pattern Drawing.

Upon completion of the laterality measures, the child was given a sharpened pencil with erasure and a booklet containing 11 8 1/2 x 11" blank white pages. He was then shown, one at a time, 10 geometric figures, and asked to draw or copy each picture, one design per page. The second drawing was not shown until the child had completed the first. Geometric designs were presented on 8" x 8" white cards, designs printed in black. Designs, in order of presentation, are shown in Figure 1.

Figure 1 about here

The last five designs are combinations of the first four simple designs. Designs were scored by the principal investigator at a later time; scores ranged from "one", not recognizable scribbling, to "four", accurate copy. The circle was used as a practice design and not scored. Children could make the designs in any way. While the child drew, the investigator sat at his side and recorded the manner in which the design was drawn, including the number and direction of strokes to complete a design, erasures, and the like. Any comments or unusual behavior were also noted. Thus, the child's drawing provides an objective measure of copying ability, and the investigator's record provides a record of process or the manner in which the drawing was accomplished.

Draw-a-Person.

Upon completion of the pattern drawing, each child was asked to draw a picture of a person on the last page of his booklet. He was told he could draw a man or a woman, a "daddy or a mother", and to "make the best picture" he could. If a child drew only a face, he was asked to make the whole person. Children were encouraged to draw complete figures, but given no specific directions or help as to what to draw. Drawings were scored by one of the graduate student members of the research team using the Harris Revised Scale (Harris, 1963). Scorer reliability was tested by random selection of 25 protocols which were scored by an experienced scorer. Inter-rater reliability was .98.

Pattern Walking.

These data were collected for School A children only, as the space restriction of School B did not allow use of this measure. After a rest, and in some cases the following day, each School A subject was seen again individually and asked to make the patterns by walking. Designs were presented singly in the same order as drawn. Subjects walked the patterns under one of three conditions:

Walking Method A (Floor). Subjects were tested in the room in which the other measures were taken. The floor was unmarked; no reference points on floor or walls, starting or stopping points, nor restrictions on space to be used were indicated. The child was asked to pretend that the floor was a large piece of paper and that he had sticky paint on the bottom of his shoes; thus everywhere he walked he would leave a mark, so he could make a picture by walking. Designs were held so the child could see them at all times as he walked. The circle was used as a practice design. Great care was taken to ensure that the child understood the task; if he appeared confused, the task was reexplained, and he was allowed to do the circle another time. All subjects walked the circle successfully. Reproduction of the design was recorded by a second investigator while the child walked.

Walking Method B (Mat). The same instructions and procedures were followed as in Method A, except the patterns were walked on a 9' x 9' plain linoleum mat which the child was asked to pretend was a large piece of paper. Reference points were not identified and the child could start the pattern from any point on the mat.

Walking Method C (Sand). Similar procedures were followed as in Methods A and B except that patterns were walked on a 9' x 9' sand box. The sand box was set in the preschool play yard; the sand was raked smooth after each trial so that footprints were visible when the child walked. No other children were in the yard while testing occurred.

Walked patterns were scored one to four, "one" representing an extremely poor, unrecognizable copy, "four" an accurate copy. Walked patterns were scored by the principle investigator at the time of walking according to characteristics of the walked copy, not the style of walking. Three scores were obtained: a subtotal of simple designs

(1-4), a subtotal of complex designs (5-9), and a total of all nine designs. The practice design (circle) was not scored.

Results

Data were organized first to describe performance of four and five year old children on the various copying, drawing, and laterality measures; to consider possible differences in performance between boys and girls; and to determine strength of relationship, if any, among the various pattern copying measures.

Pattern Drawing Results.

Results of analyses of drawing scores by sex for both samples are found in Table 2. For School A, all differences favored boys, with

Table 2

Means and Standard Deviations for Scores on Pattern Drawing Test by School and Sex

Subsample			Simple Patterns			Complex Patterns			Total Score		
School	Sex	N	Mean	S.D.	t	Mean	S.D.	t	Mean	S.D.	t
A	Boys	30	8.7	2.1	2.49*	10.1	1.7	1.44	18.8	3.5	2.18*
A	Girls	20	7.3	2.0		9.4	1.8		16.6	3.4	
B	Boys	14	7.9	2.4	0.23	9.9	1.8	0.30	17.9	3.9	0.29
B	Girls	15	8.1	2.1		10.1	1.6		18.3	3.3	
Total		79	8.1	2.2		9.9	1.7		17.9	3.6	

*p <.05

19

differences reaching statistical significance for the simple and total drawing scores. For School B, slight differences favored girls, but none was large enough to reach statistical significance. Comparisons of the two samples within sex yielded no differences of significance; direction of differences favored boys in School A over those in School B, whereas the opposite was true for girls in the two samples. Differences in drawing scores between samples, however, were nonsignificant. Scores obtained by the two groups were therefore combined for statistical analysis where possible.

Pattern Walking Results.

Pattern drawing was conducted for all subjects under standard conditions. Pattern walking, on the other hand, was conducted under three different conditions: floor, mat, and sand. Pattern walking scores according to condition and sex are found in Table 3. Analyses are based on School A subjects. For girls, no differences between

Table 3

Means and Standard Deviations on Pattern Walking Test By Sex and Condition for School A

			Simple Patterns		Complex Patterns		Total Test	
Condition	Sex	N	Mean	S.D.	Mean	S.D.	Mean	S.D.
Floor	Boys	8	7.8	1.6	9.5	1.5	17.3	3.1
	Girls	7	7.1	0.4	8.4	1.2	15.6	1.4
Mat	Boys	10	8.2	1.8	9.1	1.8	17.3	3.6
	Girls	5	7.0	2.1	7.8	1.7	14.8	3.7
Sand	Boys	12	8.9	1.8	9.9	1.3	18.8	2.9
	Girls	8	7.0	0.9	8.3	1.1	15.2	1.6
Total Sample	Boys	30	8.8	1.8	9.6	1.6	18.0	3.3
	Girls	20	7.1	1.8	8.2	1.3	15.3	2.3

groups by conditions were found to be significant. Consistent with earlier findings with primary grade children (Keogh, 1970), performance of girls did not vary according to walking condition. In the present study, the number of girls in each group was small, however, and while results are consistent, they must be interpreted cautiously. Examination of mean values in Table 3 reveals that for girls, there was no pattern or order to walking scores in terms of walking condition.

Direction of change for boys' walked scores was in the predicted direction, but differences across conditions did not reach statistical significance. Means and standard deviations are found in Table 3. In earlier work Keogh (1970) demonstrated clear improvement in boys' walking scores as a function of walking condition (floor, mat, sand). Findings for the preschool group are suggestive only. The walking task was, apparently, difficult enough for four and five year old children so as to have masked a possible differential effect of condition on performance.

Pattern Drawing - Pattern Walking Comparisons.

Comparisons of within sex group differences in pattern walking and pattern drawing were made with correlated _t_ tests. Analyses were limited to School A children for whom both drawing and walking scores were available. Mean values for within group comparisons may be found in the rows of Table 4. In all comparisons, drawing scores were better than walking scores. However, only two comparisons were significant: girls' scores on complex and total drawing and walking. Values of _t_ were 3.52 ($df = 19$, $p < .01$), and 2.19, ($p < .05$) respectively.

Table 4

Comparison of Means and Standard Deviations for Scores on Pattern Drawing and Pattern Walking (School A only)

		Pattern Drawing			Pattern Walking		
		Simple	Complex	Total	Simple	Complex	Total
Boys (N=30)	M	8.7	10.1	18.8	8.4	9.6	18.0
	S.D.	2.1	1.7	3.5	1.8	1 6	3.3
Girls (N=20)	M	7.3	9.4	16.6	7.1	8.2	15.3
	S.D.	2.0	1.8	3.4	1.8	1.3	2.3
t-test		2.49*	1.43	2.18*	2.89**	3.20**	3.20**

*p <.05 **p <.01

Analyses of drawing-walking differences according to walking method were consistent with analyses of the combined group by sex and thus, are not reported separately.

Boy-Girl Comparisons.

When walking scores from the various walking method subgroups were combined, and scores of boys and girls compared, $\underline{t}$ values were significant for all three comparisons. Findings for pattern drawing and pattern walking according to sex are summarized in Table 4. Drawing differences favored boys, two of three scores reaching significance; all walking differences were significant, favoring boys. Boys had higher scores than girls on the simple walked patterns ($\underline{t}$ = 2.89, $\underline{df}$ = 48,-3 + -2 $p < .01$), on the complex patterns ($\underline{t}$ = 3.20, $\underline{df}$ = 49, $p < .01$), and on the total pattern walking score ($\underline{t}$ = 3.20, $\underline{df}$ = 45, $p < .01$). Mean values of scores according to condition, reported in Table 3, revealed a consistent pattern of higher scores for boys than for girls. Differences were largest for scores on the sand condition, smallest for scores on the floor condition.

Relationships among measures.

Strength of relationship among measures was assessed with product-moment coefficients of correlation. Findings for Schools A and B are summarized in Table 5.

Table 5

Correlation Matrix for Major Variables
by School and Sex

	Chronological Age				Pattern Walking				Draw-a-Person			
	Boys		Girls		Boys		Girls		Boys		Girls	
School	A	B	A	B	A	B	A	B	A	B	A	B
N	27	14	18	15	30	14	20	15	27	14	18	15
Pattern Drawing	.40*	.80**	.44*	.50*	.46**	—	.62**		.50**	.49	.16	.05
Draw-A-Person	.05	.12	.05	.48	.46**	—	.25					
Pattern Walking	.76**	—	.10	—								

*p <.05 **p <.01

Because pattern copying scores differed for boys and girls, Pearson correlation coefficients were computed separately by sex groups.

Examination of the results of the correlational analysis demonstrates clearly that the pattern of relationship among variables differed for boys and for girls. For girls, DAP score, presumably a measure of general intellectual level (Harris, 1963) was unrelated to pattern copying, for either walking or drawing. For boys, on the other hand, DAP scores were significantly related to both pattern drawing and pattern walking scores. Because of the extremely limited range, relationships between age and DAP were not significant. C.A. was, however, consistently and significantly related to pattern drawing scores for both boys and girls and to pattern walking scores for boys. Thus, for boys, both age and a presumed general intellectual ability (DAP), although unrelated to each other, related to pattern copying performance. For girls, only age was associated with pattern copying.

Lateral Usage Preference

Results of the lateral preference observations are summarized in Table 6.

Table 6

Number and Percent of Boys and Girls with Consistent Right, Consistent Left, or Mixed Hand, Foot, and Eye Preference

		Boys (N=44)			Girls (N=35)			Total (N=79)		
		Hand	Foot	Eye	Hand	Foot	Eye	Hand	Foot	Eye
Right	N	35	38	26	27	33	21	62	71	47
Consistent	%	80	86	59	77	94	60	78	90	60
Left	N	0	5	18	3	2	13	3	7	31
Consistent	%	0	11	41	09	06	37	04	09	39
Mixed	N	9	1	0	5	0	1	14	1	1
	%	20	03	00	14	00	03	18	1	1

Examination of these data shows clearly that whereas the majority of children in the sample demonstrated consistent use of the right hand and right foot, almost one-half of the children preferred the left eye for sighting. This proportion is generally consistent with figures reported by Fine (1938) and Hecean (1964). It should be noted that each lateral usage measure was taken twice, a few children using both right and left with no determinable preference. Numbers of boys and girls who were consistently right, consistently left, or who exhibited mixed preference for hand, foot, or eye use are reported. Data summarized in Table 6 refer only to consistency of lateral preference within each modality.

Further analyses of the pattern of lateral usage when the three modalities were combined revealed that 22 (50%) of the boys were consistent in hand-foot-eye preference; that is, they preferred the same side, right or left, for all three modalities. The other one-half of the sample of boys had some pattern of right-left combinations of hand, foot, and eye usage. Comparable numbers and percentages for girls were 21 (60%) consistent in hand-foot-eye usage; 14 (40%) were inconsistent or mixed in hand-foot-eye usage.

When pattern copying scores of boys who demonstrated consistent laterality (all right or all left hand, foot, and eye preference) were compared with boys who had mixed lateral preference, no differences of significance were found. Results are summarized in Table 7. Comparable analyses of girls scores yielded similar results. So far as the present data were concerned, there were no differences of significance on pattern copying scores between groups of children who were consistent or mixed in preferred lateral usage.

Table 7

Means and Standard Deviations for CA, DAP, Pattern Drawing, and Pattern Walking Scores according to Consistent or Mixed Lateral Preference by Sex

	Consistent H-F-E						Mixed H-F-E					
	Boys			Girls			Boys			Girls		
	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.
CA	21	58.7	4.4	21	56.7	3.9	21	58.6	4.3	12	57.5	5.2
DAP	21	90.4	14.3	21	98.1	14.2	21	95.4	16.0	12	93.9	15.6
PD	22	18.0	3.5	21	16.9	3.4	22	18.8	3.7	14	18.0	3.5
PW	14	18.0	3.6	12	15.2	2.5	16	17.9	3.0	8	15.4	1.7

Comparisons of boys and girls, however, demonstrated that boys were significantly better pattern walkers than were girls, regardless of whether the comparisons were made within consistent or mixed lateral usage groups. Values of _t_ for boy-girls comparisons were 2.19 (df = 24, $p < .05$) for the lateral consistent group and 2.16 (df = 22, $p < .05$) for the mixed or lateral inconsistent group. Mean values for pattern walking and drawing scores, CA, and DAP may be found in the vertical columns of Table 7.

In light of suggestions of earlier investigators (Forness, 1968) that eye preference is perhaps the most significant aspect of lateral usage for symbol interpretation, data were reorganized to compare children who were left-eye dominant with those who were right-eye dominant. Findings are summarized in Table 8. When comparisons were made of CA, DAP, and pattern copying scores, no differences of significance were found.

Table 8

Mean and Standard Deviations of CA, DAP, Pattern Drawing and Pattern Walking for Groups According to Right/Left Eye Preference

	Right Eye Preferred						Left Eye Preferred					
	Boys			Girls			Boys			Girls		
	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.
CA	24	59.0	4.2	21	56.5	3.9	17	58.1	4.6	12	57.6	5.3
DAP	24	91.5	13.7	21	99.8	13.9	17	95.7	17.1	12	89.6	14.8
PD	26	18.1	3.6	21	17.4	3.3	18	19.0	3.6	13	17.1	3.8
PW	16	17.6	3.6	12	15.2	2.5	14	18.4	2.8	08	15.4	1.7

Comparisons of boys and girls within right and left eye groups are summarized across the rows of Table 8. Comparisons of CA, DAP, and pattern walking scores only approach significance. For the left-eyed group, only one comparison between sexes, pattern walking, was significant, favoring boys ($\underline{t}$ = 2.587, $\underline{df}$ = 20, $p < .02$). Thus, findings support the better performance of boys over girls on the pattern walking task, but do not provide conclusive evidence in support of the role of preferred eye function in relation to this task.

Lateral Awareness and Spatial Position Awareness.

Knowledge of body part laterality of self and others was assessed separately from the lateral preference or usage measures. Means and standard deviations for lateral and spatial position awareness measures are found in Table 9, according to sex. It should be remembered that the lateral awareness items measure the child's ability to identify his own body parts and those of the investigator; spatial awareness items tap the child's ability to recognize and identify relationships of objects in relation to each other and to himself.

Table 9

Means and Standard Deviations of Lateral Awareness and Spatial Position Awareness Scores by Sex

	Lateral Awareness					Spatial Position Awareness					
	Boys (N=44)		Girls (N=35)				Boys		Girls		
Subtest	M	S.D.	M	S.D.	t	Subtest	M	S.D.	M	S.D.	t
Self Parts I	2.6	1.4	3.0	1.3	1.4	Relative Position 1	3.8	0.8	3.9	0.3	.01
Self Parts II	2.2	0.8	2.1	1.1	.01	Relative Position 2	2.3	1.1	2.1	1.0	.01
Others' Parts	1.5	1.5	1.6	1.5	0.4	Three Objects	3.3	1.4	3.0	1.2	1.0
Total	6.2	1.8	6.7	1.7	1.2	Total	9.41	2.9	9.8	2.0	0.7

Examination of means and standard deviations of lateral awareness scores (Table 9) reveals no differences of significance between boys and girls; as expected, preschool children were more apt to identify right and left with reference to their own body than for others. Comparisons of scores of boys and girls on the spatial position items were not significantly different. On the basis of these data, boys and girls appeared to be of comparable ability in lateral awareness and in recognition of relative spatial position of items.

Comparisons of High and Low Lateral Awareness Groups

Distribution of boys' and girls' lateral awareness scores were divided above and below the mean to form high and low lateral awareness groups. These groups were then compared on CA, DAP, Pattern Drawing, Pattern Walking, and Spatial Position Awareness measures. Means and standard deviation of those measures for the high and low lateral awareness groups are found in Table 10. No differences were found to be significant. Differences in knowledge or awareness of own and others' lateral body parts did not distinguish the sample on the other spatial organization measures.

Table 10

Means and Standard Deviations for Scores on Major Variables for High and Low Lateral Awareness (L.A.) Groups by Sex

		C.A.		D.A.P.		P.D.		P.W.		S.P.A.	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
High	N	18	18	18	18	20	20	14	10	20	20
L.A.	M	58.1	57.6	97.6	92.3	18.8	17.4	18.7	15.8	10.5	9.8
	SD	4.2	4.3	15.1	13.9	3.4	3.8	2.8	2.7	1.8	2.0
Low	N	23	15	23	15	24	15	16	10	24	15
L.A.	M	59.0	56.3	89.0	101.6	18.0	17.3	17.2	14.7	9.8	9.9
	SD	4.5	4.6	14.3	14.3	3.8	3.0	3.5	1.6	2.4	1.9
	t	0.67	0.82	1.79	1.82	0.69	0.07	1.28	1.07	1.04	0.27

When comparisons of boys and girls within high and low lateral awareness groups were made, significant differences favoring boys were found for pattern walking scores for both groups. Values of t were 2.43 (df = 22, $p < .05$) and 2.06 (df = 24, $p < .05$) for high and low groups, respectively. This finding is of particular interest in that the girls with low lateral awareness scores had a substantially higher mean DAP score than did the boys with low lateral awareness scores (m = 101.6 and 89.04, t = 2.57, df = 36, $p < .02$). For boys, lower DAP scores were characteristic of the group with lower scores on the lateral awareness measures, but for girls the opposite was true. Seemingly, the general intellectual factor, as measured by the DAP, was independent of lateral awareness for girls. Means and standard deviations for comparisons of sex groups are found in the vertical columns of Table 10.

<u>Preferred Lateral Usage, Lateral Awareness, Spatial Position Awareness</u>.

Other investigators (Delacato, 1966; Kephart, 1960) have suggested that lateral usage, particularly consistency of lateral preference, may influence or even be a precursor of lateral awareness and spatial awareness. To determine possible effects of lateral preference on the awareness measures, data were organized according to lateral usage characteristics. Findings are reported in Table 11. No differences between consistent and mixed lateral usage groups were found on the spatial awareness measures. Boys and girls within lateral preference groups were about equal in scores.

Table 11

Lateral Awareness (L.A.) and Spatial Position Awareness (S.P.A.) Scores for Consistent and ~~Mixed~~ Lateral Usage Groups by Sex

	Consistent H-F-E				Mixed H-F-E			
	Boys		Girls		Boys		Girls	
N	22		21		22		14	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
L.A.	6.0	1.7	6.4	1.3	6.5	1.8	7.0	2.0
S.P.A.	9.9	2.5	9.7	1.9	10.2	1.8	10.1	2.1

When lateral awareness and spatial position data were analyzed according to left or right eye preference groups, no significant differences were found. Data are summarized in Table 12. Examination of scores of boys and girls reveal marked comparability of scores.

Table 12

Lateral Awareness (L.A.) and Spatial Position Awareness (S.P.A.) of Right-Left Eye Preference Groups by Sex

	Right Eye Preferred				Left Eye Preferred			
	Boys		Girls		Boys		Girls	
N	26		21		18		13	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
L.A.	5.9	1.7	6.2	1.4	6.7	1.8	7.3	1.9
S.P.A.	9.9	2.3	10.0	1.9	10.4	1.8	10.3	2.2

On the basis of these data, it was concluded that eye preference did not have a significant effect on lateral or spatial position awareness.

Finally, relationships of the various laterality and spatial organization measures were assessed with product-moment coefficients of correlation. Results of the correlational analyses for total groups of boys and girls separately are found in Table 13.

Table 13

Correlation Matrix for Scores on Major Variables by Sex

Measure	Sex	N	C.A.	D.A.P.	P.D.	P.W.	S.P.A.
Lateral Awareness	Boys	44	.08	.29	.18	.32*	.04
	Girls	33	.06	.15	.15	.06	.34*
Chronological Age	Boys	41		.07	.40*	.74**	.07
	Girls	33		.17	.42*	.10	.06
Draw-A-Person	Boys	41			.06	.46**	.09
	Girls	33			.06	.25	.02
Pattern Drawing	Boys	44				.45**	.00
	Girls	35				.62**	.09
Pattern Walking	Boys	30					.05
	Girls	20					.13

$^{*}p < .05$ $^{**}p < .01$

Examination of the correlation coefficients suggests that the relationships were, for the most part, low and statistically nonsignificant. Pattern drawing and pattern walking relationships reached significance for both boys and girls, and chronological age was associated with copying ability more clearly for boys than for girls. It should be noted, however, that chronological age was not associated with either lateral awareness or position in space measures. In short, patterns of relationship of the various measures were somewhat variable for both boys and girls and for the most part were not of a magnitude to reach statistical significance.

Discussion

Two major findings, one positive and one negative, warrant discussion. A clear sex difference in pattern walking was demonstrated; no association of lateral awareness or lateral usage measures with the spatial organization tasks was identified.

In this study, spatial organization was operationally defined as ability to copy patterns by drawing and walking and to identify by verbal response the correct spatial position of objects relative to the self. In contrast to theoretical positions and to empirical evidence proposed by other investigators (Delacato, 1966; Kephart, 1960; Kershner, 1970; Roach & Kephart, 1960), no relationships were found among lateral usage, lateral awareness, and ability on the spatial organization tasks.

It had been anticipated by this investigator that consistent or preferred lateral usage was probably not a direct contributor to spatial awareness or spatial organization. However, it had been hypothesized that the young child's awareness of laterality, as evidenced by his ability to name designated body parts accurately and consistently, was likely to have an important effect on the child's organization of three dimensional space. That is, it was assumed that sound knowledge of self parts, e.g. "body image", probably developed through usage, was an accomplishment which made a direct contribution to the consistent organization of representational space, with "self" as the major point of reference. Correlational analyses, as well as comparisons of differences among groups based on various aspects of lateral preference and awareness do not allow support of this hypothesis. In the present study of preschool children, it is possible that the age of the subjects might have been a critical factor. Children this young may not have established lateral preference or lateral awareness at a level of consistency which provides a basis for organization of representational space; thus the lack of relationship of usage or awareness measures to copying or position in space measures. However, approximately one-half of the subjects demonstrated consistency of preference in lateral usage, a proportion consistent with reports of other investigators (Fink, 1938; Hecaen & Ajuriaguerra, 1964). Consistency of usage thus did not explain the negative results.

Findings are compatible with the formulations of Belmont & Birch (1963, 1965) who suggest that awareness and usage are independent functions. It is possible to speculate that systems of lateral usage and lateral awareness develop independently and are then synthesized into a more complex system of spatial organization which involves self and three-dimensional spatial referents. It seems entirely possible that the motor or usage system and the cognitive or awareness system may be independent but interacting components in the development of representational space. The nature of the interaction may be one of validation or verification, not one in which one system develops from, or is built upon, the other. A test of the contributions of the motoric and cognitive components in the development of spatial organization might be possible by comparing the performance of preschool children with that of somewhat older children; subjects in the present study demonstrated relative independence of usage and awareness abilities.

Finally, the findings in regard to the laterality measures may also be explained in terms of the tasks used in this study. It may be that the dependent measures, particularly the pattern walking task, were not appropriate for children of this age. It was the subjective impression of the research team members that the paper-pencil copying and drawing measures, and the modified Piaget lateral usage and understanding tasks were reasonable for children of this age, but that many children found the pattern walking task more difficult. It is a matter of interest, to be discussed in a later section, that pattern walking was easier for boys than for girls. However, it is possible that the low correlations with laterality measures were non-definitive because the latter measures were inappropriate for children of this age.

On the basis of the present data, it is not possible to support other reports which suggest that consistency of lateral preference has a direct effect on lateral awareness or on developing the ability to organize representational space. Neither is it possible to support the hypothesis that lateral awareness is directly associated with ability to perform spatial organization tasks.

The major finding of interest has to do with the consistent and significant sex difference favoring boys on the pattern walking test. These findings are consistent with earlier work (Keogh, 1970) in which elementary school age boys were found to be better than girls of the same age in ability to reproduce patterns in an expanded spatial field. This sex difference in performance was clearly identifiable in the preschool age group. In this regard, it should be noted that boys in School A were better than girls on both drawing and walking tasks. While it may be possible that some overall ability factor might account for this difference in performance, it is of interest to note that boys in the sample were slightly <u>lower</u> in DAP scaled scores than were the girls. It would thus be inappropriate to attempt to explain the differences in pattern copying scores in terms of a general "intellectual" effect.

Another possible interpretation of the sex difference in performance is that boys are indeed better than girls on spatial organization tasks, but that this difference is usally masked by the greater preschool and early school experience of girls in paper-pencil type tasks. In the present study the measures may have been taken early enough to negate the experience effect. Further, differences between boys and girls were greater for walking than drawing tasks; the novelty of the walking task may have served to reduce experiential effects.

A third and not necessarily independent explanation of the pattern copying scores had to do with more pervasive field organization and/or motivational characteristics. Subjectively, the investigators were

were struck by differences in ways in which boys and girls approached and attempted to solve the tasks. This was especially true of pattern walking, a novel task. Differences seemed to center around the amount and kind of attention to task or attention to investigator. Although distributions of objective scores overlapped, some observational or subjective aspects of performance were noted as particularly characteristic of boys or girls. Boys were, for the most part, considerably more task involved than were girls. They seemed to pay more careful attention to the directions which were verbalized or demonstrated by the investigator. While performing a drawing or walking task boys seemed to concentrate on the components of the task; they gave clear indication of having finished a design or a picture and, in very subjective terms, seemed involved in the completion of the task.

Girls, on the other hand, appeared much more investigator-oriented. They tended to seek more reassurance that what they were doing was correct, they needed more encouragement to try the tasks, especially the walking task; they were hesitant and seemed uncertain as to when a walked pattern was complete. Many girls paid little attention to the stimulus design and watched the investigators. They seemed to want to talk about other things and often mentioned topics unrelated to the task. In short, girls were investigator-oriented, boys task-oriented. Such differences in orientation might well influence the kind of cues selected and the ways in which they were utilized, and thus affect problem solving. To use other terminology, the pattern-copying style of preschool girls was highly field dependent. Findings for the preschool children were consistent with those found for older children (Keogh, 1970; Keogh & Roth, 1970) and support the interpretation that sex differences in perceptual and possibly cognitive styles are identifiable by the late preschool period.

Findings for both walking and drawing scores were consistent with findings by this author in a study which described pattern copying performance of six, seven, and eight year old children (Keogh, 1969). Pattern drawing means were 24, 26, and 28 for the six, seven, and eight year olds; walking means were 21, 23, and 24 for the same groups. Four and five year old children in the present study were clearly less able on the drawing and walking tasks than were the older school children, as anticipated.

The question of whether performance differences are related to underlying developmental dimensions or more directly reflect experience is of interest. Findings from an earlier study by this author (Keogh & Smith, 1968) may be pertinent. Entering kindergarten children were given the Bender Gestalt Test, and the same test was readministered at two month intervals throughout the school year; the most significant improvement in copying performance was found to occur in the first two months of school. Apparently many children enter kindergarten with limited paper and pencil skills and limited experience in organized school-type tasks; improvement is rapid and major for most children, apparently in direct response to school programs, even to the relatively loosely structured programs of most kindergartens.

Children in the present study were for the most part from middle to upper middle SES homes in which opportunities for school-type tasks are likely to be present; these children were also in enrichment-type preschool programs. Yet, overall performance, as reflected in group means, was considerably below performance levels of children in kindergarten programs. This finding, coupled with the earlier study of the Bender with kindergarten children, suggests the need for caution in interpreting drawing or copying performance of preschool children in terms of definitive "readiness" statements. This would seem particularly important when such tasks are used with children from less advantaged SES homes. School expectancy for the majority of children in the present sample is good. Yet, a goodly proportion of these children performed in immature fashion on the drawing test. It very well may be that lack of precision and "immaturity" of drawing may reflect lack of experience rather than possible defect or deficit conditions in the child. Immaturity and lack of precision were characteristic of the majority of children in this sample, especially on the walking task with which they had had no previous experience. From an educational or clinical point of view, only a few of the very extreme poor performers would seem to warrant specialized attention as possible school learning problems. Data from the present study support a growing body of evidence which suggests caution in the interpretation of preschool test findings for educational prediction.

From the point of view of this investigator, several things were of particular interest. First, the almost complete lack of positive findings in regard to the laterality measures suggests that that particular dimension of development, while perhaps of interest for its own sake, is not of real interest or value in the study of spatial organization. Lateral usage and lateral awareness measures do not appear to provide meaningful information of relevance for spatial organization, at least for preschool children of the four-to-five year age range.

Second, the consistent finding of superior performance of boys on the pattern walking task raises question as to the nature of field organization of preschool boys and girls. In light of the known differential rates of achievement of boys and girls in the elementary school programs, investigation of aspects of field organization, including the kind of cues selected and functional organization of these cues, may prove of value for educational programming. It seems entirely possible that a more analytic or field independent style of perceptual, and possibly cognitive, organization might be extremely advantageous for extra-school activities, but less compatible with primary grade atmospheres and teacher styles. Further investigation of styles of field organization, with particular emphasis upon educational implications, seems warranted.

Finally, the single finding of most interest to all members of the research team was a more subjective, but extremely consistent observation as to differences in ways in which individual children approached a new learning situation and task. In a simplified way, differences were characteristic of boys and girls; these characteristics were described in the body of this report. However, the pervasive nature of the observations deserve emphasis. Differences in task orientation, including the kinds of cues selected, the value placed on mastery or even completion of a task, the question of what or who determines success or non-success, may very well have their origins in the preschool period. On the basis of this study of preschool children, questions of problem solving approaches and strategies deserve high priority for further research.

Footnotes

1. This research was carried out through the UCLA Center for Research in Early Childhood Education, sponsored by the United States Office of Economic Opportunity, Contract No. CG 9938, Dr. Carolyn Stern, Director.

2. The author wishes to thank Mrs. Kathryn Forsyth, Director of the Little Red School House, and Mrs. Judy Soldana, Director of the Manhattan Beach Nursery School, and their staffs for their gracious and enthusiastic cooperation in this study. Thanks is also extended to Cathleen Wickman and Ron French, graduate students in Special Education at UCLA, for their help in data collection and processing.

References

Belmont, L. & Birch, H. G. Lateral dominance and right-left awareness in normal children. Child Development, 1963, 34, 257-270.

Belmont, L. & Birch, H. Lateral dominance, lateral awareness, and reading disability. Child Development, 1965, 36, 57-71.

Bender, L. A visual motor gestalt test and its clinical use. American Orthopsychiatric Association Research Monographs, 3, 1938.

Benton, A. Right-left discrimination and finger localization. New York: Paul B. Hoeber, Inc., 1959.

Benton, A. & Kemble, J. D. Right-left orientation and reading disability. Psychiatry and Neurology, 1960, 139, 49-58.

Birch, H. G. & Lefford, A. Visual differentiation, intersensory integration, and voluntary motor control. Monographs of the Society for Research in Child Development, 1967, No. 32.

Bryan, Q. R. Relative importance of intelligence and visual perception in predicting reading achievement. California Journal of Educational Research, 1964, 15, 44-48.

Call, J. D. Early identification of children with potential learning problems. Social and Affective Factors in B. K. Keogh (Ed.) Early identification of children with potential learning problems. 1970, in press.

Clements, S. & Peters, J. Minimal brain dysfunctions in the school-age child. Archives of General Psychiatry. 1962, 6, 185-197.

DeHirsch, K., Jansky, J., & Langford, W. Predicting Reading Failure. New York: Harper & Row, 1966.

DeHirsch, K. Tests designed to discover potential reading difficulties at the six-year-level. American Journal of Orthopsychiatry, 1957, 27, 566-576.

Delacato, C. The diagnosis and treatment of speech and reading problems. Springfield, Illinois: Charles C. Thomas, 1963.

Faust, M. Early identification of children with potential learning problems: cognitive and language factors. In B. K. Keogh (Ed.) Early identification of children with potential learning problems. 1970, in press.

Fautz, R. L. The origin of form perception. Scientific American, 1961, 204, 66-72.

Fink, W. The dominant eye: Its clinical significance. Archives of Opthamology. 1938, 19, 555-582.

Forness, S. R. Lateral dominance in retarded readers with signs of brain dysfunction. Unpublished doctoral dissertation, UCLA, 1968.

Friedman, S. J. Neuropsychology of Spatially Oriented Behavior. Homewood, Illinois: The Dorsey Press, 1968.

Frostig, M., Lefever, D. W. & Whittlesey, J. A developmental test of visual perception. Perceptual and Motor Skills, 1961, 12, 383-394.

Gesell, A. & Ames, L. The development of handedness. Journal of Genetic Psychology, 1947, 70, 155-175.

Gesell, A. & Ames, L. B. The development of directionality in drawing. Journal of Genetic Psychology, 1946, 68.

Gill, H. T., Herdtner, T. J. & Lough, L. Perceptual and socio-economic variables, instruction in body-orientation, and predicted academic success in young children. Perceptual Motor Skills, 1968, 26, 1175-1187.

Harris, D. B. Children's Drawings as Measures of Intellectual Maturity. New York: Harcourt, Brace & Company, 1963.

Hecaen, H. & Ajuriaguerra, J. Left-Handedness: Manual Superiority and Cerebral Dominance. New York: Grune and Stratton, 1964.

Howard, I. P. & Templeton, W. B. Human Spatial Orientation. London: Wiley and Sons, 1966.

Kagan, J. On continuity: A demonstration from infancy. Paper delivered at the Society for Research in Child Development meeting. Santa Monica, California, 1969.

Keogh, B. K. Pattern walking under three conditions of available visual cues. American Journal of Mental Deficiency, 1969,

Keogh, B. K. Pattern copying under three conditions of an expanded spatial field. Developmental Psychology. In press, 1970.

Keogh, B. K. Pattern copying and pattern walking performance of normal and educationally subnormal boys. American Journal of Mental Deficiency, 1967, 71, 1009-1013.

Keogh, B. K. & Keogh, J. F. Pattern walking: A dimension of visuo-motor performance. Exceptional Children, 1968, 34, 617-618.

Keogh, B. K. & Smith, C. E. Changes in copying ability of young children. Perceptual and Motor Skills, 1968, 26, 773-774.

Keogh, B. K. & Roth, S. Relationship of three measures of field dependence-independence. Unpublished report, 1970.

Keogh, B. K. & Donlon, G. Perceptual-spatial organization of learning in disadvantaged boys. Unpublished report, 1970.

Kephart, N. C. The Slow Learner in the Classroom. Columbus, Ohio: Charles Merrill, 1960.

Kershner, J. R. Children's conservation of multiple space relations: Effects of laterality, movement and language.

Leydorf, M. Early identification of children with potential learning problems: Physical motor factors. In B. K. Keogh (Ed.) Early identification of children with potential learning problems, 1970, in press.

Lord, F. E. A study of spatial orientation of children. Journal of Educational Research, 1941, 34, 481-505.

Luria, A. The Role of Speech in the Regulation of Normal and Abnormal Behavior. New York: Pergamon Press, 1961.

Maccoby, E. E. (Ed.) The Development of Sex Differences. Stanford: Stanford University Press, 1966.

Mellone, M. A. A factorial study of picture tests for young children. British Journal of Psychology, 1944, 35, 9-16.

Messick, S. The criterion problem in the evolution of instruction: assessing possible, not just intented, outcomes. CSE Report, No. 22, UCLA, 1969.

Mountcastle, V. (Ed.) Interhemispheric Relations and Cerebral Dominance. Baltimore: Johns Hopkins Press, 1962.

Piaget, J. & Inhelder, B. The Child's Conception of Space. London: Routledge and Kegan Paul, 1956.

Piaget, J. Judgement and Reasoning in the Child. London: Kegan Paul, 1928.

Roach, E. G. and Kephart, N. E. The Purdue Perceptual-Motor Survey. Columbus, Ohio: Charles E. Merrill Company, 1966.

Silver, A. & Hagin, R. Specific reading disability: Delineation of the syndrome and its relationship to cerebral dominance. Comprehensive Psychiatry, 1960, 1, 126-134.

Vernon, M. D. The development of perception in children. Educational Research, 1960, 3, 2-11.

Watson, B. L. Field dependence and early reading achievement. UCLA, unpublished doctoral dissertation, 1969.

Wedell, K. Perceptuo-motor difficulties. Special Education, 1968, 57, 25-30.

Wedell, K. Early identification of children with potential learning problems: Perceptuo-motor factors. In B. K. Keogh (Ed.) Early Identification of children with potential learning problems, 1970, in press.

White, B. L. Evidence for a hierarchial arrangement of learning processes. In L. P. Lipsitt and C. C. Spiker (Ed.) Advances in Child Development and Behavior. Academic Press, 1965.

White, B. L. An experimental approach to the effects of experience on early human behavior. . In J. P. Hill (Ed.) Minnesota Symposium on Child Psychology. Minneapolis: University of Minnesota Press, 1967.

Witkin, H., Dyk, R. B., Paterson, H. F., Goodenough, D. R., & Karp, S. A. Psychological Differentiation. New York: Wiley, 1962.

Witkin, H. A. Some implications of research on cognitive style for problems of education. Archivio di Psycologia, Neurologia, e Psychiatria, 1965, 26, 27-55.

Preschool Spatial Organization Inventory

Name ____________ ID ______
Sex ____________
C.A. ____________
Date ____________

A. Lateral Preference

	Trial 1		Trial 2		
	R	L	R	L	
Hand preference:					
a. ball throw	R	L	R	L	
b. scissor cutting	R	L	R	L	
c. writing	R	L	R	L	
					________
Eye preference:					
a. kaleidoscope	R	L	R	L	
b. paper with hole	R	L	R	L	
					________
Foot preference:					
a. kick ball off wedge	R	L	R	L	
					________

Total Lateral Preference: ________

B. Lateral Awareness (Piaget) Score + or -

1) Show me your right hand ________
Show me your left hand ________
Show me your left leg ________
Show me your right leg ________

____

2) Show me my right hand ________
Show me my left hand ________
Show me my left leg ________
Show me my right leg ________

____

3) Raise your right hand ________
Touch your left ear ________
Point to your right eye ________
Show me your left leg ________

____

Total Awareness of Body Parts: ________

C. Spatial Position Awareness

1) Penny-key-pencil
   a. Is the penny closer to you or closer to me? + -
   b. Is the pencil closer to you or closer to me? + -

   Reverse Position
   c. Is the penny closer to you or closer to me? + -
   d. Is the pencil closer to you or closer to me? + -

2) Penny-pencil
   a. Is the penny to the right or to the left? + -
   b. Is the pencil to the right or to the left? + -

   Child Reverse Position
   c. Is the penny to the right or to the left? + -
   d. Is the pencil to the right or to the left? + -

Total ________

3) Penny in right hand and pencil in left
   a. Do I have the penny in my right hand or my left hand? + -
   b. Do I have the pencil in my right or left hand? + -

Total ________

4) Three objects in a row, left to right: pencil, key, coin
   a. Is the pencil to the left or right of the key? + -
   b. Is the pencil to the left or to the right of the penny? + -
   c. Is the key to the left or to the right of the penny? + -
   d. Is the key to the left or to the right of the pencil? + -
   e. Is the penny to the left or to the right of the pencil? + -
   f. Is the penny to the left or to the right of the key? + -

Total ________

Total Spatial Position Awareness: ________

Figure 1