THE EFFECT OF FOCAL POINTS ON FIGURE ORIENTATION IN THE DRAWINGS OF CHILDREN FOUR TO SEVEN YEARS OLD

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Abstract

The effect of focal points on figure orientation in the drawings of children four to seven years old

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This study investigated the effect of children's judgements of form orientation on their drawing of human figures. It was hypothesized that four to seven year old children assess the orientation of graphic forms using either of two standards. Non-upright human figures are drawn only by children using the focal point standard. Children using this standard judge the orientation of the first graphic head form they draw according to the placement of internal detail within the form. The standard employed in assessing the orientation of a provided graphic head form determines the orientation of the completed human figure. Chi-square analysis showed a significant association between perceptual judgements and graphic orientation response. Children drew human figures which agreed in orientation with previously made assessments of the basal or head form's orientation. Controls were added to these experiments to ensure that all children understood the concepts of upright and upside down and could draw inverted figures in a constrained drawing task. It was not found possible to reject a discrimination factor underlying the drawing of non-upright human figures, as some writers have insisted.

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Table of Contents

List of Tables

List of Tables (cont.)

List of Figures

List of Figures (cont.)

List of Figures (cont.)

Chapter I

Introduction

The cultural convention favoured in western societies demands that pictorial space be structured according to well-defined principles. All objects and figures represented appear as if seen from one stationary viewpoint. The viewer looks into pictorial space as if he were looking through a window into environmental space: the three-dimensional world is transposed onto a two-dimensional surface. A variety of artistic devices (e.g. foreshortening) have been developed, particularly since the Renaissance, to recreate the three-dimensionality of objects on a two-dimensional surface (White, 1958), as well as for suggesting distance or depth (Gombrich, 1972).

Human figures are also ordered in pictorial space in a specific way, sometimes rigidly so, as in representations which attempt a veridical depiction of the environment (e.g. photographs and the graphic illustrations accompanying texts in newspapers and magazines). In this pictorial world top, bottom, left and right are equated with the farthest, closest and side edges of the pictorial frame; human figures are aligned in agreement with these spatial co-ordinates.

Unfortunately, writers (cf. Barry, 1809; Ruskin,

1843) have traditionally identified the system of one-point perspective as the culmination of artistic development, considering other artistic conventions to be mere preparation for this development. More recently, Arnheim (1954) has been especially critical of the assumption that one-point perspective is the apex of artistic development.

Gombrich (1972) has written that to consider one particular convention of representation to be more truthful (i.e. a better or more exact replication of reality) than any other is based on two false assumptions: that artists seek (or even desire) to directly portray objects or events in the environment, and that artistic media are appropriate vehicles for a "reconstruction of reality." There has been an unfortunate tendency to measure all artistic endeavours, including those by children and artists in pre-industrial societies, by the representational "schemata" (Gombrich, 1972) favoured in post-Renaissance western societies. Comparing children's drawings with conventional criteria, developmental psychologists often stated that children could not achieve adult levels of performance because they were "preconceptual" or "conceptually syncretic" (Piaget and Inhelder, 1956), conceptually immature (Harris, 1963), "perceptually syncretic" (Bassett, 1977) or "emotionally unbalanced" (Koppitz, 1968).

Specific features of children's drawing have also been singled out as being indicative of a variety of deficiencies. One of these "drawing phenomenon" (Stern, 1930) is the orientation of the human figures drawn by children. It has long been a truism of developmental psychologists that children younger than five draw human figures with little regard for their orientation relative to the vertical axis of the paper (Luquet, 1913; Passy, 1898; Rouma, 1913; Stern, 1930). Historically, psychologists have explained the horizontal, oblique and inverted human figures drawn by pre-school children from three very general viewpoints.

First, "disoriented" figures were thought to represent a deficiency in conceptualization: children's graphic human figures were non-vertically oriented because children's image (Luquet, 1920), schema (Stern, 1930), formula (Eng, 1931) or concept (Goodenough, 1926) of the human figure was unstructured or amorphous. A more complex version of this paradigm was suggested by Piaget and Inhelder (1956, 1963): until children have achieved operationality in thinking, they will remain incapable of applying a unified perspective system (or co-ordination of viewpoints) to pictorial space. Similarly, other authors (Howard and Templeton, 1966;

Vereecken, 1961), discuss the development of a "logic of drawing," or the application of a logical system of spatial relations to pictorial space.

In a second approach, writers (Caramaussel, 1924; Fehrer, 1935; Rice, 1930, 1931) have considered disoriented drawings to be indicative of young children's "perceptual syncretism" (Rice, 1931), or their incapacity to <u>perceptually</u> integrate the components of figures into well-structured whole configurations. These writers generally have derived their position relative to perception and drawing from Gestalt theory (Kohler, 1929). According to this theory, maturation of the neurological field determines the child's increasing capacity to discriminate changes in the visual field, one of which is change in form or figure orientation. Writers such as Davidson (1934) and Rice (1930, 1931) postulated that the capacity to "correctly" orient human figures in pictorial space, i.e. to draw them constantly upright, was a function of neurological maturation. This maturation was dependent upon the gradual accretion of perceptual experience, or visual encounters, with objects. This experience eventually became "solidified" or formed into coherent, structured, internal representations of objects. To summarize this approach, disoriented figures are drawn by young children as a result of neurological immaturity. Familiarity with orientation interacts with neurological development to facilitate the child's ability to use the vertical axis of a page to orient drawings (Bender, 1932, 1938; Osterreith, 1949; Vernon, 1962; Wolhlwill, 1960).

It was also believed that the child's level of neurological maturity would be reflected in his or her accuracy in copying the orientation of forms. Children's capacity to discriminate the most general differences in form orientation, in some experiments to differentiate between the upright and inverted versions of an object (Rice, 1930), was treated as prima facie evidence that children could correctly copy the orientation of an object. Conversely, experiments were also designed to measure pre-school children's level of perceptual development through copying tasks, in which children's perceptual differentiation of objects was inferred from their copies (Davidson, 1934; Rice 1930, 1931).

Bee (Bee and Walker, 1968; Maccoby and Bee, 1965) and Maccoby (1968) have more recently emphasized this intrinsic, direct connection between perceiving and copying, while Salome (Salome, 1965; Salome and Reeves, 1972; Salome and Szeto, 1976) has stated that accurate drawing of an object is a function of the visual analysis of that object. According to this hypothesis, children directly reproduce in their copies, or drawings, the attributes or properties they have extracted during visual analysis of form. By extension, drawing accuracy can be improved by training children to discriminate the criterial or definitive visual properties of the objects they draw.

A third model describes disoriented figures as evidence of emotional unbalance (Koppitz, 1968) or a distorted self-image (Levy, 1958; Machover, 1949). This model has been developed within clinical settings by psychoanalysts interested in children's emotional development. A variety of personality disturbances have been attributed to children older than five who persist in drawing disoriented figures.

These three approaches can be most simply characterized as "deficiency theories." The child draws disoriented figures because he either cannot do something, i.e. conceptually or perceptually structure environmental (and, by extension, pictorial) space, or because his self-image or emotions are in a state of disequilibrium. These theorists have taken little interest in drawing behaviour per se; they have not looked at ways in which disoriented figures are constructed nor at the way in which children's visual analysis of form interacts with graphic figure construction. These theories emphasize the internal determinants (concept, image, formula) from which children draw; disoriented figures are directly reproduced from these determinants.

It is now generally accepted that models of a simple, "one-channel" percept to drawing, concept to drawing, or personality trait/emotion to drawing relationship are inadequate. Writers such as Bassett (1977), Freeman (1972, 1975b, 1976), Millar (1975) and Olson (1970) stress that "making" and "seeing" constantly interact as the child draws. The child continually monitors what he or she has produced before drawing the next feature. In addition, Golomb (1973, 1974) has described the inadequacy of simple concept to drawing models, stating that there is no evidence that drawings are representative of children's conceptual attainments. It is the intention of this study to examine some of the factors which influence the production of differentially oriented graphic figures by the young child. More specifically, there will be an attempt to determine how a perception factor, children's judgement of form orientation, affects the sequential construction of graphic human figures. One outcome of sequential construction is figure orientation. Both perceiving and drawing are ongoing sequential activities, complementing each other throughout a specific graphic "production" (Freeman, 1976 , p. 348).

The target of this study, then, is the interaction of two ongoing processes, drawing and perception, during the graphic production of human figure drawings (HFDs). The purpose of the study is to investigate the effects of this interaction on the orientation of children's HFDs, and to show that graphic figure orientation can be most parsimoniously accounted for by this interaction; reference to the traditional causal agents (image, formula, prototype) may not, in fact, be necessary.

This study assumes that drawing is a sequential activity, and as such contains a series of decision points. Monitoring graphic sequences reveals what "moves" children make at each decision point: where they attach later forms to earlier forms, to what type of visual information they attend at each decision point and whether they make the appropriate decisions for continuation of a sequence towards the desired end point. Goodnow (1977) has elucidated various principles, and a syntax for ordering principles at different development levels, to explain such facets of drawing as orientation, spatial patterning, and motor "paths" used for constructing discrete forms (Goodnow, 1977, 1978; Goodnow and Friedman, 1972).

If it is accepted that a set of decisions governs the spatial positioning of each successive part or unit in a graphic sequence, it becomes crucial to define how choice of visual cues affects decision-making. For example, to what type of visual cue do children attend in appending one form to another? Freeman (1977) has stated that young children attend to within-form details (or internal cues) when appending one form to another: these details indicate a form top and bottom which is independent of framework - given top and bottom co-ordinates. Older children, writes Freeman, align "linear orders" of parts in agreement with framework cues (or external cues) of top, bottom, left and right. A number of writers (Ibbotson and Bryant, 1976; Piaget and Inhelder, 1956; Wilson and Wilson, 1980) have examined this transition in drawing from aligning each figure perpendicular to the most proximate baseline to aligning all figures within one unified pictorial grid or "trellis" (Arnheim, 1954). Can the phenomenon of "perpendicularity" (e.g. chimneys 90° to houses, human figures 90° to sloping baselines) be attributed to children's attention to the orientation of discrete forms, at the expense of attention to pictorial framework cues? It will be argued here that this transition in drawing from use of internal cues to use of external cues is related to the way in which children visually assess form.

Evidence drawn from two areas of developmental research are directly relevant to this study. Firstly, findings from the area of children's perceptual development indicate that children younger than five visually assess the orientation of form differently from older children and adults. Secondly, evidence from the area of drawing development shows that these different assessments of form affect graphic figure construction and, ultimately, figure orientation.

In the area of perceptual development, Lila Ghent Braine (1961, 1964) has shown that young children do not judge form using the same "perceptual standard" as children older than six or adults. Young children do not analyze the network of spatial directions enclosing form. Children younger than six judge the orientation of form by the position of focal points (the area of highest visual attraction). They judge form to be upright when the focal point is located near the top of the form and inverted when it is near the bottom. Children older than six judge the orientation of form according to spatial co-ordinates given by the framework. The top of the form is that area most proximate to the framework top. Therefore, all non-figurative forms are upright regardless of the placement of within-form cues (such as focal points), given that the child has evaluated the framework as being upright. Ghent (1961) has characterized these ways of assessing form orientation as use of different "perceptual standards:" children younger than six employ a "focal point standard" while their older counterparts use a "form to framework" standard.

Drawing research has revealed that children's visual assessment of the orientation of graphic forms determines the placement of form during graphic "productions" (Freeman, 1977; Goodnow, 1977; Goodnow & Friedman, 1972). Freeman has defined this as an "opposition" between internal cues and external cues, during drawing sequences. He (1977, pp. 19-23) has described two qualitatively different types of visual information to which children respond in drawing human figures, in particular for deciding where to attach the part "in play" to preceding parts. In drawing human figures, children assemble serial or linear orders of parts by attaching later parts to earlier parts according to two types of cues: internal or external.

These internal cues consist of within-form details. Their placement determines how young children assess a form's orientation, particularly assessment of a form's top. Furthermore, Freeman (1977) has stated that even ambiguous features (i.e. features which do not exactly resemble graphic parts children habitually draw) may be treated as indicating the top of the figure. This agrees with Ghent's (1961) findings that young children judge forms to be upright when the area of "highest visual attraction" is near the top of a form. Other authors (Serpell, 1971; Shapiro, 1960) have found that children will rotate their copies of forms to reposition "focal points" in the top areas of forms. Top and bottom of graphic forms are, in the case of children who respond to internal cues, independent of the directional cues of top and bottom provided by the pictorial framework. Children who respond to internal cues typically append later forms to a subjectively-determined "bottom" of earlier forms.

Goodnow et al. (1972) demonstrated that pre-school children assigned top and bottom ratings to their drawn forms according to internal, or within-form cues: they typically judged their initial form to have one top or bottom location, dependent on the placement of interior details. Goodnow et al. delineated two principles used by children for orienting their drawn human figures. Children who attach the later parts of a figure to early parts as a function of internal cues within the initial part(s) are obeying "an agreement between parts principle" (p. 11).[1] Children who align each part along a vertical axis, parallel to the side edges of the paper (ignoring cues inside the forms they draw) are employing "a standard page orientation principle" (p. 11).

External cues are the spatial co-ordinates of top, bottom, left and right provided by different spatial frameworks. In drawing, the most proximate framework cues are the four paper edges. Freeman (1977) and Goodnow (1977) both state that children older than six increasingly attend to framework cues for orienting their graphic figures; for these children the top of the head form is aligned in agreement with page top.

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[1] In this study, in conformity with Goodnow et al. (1972, p. 11), drawn human figures will be described as being in either standard or non-standard orientation. Standard figures are oriented in agreement with spatial co-ordinates determined by the paper framework: the edge of the paper farthest away is top and the closest edge is bottom. Top and bottom of drawn figures are aligned in agreement with these co-ordinates, and the vertical axis of the figure runs parallel to the side edges of the paper. Non-standard figures are aligned along axes that are non-parallel to paper edges, and the top of the figure is not defined by top of the paper.

Although studies have determined that children judge form orientation by assessing either internal or external cues and that children orient their graphic figures using both types of visual information, little attention has been given to teasing out whether perceptual judgements of form orientation directly affect the sequential construction (and resulting orientation) of human figure drawings. The study most relevant to this question, by Goodnow et al. (1972) rules out "visual discrimination of form" as a factor affecting sequential construction of human figures. The present study attempts to relate discrimination of the orientation of form to graphic figure construction, in order to show that children's judgements of form orientation directly determine a) where children attach later forms to preceding forms and b) the effect of this placement on the appearance of the completed figure. The orientation of graphic figures is thus a direct outcome of children's assessment of the orientation of the forms (and especially the basal forms) they draw.

Children in this study are presented with a form in which internal cues are located either near the top or bottom of the form. They are asked to judge which of these versions of the form is upright and which is inverted. Children who judge form orientation according to the placement of within-form detail consider "high-focal-point" (Ghent, 1961) forms to be upright and "low-focal-point" forms to be inverted. Children who assess the orientation of form by its relationship to the framework consider both versions of the form to be equally upright. The first group of children have been identified by Ghent (1961, 1964) as employing a "focal point" standard to judge form orientation, while the second group uses a "form to framework" standard. It is expected that the way children judge form orientation will affect their graphic figure constructions. The first group of children above (judging form by placement of within-form details) will complete an inverted figure if given a basal[2], form they

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[2]The term "basal form" (Gridley, 1938, p. 244) has been adopted in this study to signify the initial, and usually elliptic, form drawn by children in human figure drawings. One term has been chosen because of the disputed meaning of this initial form in young children's HFDs. If the initial unit is the only enclosed form (i.e. when there are not two discrete head and trunk forms), writers have suggested that it represents a) a head only, with trunk omitted (DiLeo, 1970; Lowenfeld & Brittain, 1964; Luquet, 1920; Machover, 1949); b) the trunk and head amalgamated in one form (Arnheim, 1954). Since the increasing differentiation of "core units" (Goodnow, 1977) is not the central concern of this study, one term, basal form subsumes head or head-body terms in the case of human figures with only one enclosed form. (These figures are commonly known as "Tadpole Men," after Luquet [1920]).

judge to be inverted (with focal point low in the form), and an upright figure if given a basal form they judge to be upright (focal point high in the form).

A pilot study conducted by this author, and described in detail in the next chapter, showed that graphic figure orientation was inadequately accounted for by the "orientation standard" model (Goodnow et al., 1972). Children in the pilot study evaluated certain types of internal cues according to their visual salience while ignoring their meaningfulness as graphic features. Goodnow et al. had assumed that identification of provided features as specific graphic units (e.g. two dots equals eyes) was necessary before disoriented figures would be drawn. The pilot study showed that young children drew disoriented figures even though not identifying provided details as graphic items; the details here seemed to act as generalized indicators of the basal form's top.

The study of Goodnow et al. (1972) had the advantage of focusing attention on graphic factors determining figure orientation, if rather prematurely discarding other determinants. There was a clear attempt to avoid global explanations, which was valuable in itself; the thrust of previous research has been to indirectly describe the status of internal entities through evidence taken from drawing. As discussed above (cf. Goodenough, 1926; Harris, 1963), many writers have described internal states as being incomplete, unstructured or unbalanced to the extent that drawn figures depart from an upright orientation. There is also an undercurrent running through previous studies which assumes that children are somehow "reading off" from a perceptual image or "prototype" of the human form (cf. Gibson, 1969).

However, this author's observations of the drawing behaviour of four year old children revealed that they were attending very closely to the forms they had already created before appending later forms. In fact, they often rotated the paper to re-align forms to their satisfaction. It was this phenomenon of "paper turning" which suggested that children were judging the orientation of their graphic forms with a rather blithe disregard for framework spatial co-ordinates, and led to the testing of the Goodnow et al. (1972) findings in a pilot study. Although the results of this study do not confirm the conclusions of Goodnow et al., and suggest certain methodological problems in their design, it is this author's opinion that the approach of Goodnow et al. to the problem was sound (cf. Goodnow, 1977). Their use of the "constrained drawing task" (Goodnow, 1977), discussed in detail in Chapter Three, reduces the problem of graphic figure orientation to manageable proportions, at the same time approximating a natural drawing situation. In a constrained drawing task, information is given to the child requiring that he or she modify a "routine sequence" (Goodnow, 1977) of drawing. This information may consist of either graphic forms which the child completes as a human figure, or a new task demand for which a solution must be generated. The present study falls into the first category of constrained drawing task, providing a basal form which must be accommodated in a graphic sequence.

It is possible to describe the drawing test in this study as a graphic problem; to examine its task demands and to describe possible solutions. Both Freeman (1977) and Goodnow (1977) have encouraged such an approach. Children here are presented with two types of visual information at the onset of the drawing task in this study. A provided basal (or head) form contains internal or focal point cues (one type of information) while the pictorial framework offers external cues (a second type of information). Children may orient their graphic figures by attending exclusively to either type of cue (internal or external), or orient their figures by alternately attending to both cue types (i.e. start their figures in agreement with the internal cue but switch during the sequence to a figure alignment that agrees with the framework cues). The solution, or figure orientation, will be a function of the type of cue children attend to during the process of figure construction. Specifically, the child who completes a "low" focal point basal form with an inverted figure is attending to the placement of the internal marker of "top" within the basal form; the child who completes an upright figure given the low focal point is attending to the framework marker of top. Different utilization of available information results in different figure orientations. It is the contention of this study that different standards for judging form orientation determine which type of visual information (internal or external cues) is monitored during the sequential construction of HFDs.

This study examines children's understanding of the concept of inversion in three domains: the cognitive, the perceptual and the representational. A description of one of the "multiplicity of determinants" (Golomb, 1973) underlying children's performance in the medium of drawing will be developed. Without taking refuge in the ideas of perceptual images, prototypes, or schemata, the author hopes to elucidate the effects of a "perception factor" on drawing performance. As a means to this end, it will be necessary to consult both statistical and anecdotal information from the studies described in the next chapter.

Chapter II

Background of the Study

Models of figure orientation in children's drawings: an outline

The problem of disoriented human figures in children's drawings has been approached from various angles. Those developmental psychologists interested in cognitive development have suggested that children draw oblique, horizontal or inverted figures because their "concept" (Goodenough, 1926) or image (Luquet, 1920) of human beings is unstructured. A more sophisticated view has been generated by Piaget and his followers (Piaget & Inhelder, 1956; Smedslund, 1963), who postulate that once space has been conceptualized, or subjected to the operations of logical thought, all figures will be situated in pictoral space within a co-ordinated perspective system. Other authors, such as Bassett (1977) and Maccoby (1968) believe that children must be able to reconstruct a "perceptual image" of the human form within the graphic medium before consistently upright figures will be produced; this theory differentiates very little between perceiving and drawing. Within the psychoanalytic school of thought, authors (Koppitz, 1968; Machover, 1949) have argued that graphic disoriented figures signify a personality "in transition" (Machover, 1949) or emotional disturbance (Koppitz, 1968). Finally, other authors (Goodnow, 1977; Goodnow et al., 1972) have examined the drawing process itself for evidence of how disoriented figures are graphically constructed.

This review of literature examined these paradigms in some detail. It is the position of this author that the cognitive and personality theories are too global in nature to deal adequately with the issue of figure orientation in children's drawings. Figure orientation is not a direct by-product of an unstructured concept, percept or internal image, or of a disturbed emotional state or personality trait. The causal agent, or independent variable, which supposedly determines the production of disoriented figures is in all of these models inherently "unresearchable." The circularity of these arguments becomes apparent when they are reduced to their simplest form. For example, percepts or concepts are considered to be unstructured because a graphic figure is disoriented, and a graphic figure is disoriented because percepts or concepts are unstructured. Similarly it is invalid to assume that children have incompletely analyzed the features of the human form because his or her graphic figures are not veridical replications (in appearance, orientation, number of features represented) of the human figure (Freeman, 1975b).

The findings which show the most promise for an understanding of this problem come from two areas: drawing studies and perception studies. Drawing studies (Bassett, 1976; Goodnow et al., 1972; Gridley, 1938) have analyzed the production of figures in different orientations. They relate disoriented figures to problems inherent in graphically constructing human figures. As well, the type of tasks they posit, described in this review, reduce the topic to manageable proportions. Perception studies (Braine, 1973; Ghent, 1961) show that young children's judgements of form orientation are different from those of older children and adults, and that these judgements are operative in copying tasks. The emphasis of this review is accordingly on judgements of form orientation at different ages, and on the effect of orientation judgements during graphic sequences. Since both standard and non-standard figures are the products of a series of successive acts or sequences (Goodnow, 1977), and since judgements of form orientation often guide the placement of form during sequences (Freeman, 1977), studies describing orientation judgements and graphic sequences are described in detail, and points of contact between perception and drawing studies emphasized.

There are five theoretical positions which give different explanations for the orientation of young children's human figure drawings. The Piagetian and cognitive paradigms describe disoriented figures as a brief episode in the young child's acquisition of logical or "conceptually mature" (Harris, 1963) thought. The psychoanalytic model similarly treats disoriented figures as evidence of a "deficit," but of an emotional or personality-based deficiency. Finally, other paradigms describe graphic figure orientation as being caused by the interaction of perception and graphic sequence. They differ to the extent to which they emphasize perception and visual analysis of form (Braine, 1973; Freeman, 1977) or the operation of drawing rules (Goodnow, 1977; Millar, 1975) as the primary determinant of figure orientation. The main emphasis of each position is described, a brief overview of the problem and the convention of figure orientation is given, and then each of the five positions is discussed in detail.

The main hypothesis of each position is stated below:

1) Until children have acquired an operational system for co-ordinating perspectives, and can apply

this system to the organization of pictorial space, each drawn form is oriented in relation to proximal forms. While young children accord each form its own perspective view, children older than seven or eight years orient a whole figure relative to one co-ordinated perspective system (Piaget, 1969; Piaget & Inhelder, 1956; Smedslund, 1963).

2) Non-upright figures in children's drawings reflect syncretic reasoning. Children incompletely understand (i.e. possess an unstructured concept, image or "formula" [Eng, 1931]) the structure of the human form, and therefore cannot reproduce it in a drawing. Inability to conceptually integrate the discrete parts of the human figure into a meaningful whole is mirrored in children's human figure drawings (Goodenough, 1926; Goodenough & Tyler, 1959; Harris, 1963). While Piaget emphasizes the activity of planning, or structuring pictorial space, Goodenough and Harris see a more direct channeling of the "mature concept" of human being onto paper; they evince less interest than Piaget in the gamut of perceptual and motor skills which contribute to the drawing of human figures.

3) Non-upright figures in children's drawings indicate emotional disturbance (Koppitz, 1968) or

distorted body image and self-concept (Machover, 1949).

4) The orientation of children's graphic human figures is determined by the process children employ to visually explore, or scan, form. Young children judge the orientation of each form they draw by its within-form contents, which define each form's top; they append forms to each other in a drawing sequence by cues intrinsic to each form. Older children visually relate all forms to an external framework; all forms in their human figure sequences are oriented relative to external (framework) cues (Braine, 1973; Bassett, 1976; Freeman, 1977).

5) The orientation of children's graphic human figures is determined by the operation of two conflicting graphic principles. Children orient the later parts of a figure in agreement with the orientation of the basal form, following an "agreement between parts" principle, or they orient all figures in agreement with a page-defined vertical axis, obeying a "standard page orientation" principle (Goodnow, 1977; Goodnow et al., 1972).

Since the purpose of this study is to examine the relationship between perceptual facility and the orientation of children's HFDs, the perception and drawing positions (points 4 and 5 above) are discussed in more detail than the Piagetian, cognitive or psychoanalytic positions (respectively, points 1, 2 and 3 above).

The Problem

If one accepts that children's drawings directly reflect the level of perceptual or conceptual development achieved by children, it becomes feasible to link a specific phenomenon in children's drawings of the human figure, such as figure orientation, to children's concept or percept of the human form. In other words, the child's conceptual and perceptual processes can be inferred by examining the features of their drawings. This has been typically the case with various writers' examination of graphic human figure orientation: children eventually draw upright figures because they "notice" more about the human form, either visually or conceptually. The history of this approach (i.e. unidirectional concept to drawing or percept to drawing models) is briefly outlined, along with some of the salient criticisms that have been levelled against it.

Since the beginning of this century, collectors and students of children's drawings have observed that pre-school children seem insensitive to the orientation of the human figures they draw (Eng, 1931;

Ivanoff, 1908; Lukens, 1896; Stern, 1930). They viewed the disoriented or non-standard (see Note 1) figures found in young children's drawings as virtual "print-outs" of a deficient reasoning capacity or of perceptual syncretism.

Eng (1931) wrote that children oriented their figures in a non-standard fashion because their internal image of objects in environmental space was fragmented or unstructured.

> Children place objects which belong together as parts of a thing, a landscape, etc. on the paper without any relationship to one another, or even join them together in a way which does not correspond to reality. (p. 143)

Citing young children's "defective capacity for synthesis," and considering drawings to be direct evidence of this synthetic incapacity, Eng stated that with development children became better able to "know" the veridical relations of objects in space; once understood, these relations could be accurately drawn.

Other writers (Luquet, 1920; Stern, 1930) stated that if children's image of the human form was correctly oriented in internal or conceptual space, then upright figure drawings would inevitably result. Drawings were an exteriorisation of internal space. Stern (1930) wrote that the child's confusion about spatial relations in his environment extended to his treatment of pictorial space.

Rice (1931) contended that non-standard figure orientations were a by-product of young children's perceptual syncretism, or inability to visually discriminate orientation differences in forms and objects. She suggested that orientation became a potentially discriminable dimension of form in the child's fifth year. Prior to this, discrimination and reproduction of the orientation of form was deficient. Davidson (1934) reached similar conclusions in a series of experiments where children were asked to copy a series of letter-like forms: until children could visually differentiate between letters in different orientations, their copies would reflect orientation errors.

One author who examined the orientation of children's human figure drawings from a different perspective was Rouma (1913). He considered orientation to be a function of drawing factors, i.e. how young children graphically organized pictorial space. One of the most perceptive and methodical writers of the early twentieth century on children's representational development, Rouma stated that children when drawing were engaged in a problem-solving activity. The frequency with which oblique, inverted and horizontal human figures appear in children's drawings was not a surprising occurrence, he stated; young children do not yet equate a sheet of paper with the "real world." They do not associate the top, bottom, left and right directionality of the space they live in with, respectively, the farthest, closest, or side edges of a piece of paper. Instead, Rouma argued, children orient their drawn figures to fit the available space and treat all paper edges as potential "bottoms" of their pictorial worlds. Rouma found that children draw their human figures so that they will "stand" on the edge of the paper most proximal to where the head is drawn. More than half a century before Freeman (1972), Rouma was attempting to define a "production problem" encountered by children organizing pictorial space through the medium of drawing.

Since 1935, a variety of studies have shown that discrimination of form orientation is a function of task related factors and not based on a simple inability to perceptually structure spatial relations between objects in the external world. Whereas children younger than five pay little attention to orientation in matching tasks (Newhall, 1937; Takala, 1951) or in tasks where discrimination of topological features (shape, size) competes with the orientation dimension (Gibson, Gibson, Pick & Osser, 1962; McGurk, 1972), they are expert at detecting changes in the orientation of objects and simple forms when this is the only dimension of difference (Hunton, 1955). Indeed, they judge abstract forms, having no one upright or canonical orientation according to adults, to be upright or inverted depending on the placement of within-form details (Ghent, 1961, 1964; Wohlwill & Wiener, 1964). Gibson et al. (1962) state that orientation is the last dimension of form to be discriminated because it is least critical for identification of objects in the environment; objects retain their identity when rotated, which is not the case if their shape or size are changed.

Ghent (1961) states that young children judge non-realistic forms to have one consistent upright orientation, which adults do not. Furthermore, their preference for canonical orientation of form is a function of the way they perceptually explore form. Young children are not insensitive to the orientation of form, but rather judge the orientation of form using a different criterion than older children and adults. It is safe, then, to dispense with the notion that non-standard graphic figures are evidence of the young child's inability to discriminate an upright human figure from figures in other orientations, i.e. a generalized perceptual syncretism. The way in which young children's visual exploration of form (and resultant judgements of form orientation) affects graphic production of human figures, including their orientation, is discussed later in this chapter.

In general, it is counter-productive to attempt definitions of what internal determinants, or deficiency in these determinants, may cause children to draw non-standard human figures. First, it is hardly feasible to directly measure images (Stern, 1930), formulae (Eng, 1931) or concepts (Goodenough, 1926; Harris, 1963) in the hope of detecting their "misplacement" (Stern, 1930).

Commenting on the promotion of imagery to the status of independent, causative variable by Bugelski (1970), Brainerd (1971, p. 600) writes that imagery is perhaps more parsimoniously accounted for as one of a variety of cognitive skills.

> . . . To admit the present destructive and constructive criticisms to the realm of possibility also is to view imagery as a dependent variable; it implies the hypothesis that imagery may be just another dependent cognitive skill of the same order as the capacity to do multiplication tables or solve long-division problems inside one's head.

Similarly, on the basis of research in the field of drawing development, it is evident that drawing productions are not exteriorisations of what the child knows (Golomb, 1973, 1974), nor copies of static perceptual images or little retinal pictures (Arnheim, 1966, 1969; Olson, 1970). The "causal agents" (Brainerd, 1971) of non-standard human figures must be sought at least partially within the workings of the drawing process itself (Freeman, 1977; Goodnow, 1977), and in the development of a drawing syntax which organizes graphic productions (Goodnow, 1978). Viewing each drawing as an end product, created through the effects of a "multiplicity of determinants" (Golomb, 1973, p. 202), precludes the simple explanation outlined above.

The Convention of upright figures

Authors such as Howard and Templeton (1966) and Goodnow (1977) argue that while young children are not indifferent to the orientation of forms or figures, they are indifferent to the placement of figures within pictorial space. They suggest that children must acquire the "logic of drawing" (Howard et al., 1966) favoured by the cultural group before they will consistently draw all figures in an upright orientation.

Howard et al. (1966) contend that the pictorial convention promoted in this society requires that drawn human figures be set in a constant upright orientation relative to page co-ordinates (top of the pictorial space being aligned with the edge of the paper farthest from the child's position, and the bottom of the pictorial space being aligned with the edge of the paper closest to the child's position). They write (1966, p. 339) that young children are not indifferent to the orientation of abstract or realistic forms (here agreeing with such authors as Ghent [1961]), but instead do not carefully monitor the placement of figures within the pictorial framework (cf. Rouma, 1913).

Howard et al. (1966) define artistic convention favoured in western society as follows:

> In our society there are certain techniques and conventions in drawing: (1) the drawing should be a projective transformation of the thing drawn, (that is straight lines should be represented by straight lines), (2) the proportions of the original should be kept . . . and, (3) that which is gravitationally 'up' should be placed towards the edge of the paper farthest away from the drawer. (p. 340)

The third criterion described by Howard et al., is, arguably, the first to appear developmentally in children's drawing. There is, however, no reason to expect that a "top of paper equals farthest away" equation is ever made in other cultural groups. It is simply a culturally-promoted standard (Goodnow, 1972). A more natural standard would be "my top should be aligned with the top of my figures" (cf. Gridley, 1938). Some of the evidence indicating that young children do align their graphic figures in agreement with a posturally- or retinally-determined "top of child" will be examined in the section on figure orientation in children's drawing. For the present, it suffices to note that acquisition of the pictorial convention of figure orientation (framework top determines figure top) is a) culture-specific and b) may be linked to development within the perceptual domain.

Other authors (Gombrich, 1972; Wilson & Wilson, 1980) have proposed that children's art increasingly conforms to the expectations of the cultural group. Gombrich argues that the child's "schema of representation" increasingly conforms to the schema favoured by the child's cultural group. According to this view, the child "makes" art without attempting to "match" his rendition to the appearances of the objects he draws. The schema of making favoured by the child represents the child's "symbols of concepts" (Gombrich,1972, p. 292). Moreover, the child is not concerned with the "veridicality" of his symbols, i.e. their duplication of an object's exact appearance . The disoriented graphic human figure adequately symbolizes the young child's concept of "human being"; it is not yet a requirement of his representational schema that all human figures be situated in a rigid and well-defined (i.e. constantly upright) fashion within the pictorial "grid".

Wilson and Wilson (1980) have more specifically examined the way in which cultural "influences" increasingly shape children's representation of the human figure. In their study children were provided with a sloping baseline (a "hill") and asked to draw a person walking up or down the hill. They found that seven and eight year old children oriented their graphic human figures perpendicularly to the given baseline more often than five and six year olds. Interestingly, this developmental trend towards increasing perpendicularity is the reverse to what was found in previous studies (Piaget et al., 1956). According to Wilson et al., "innate" factors determining figure-baseline alignment co-exist with "influence" factors throughout representational development. The child will ignore given cultural solutions to graphic problems, e.g. that all figures must be upright even on a hill or "mountain" (Piaget et al., 1956), if a previously-established "graphic image" more satisfactorily (in the child's eyes) solves the problem. Unfortunately, the Wilsons tend to group every sort of factor which is not directly traceable to cultural influences into their innate category of graphic determinants.

Both Gombrich and the Wilsons dichotomize children's art-making into pre-conventional and conventional stages (Gombrich into matching-making, the Wilsons into innate-influence factors). Although the Wilsons' findings show that what they call "innate" factors (perceptual, cognitive and motor) persist in determining children's orientation of graphic figures, they continue to assert that children must inevitably adapt the convention of standard figure orientation. Children eventually come to draw only upright figures because that is the orientation found in the images provided by the cultural group. The Wilsons assert that children older than seven or eight derive most of their graphic images from the pictorial material they find around them.

The Wilsons' approach over-simplifies the issue of graphic figure orientations: innate, or perceptual, factors have been shown to be operative in the production of graphic figures well into the child's seventh year (Goodnow, 1977). Children do not stop evaluating visual information during graphic sequences (i.e.

information provided by the forms they draw and the enclosing framework) in order to switch to "copying" of comic-strip, magazine or book illustrations. Evidence supporting this position will be referred to throughout the following chapters.

Although writers are quite definite about the nature of the cultural convention to which children are supposedly aspiring in their art-making, a certain undercurrent running through these works implies that preconventional organization of pictorial space is unlawful or random. Prior to acquisition of the conventional standard for orienting figures in pictorial space, these writers suggest that figure placement is not governed by use of any criterion or principle. Acquisition of a convention thus regulates a previously random ordering of figures within the pictorial frame.

Goodnow (1972) has described the danger of assuming that children's performance in any task is "lawless" (p. 93) because it is not directed toward adult-defined criteria-of-success, or is not informed by the rules adults use in solving tasks. She writes that "errors," as defined by adult standards of performance, are in fact solutions appropriate to the child's definition of the problem. Developmentally-determined principles dictate both the techniques and the criterion for a successful solution that will be applied to a graphic problem. Until children have acquired the "tricks of the trade," or task strategies favoured by the cultural group to which they belong, they will solve tasks in all media according to rules determined by two factors: level of development in the domains affected by the performance and the constraints of the medium in which the task is accomplished. Children's performances can therefore be labelled sub-standard only if error patterns reveal no transition from one set of rules to a developmentally later set.

> The first point to be made is that rules can be isolated, and a progression of rules can be charted against age. (Goodnow, 1972, p. 95)

Inverted figures, according to Goodnow (1977), should not be considered amusing failures to achieve an adult standard of graphic figure orientation, but instead the inevitable result of the deployment of a developmentally-determined graphic rule system, or syntax. In addition, the convention of representation used by adults in post-western Renaissance societies has been neither achieved nor aspired to by adults in the overwhelming majority of societies so far existent (White, 1958).

Can "learning the convention" adequately describe children's increasingly upright placement of figures within pictorial space? Some authors (E. J. Gibson, 1969; J. J. Gibson, 1966, 1971) have argued that maturation of the perceptual system makes possible a particular way of artistically "seeing," and thus of depicting reality.

They describe the artistic convention in the following way. Firstly, the convention demands that the structure of the pictorial display correspond as closely as possible to the structure of ambient light emanating from objects. Secondly, the structure of the visual world must be represented from a stationary viewpoint, i.e. as if seen without eye movements. Thirdly, this stationary visual display must be mapped onto a two-dimensional surface, in which the frontal surfaces of objects are featured. The three-dimensional and hidden aspects of objects are represented by a repertoire of artistic devices, or "tricks of the trade."

Gibson (1971) states that the ability to depict the projected appearance of objects on a two-dimensional surface demands adoption of a "perspective attitude." Developed in Italy and Northern Europe during the fifteenth and sixteenth centuries, this convention demands that the viewer accept the pictorial frame as a window, inside which a view of the environment is displayed. For example, in 1715 the painter Taylor asserted that a faithful reproduction of a view required that ". . . the light comes to the Spectator's Eye in the very same manner as it would do from the Objects themselves" (in White, 1958, p. 35). Similarly, in our society a photograph is generally considered accurate to the extent to which it duplicates the features of the objects it represents (Gombrich, 1972, p. 38).

Gibson (1966) writes that ". . . the ability to see the world as a picture must be learned." Artist and beholder must share basic "rules of the game" if the artwork is to transmit every aspect of the objects treated. There must be basic agreement between artist and viewer about (a) which properties are best transmitted in which media, and (b) which artistic devices best transmit these properties. In developmental studies, Korzenik (1976, 1977) has described how young children come to design their drawings to transmit meaning to viewers removed in time and space from the setting in which the drawing was made. She terms this development as "decontextualization" of the drawing product. Young children eventually realize that their art products must embody, at least minimally, a standard language of form understandable to the removed viewer, and that use of certain accepted conventions will further this understanding. For example, the child learns that the viewer will not inevitably turn the paper so as to right a figure which is inverted in relation to the picture framework, but may inconveniently ask "Why is it upside down?"

Gibson (1966) specifies that reproducing one view of the environment is not in agreement with how objects are actually seen; E. J. Gibson (1969) adds that this convention contradicts both how children see objects and what they know about them. To represent from a one-point perspective demands a selection from the multitude of constantly changing views engendered by eye movements. What is seen must be frozen into one time frame in which selected aspects of the visual display (and not those necessarily criterial to the child) are represented. All features extraneous to this one view must be excluded if the picture is to be veridical. This may "go against the grain" of normal cognitive functioning, for no one refuses, as a rule, to add information from past experience to what is momentarily seen.

> Detecting the permanence of the objective environment behind barriers or outside the momentary field of view, or behind one's own back, is entailed in the fact of intelligent behaviour. (Gibson, 1966, p. 206)

The adult artist (at least until the late nineteenth century) ignores changes in the properties of objects that result from movement of the eyes or head, in order to fix on a two-dimensional surface the projected surfaces of objects. The viewer accepts that these fixed projected forms are the equivalents of objects, as seen while stationary or in motion. Gibson (1971) argues that pictures are informative only to the degree to which they recapture the underlying structure of objects, i.e. the facets of objects which do not change as a result of transformations produced by movement, changes in lighting, or other "distortions." A picture is veridical if it ". . . contains the same kind of timeless invariants that a sequence of perspectives contains." (p. 31)

The perspective attitude is learned, and is not inherent in the perception of the world. Prior to acquiring this attitude, young children represent the world "naively" (naive attitude, Gibson, 1971). Being incapable of analyzing the projected appearance of objects, young children represent the invariants or non-changing structural properties of form which the level of their perceptual system enables them to detect. Because of the undeveloped state of their perceptual system, young children detect, and inevitably represent, the most global invariants (Gibson, 1969). As well, since the "prototypes" (stored invariants) are primitive, represented features of objects appear in juxtaposed arrangements. Representational development consists, then, of increasing capacity to detect form invariants (of which orientation is one), and a concomitant capacity to analyze the appearance of objects preparatory to their depiction.

While sharing some similarities with the above model of representational development, Arnheim (1954, 1966) states that equating percept with drawing is unwarranted. The Gibsons assume that children somehow simultaneously perceive both the appearance and structure of objects, and that detection of invariants is synonymous with the processing of visual information. Arnheim states that while children do abstract the structure of what is perceived, this does not occur at the initial moment of perception. Rather, visual information must be internalized (within the perceptual sphere), its structural features abstracted, and finally this structure organized into a form conducive to representation in a specific medium. Arnheim does not believe that drawing directly represents invariants the child has been able to detect, or that it is even possible to reproduce these invariants on paper. Some experience with a medium, and knowledge of its characteristics is required.

Arnheim argues that "representational concepts" develop long before the operations of logical thinking become apparent. He states that young children have one representational concept for depicting "Man," "Dog," and so on; all aspects of an object are combined into one visual concept. Similarly, in depicting spatial relations one organizational system is applied to the depiction of all perspective views: aerial, frontal, or projective.

> As long as the two-dimensional view is not differentiated from the projective view, the flat pictorial plane serves to represent them both. (1954, p. 202)

Young children perceive both the frontal and aerial view of objects, and often attempt to map them both onto pictorial surface. Frontal, aerial and projective systems for representing pictorial space gradually become discrete, with children applying one of these systems to each drawing without implicating the others.

Whether the drawing of upright figures must await acquisition of perceptual or cognitive systems in many ways begs the issue. The approach of this study can be formulated as a question: how does young children's judgement of the orientation of form affect the drawing process, specifically the sequence of graphic figure construction underlying the orientation of the completed figure?

Major theoretical approaches to the orientation of children's HFDs

The Piagetian model: the conceptualization of pictorial space. Piaget (1969), Piaget et al. (1956, 1963) and those writers who have applied Piaget's theory to children's symbolic development (Furth, Ross & Youniss, 1974; Inhelder, 1965; Smedslund, 1963), stress that symbolic behaviour, of which they consider drawing to be an example, is a function of the figurative aspect of thinking and not of its essence, which they emphasize is sensori-motor and later operational thought. Children at all stages represent the symbols of thought, and not the actions and operations of which it is composed. Questions about symbolic development and drawing are typically phrased as follows.

> What role should be attributed to symbolic imagery as an auxiliary of thought? (Inhelder, 1966, p. 4)

Inhelder (1966) asserts that symbolic imagery (and its direct byproduct, drawings) acts as a storehouse of "past" perceptions and, once operationality has been achieved, "anticipatory images." Preconceptual children copy past perceptions; conceptual children create images from fully formed schemae, prior to the act of drawing.

The operational child has distanced himself from his set of symbolic tools (language, drawing, and other symbol systems), manipulating internal representations (schemata) to form logical propositions. Unlike the younger child, the operational child can transpose, combine and reverse spatial relations between objects in their absence. Schema do not represent the figurative aspect of objects but the accumulated experience of acting upon objects.

Drawing, Piaget et al. (1956) write, remains only the deferred imitation of the appearance of an object if the child has not yet acquired a schema for the object. Drawings are therefore based on unveridical figurative information, given that young children do not yet understand the "reality" of the object, i.e. how its identity remains constant across transformation. Even the older child's drawings are once-removed from his understanding of objects, or their schema. In fact, according to Piaget (1969), children eventually prefer to express an object's transformations through other means than drawing, i.e. in propositional form. The point to be made, however, is that the figurative aspects of schemata, i.e. the aspects of objects and events which children represent, keep step with advances in the acquisition of operational thought. The child who can conserve the identity of objects, regardless of transformations in appearance, is ready to depict these transformations in symbolic form (because symbols preserve the figurative aspects of transformations).

In addition to possessing preconceptual (or sensori-motor) schemata, pre-operational children do not possess reliable perceptual information about objects. Their "perceptual images" are unstructured because they do not visually explore objects (centrate) completely. Instead they concentrate on the areas of highest visual attraction, disregarding other information yielding areas in a visual display. Spending an inordinately large amount of their viewing time on the most salient areas, they are unable to produce a balanced series of eye movements which encompass a whole display. Their perceptual images of objects therefore represent an incomplete understanding of objects (Piaget, 1969).

According to Piaget et al. (1963), the ability to make a full visual exploration of objects is a prerequisite for the formation of comprehensive schemata and anticipatory figurative images. Piaget et al. (1956) state that "conceptual space" must be constructed, and that this construction necessitates the application of a logical system to pictorial space. This rationalization of space becomes apparent when children begin to relate all objects in pictorial space to one viewpoint, rather than a series of disparate viewpoints. Children become able to co-ordinate all perspective views into one "rationalized" view: this is an achievement of logic. The end point of this process is similar to that defined by Gibson (1950): children come to represent projected form as seen from one stationary point (Gibson's "perspective attitude").

One ability is crucial to the development of a co-ordinated system of perspective: the capacity to project a straight line from the observer's position into all areas of the picture plane. Young children at the sensori-motor stage project a series of discrete straight lines, separately sighting or "taking aim" (Piaget et al., 1956, p. 155) on each form they draw within pictorial space. Forms are therefore oriented relative to single sightings, each form having its own linear axis.

It is the capacity to co-ordinate these sightings, to project a series of straight lines from one viewpoint, that underlies spacial unification of the pictorial field. Until this ability has been acquired, human figures in drawings will be oriented individually, In particular, they will be oriented using other forms as baselines.

For Piaget et al. (1956, p. 156) the projected straight line is the basic building block in the development of a perspective system. A perspective system is

> . . . concerned with preserving the shape of straight lines despite modification in length, inclination, parallelity, etc. Hence it is mainly the projective straight line we must deal with, both in its own right and in relation to elementary perspective, since the straight line is the sole aspect of shape which remains unaffected by perspective changes.

Piaget et al. (1956) note that perceptual capacity to discriminate that a straight line is different from other line configurations is qualitatively different from the logical operation of planning a system of intra-picture straight lines. This finding has been corroborated in other studies (Graham, Berman & Ernhart, 1960; Olson, 1970), although Olson doubts that once children can imagine straight lines projecting in any direction from one viewpoint they will automatically be able to "plan" space. However, Piaget et al. (1956, p. 173) argue that use of a unified anticipatory image is the basic requirement for attaining a co-ordinated system of perspectives. Pior to this each object is imagined separately, as if unrelated to objects around it. This is an example of young children's synthetic incapacity.

Children younger than six are particularly concerned with the topographical arrangement of forms in drawing, i.e. with the accurate forming of each part and the combining of small numbers of parts into units (Piaget et al., 1956, chapter 3). This precludes attention to other form relations which underly the creation of uniform, overall, figure orientation axes, i.e. metric, Euclidean and projective relations between forms. Although being able to differentiate representations where a one-perspective view is featured from representations containing a number of perspective views, young children cannot reconstruct on paper a unified view of a visual display.

As the pre-operational child cannot co-ordinate his sightings, objects are represented as absolutes. Although figures are attached to each other, often at right angles, each figure exhibits a "pseudo-constancy" (Inhelder, 1965, p. 15), characterized by an ". . . incapacity to symbolize the continuous transformations of shapes and movements." Topographical features outweigh all other spacial relations, as young children make ". . . efforts to conserve certain features of the figure while neglecting others." For the young child, criterial features are those whose identity does not change across transformations, i.e. the topography of forms (proximity, separation, order, enclosure and continuity of forms). Of what does "rationalization of space" consist? Piaget et al. (1956) state that operational children structure pictorial space in the following way. Being able to internally imagine the transformation of objects through possession of schemata, they can preplan the appearance of objects after transformations. Being able to co-ordinate a series of perspective views, they can subordinate all figures to one viewpoint.

Piaget et al. (1956) state that children must attain operationality before all figures can be oriented relative to external framework cues. Prior to this, all figures in pictorial space are oriented relative to intrinsic cues (e.g. the baselines given by proximate forms). Furthermore, pre-operational children draw figures in non-standard orientations because their figurative information about the appearance of human forms is unstructured. Piaget et al. (1956) in fact acknowledge their debt to Luquet (1927), who also emphasized the amorphous nature of the images underlying drawing. In the absence of the object to be drawn, pre-operational children "lose their place" in assembling the parts of the object, being forced to work from unstructured mental constructs. Piaget et al. compare this inability to order a graphic series of parts with the problems young children encounter in reconstructing a series of objects in the absence of the model. The child, lacking schemata for conserving the spatial relations of objects, resorts to a "topographical ordering," i.e. attends only to the topographical relations between objects. Thus, non-standard graphic human figures are further evidence of "synthetic incapacity," and disappear with the onset of logical thought.

Most of the evidence for Piaget's model of drawing, in fact his model of all symbolic behaviour, is derived from two types of tasks, copying and the ordering of arrangements of objects (Piaget et al., 1956). These tasks, although ideal for monitoring the growth of mathematical ability, may only indirectly indicate drawing development (Gardner, 1980). For, as many writers (Gardner, 1973; Golomb, 1974, 1976; Olson, 1970) have asked, is conceptualization sufficient for execution of the concept in a medium?

Many questions are of necessity left unanswered by Piaget's formulations, because Piaget tended to extend his formulations to include symbolic development. For example, can it be assumed that performance in ordering a series of physically present objects can be compared to graphic ordering of human figure parts, given that graphic parts must be first "accessed" (Freeman, 1977) from memory? Can it be assumed that perspective-taking, a logical capacity, is the sole determinant of a unified representation of space? Should non-standard figures be considered indication of an incapacity to imagine lines radiating from the child's position into pictorial space? What is the nature of the figurative (or, for that matter, perceptual) images from which children supposedly draw, leading to unstructured human figure drawings? Many of the theoretical gaps in Piaget's model of symbolic development (which can at least be partly attributed to Piaget's assimilation of symbolic behaviour to a cognitive super-structure which attempts to explain all behaviour) can also be discerned in what Golomb (1973, p. 204) has called "conceptual" theories of drawing. The approach of other cognitive developmentalists to the phenomenon of orientation in children's human figure drawings is described next.

The "Conceptualist" model. Early cognitive theorists of children's drawings were adamant that children drew "what they know" (Eng, 1931, pp. 181-188). From this premise, it was argued that human figures in children's drawings are spatially misplaced because the image, or mental picture, of humans is disoriented or confused, and the parts incorrectly synthesized into a coherent internal representation (Stern, 1930). From a stage of intellectual realism, where children copy these unorganized images, children advance to a stage where they can draw the "real appearance" of an object. At this point, they attend to the visual attributes of the objects they draw. Attending to the visual properties of the human figure, these older children can faithfully replicate it, including its correct (upright) orientation (Luquet, 1920). Orientation of HFDs thus became an indice on intelligence tests, in which correct representation of a human figure's orientation was considered additional evidence that the child's concept for "human" was complete (Goodenough, 1926; Thorndike, 1913).

However, it has become increasingly evident that children do not directly replicate their store of concepts in drawings. Writers (Golomb, 1973; Goodnow, 1972, 1977; Olson, 1970) have emphasized the importance of distinguishing between concepts and their execution in a specific medium.

Gardner (1973) and Korzenik (1974, 1976) specify that conceptualization and execution of concepts through a performance are two steps in the process of artistic problem-solving. Both emerge during the exercise of artistic behaviour. As children develop, the problem-solving strategies they employ become increasingly tailored to the specific demands of the medium in which the artistic problem is being solved.

Gardner (1973) defines three steps underlying the translation of conceptual attainments into artistic form. The child a) determines the elements of the problem, defining in advance the end state; b) selects the forms within the medium necessary to create the end state; c) undertakes ". . . the restructuring and re-integration of factors essential for the desired end state." (p. 276)

The process described by Gardner is increasingly determined, as children develop, by planning, monitoring of the ongoing performance, and evaluation. This requires active cognitive restructuring of an ongoing artistic process, rather than reproduction of a static initial concept.

Olson (1970) writes that covert conceptual properties must be translated into a sequential process, extended in time, if performance in any medium is to be successful. Therefore, knowledge of a concept's attributes is not synonymous with their representation. Performance demands, first, the extraction of that visual information which is conducive to continuation of the performance towards the desired objective, i.e. a constant monitoring of configurations already produced in the behavioural stream. Second, there must exist a strategy for decoding the meaning of this information; Olson argues that visual cues represent the alternatives that must be chosen from during a behavioural sequence. This may be characterized as "looking outward at what you're doing rather than inward at what you're representing." Correct decision-making (for example, in the production of an upright HFD), which keeps performance moving in the right direction, calls for mastery of the total information available.

Goodnow (1977, pp. 51-52) states that children's "solutions" to graphic problems determine the appearance of the final graphic product, including orientation, which features are included, and the complexity of the figure.

She adds that psychology has been tempted to equate "knowing what" with "knowing how" (p. 3), when knowledge is useless if it cannot be structured in a medium. Each medium demands specific strategies and techniques for structuring knowledge. Therefore, certain properties of objects are best expressed through one medium e.g. the volume of solid objects through modelling, or shape through drawing (Smith, 1978).

So, what an artistic task may measure is the child's capacity to translate a certain concept into a medium. Researchers may assume that the child's concept of a human being is unstructured because his graphic human figure is disoriented. However, the child may in fact be lacking a graphic "system" (Olson, 1970), "plan" (Miller, Galanter & Pibram, 1966) or "executive program" (Freeman, 1975b, 1977) for gathering and transforming the information necessary for a successful performance, in this case an upright graphic figure.

Freeman (1977) has hypothesized that figure orientation in drawings is the child's solution to a spatial organization problem. Two types of information are available during performance, intrinsic (within form) and external (pictorial framework) cues. Of these, children orient their figures using either one, or a combination of these cues. Children who orient their figures according to the configurational properties contained within each form will produce non-standard figures (they attach each form after monitoring the discrete orientations of previously drawn forms). Standard figures, on the other hand, are drawn by children who align each form in the figure relative to the enclosing framework.

The orientation of children's HFDs may be parsimoniously accounted for without introducing such internal determinants as images, formulae or schemata. Although all children have some (undetermined) internal representation of "human being," it is insufficient to state that the internalized version looks like the finished drawing of a human being. The findings so far discussed indicate that a more fertile area of theory formulation lies in the "measurable": i.e., how children analyze form orientation, and how this analysis contributes to the graphic placement of form resulting in specific figure orientations. Efforts can be directed towards looking at the ongoing process of drawing; discrimination of cues contained in forms drawn or given by the framework; the effect of cue selection on decisions made during the drawing sequence; the capacity of children to select cues which represent the appropriate alternative at each decision point. If a child judges each form to have its own absolute orientation and assembles forms according to this within-form criterion of top and bottom (Goodnow, 1977), it is highly unlikely that a single-axis, vertically upright figure will be drawn.

<u>The psychoanalytic model</u>. The orientation of young children's HFDs has been considered representative of a type of internal determinant other than cognition. In the psychoanalytic literature, horizontal, oblique or inverted HFDs have been treated as a symptom of emotional instability (DiLeo, 1970, Koppitz, 1968) or as the projection of a distorted body image or self-concept (Hammer, 1958, Jolles, 1952; Levy, 1958; Machover, 1949, 1953, 1960).

Clinicians accepting either, or both, of these definitions developed tests in which children were asked to draw themselves, a person of the other sex, or scenes containing more than one person. Human figure orientation in drawings was considered a diagnostic index of emotional state, i.e. an "Emotional Indicator" (Koppitz, 1969), or of self-concept, i.e. representative of certain personality traits (Machover, 1949, 1953).

In the earlier of these models (Machover, 1949), it was stated that children projected a self-image into their HFDs. Feelings and thoughts that children entertained about body image and self could be detected through analysis of the discrete items of their drawn figures.

Children's drawings were considered the ideal method to evade verbal defenses or confabulations.

> Stereotyped defenses are less easy to apply to graphomotor than verbal projections. (Machover, 1949, p. 85)

Machover (1953) defined figures in non-standard orientations as being significant of an insecure personality, forced to cope with changes for which it is not prepared. A "toppling" (oblique) figure represents feelings of unbalance, and is indicative of a personality in the middle of a transition crucial to its further growth. Hammer (1958, p. 43) stated that ". . . slanted or oblique figures are common in the drawings of preschizophrenic patients." DiLeo (1970) reached a conclusion similar to Machover's: that although children "see" (sic) the world differently than adults, non-standard orientation of drawn human figures can be credibly related to young children's "idiosyncratic" way of relating to people and events. Clinical psychologists employing projective techniques have generally considered disoriented figures to be externalizations of various personality traits in disequilibrium (Witkin, Lewis, Hertzman, Machover, Meisner & Wapner, 1954).

The second approach to orientation in children's HFDs within the psychoanalytic community, rationalized at great length by Koppitz (1968), features the emotional basis for human figure drawings. Koppitz asserts that HFDs reflect childrens feelings about themselves and those close to them. Drawings reflect the level of personal interaction between the child and his "protectors." Analysis of children's HFDs will therefore reveal children's emotional functioning in day to day situations, particularly his reactions to the dominant personalities in his life. Koppitz includes figures in non-standard orientation among her armamentum of Emotional Indicators. She defines disoriented figures as those slanted more than 15° from the vertical axis of the page.

She contends that "clinic patients, brain injured children, poor students, and special class pupils: . . ." produce more disoriented figures than "good students and well-adjusted pupils" (p. 59). In addition, oddly oriented figures are drawn by ". . . both aggressive and shy children, by youngsters with psychosomatic complaints, and . . . those who steal" (p. 59). Although Koppitz initially stresses that disoriented figures must be treated as an indice of a variety of discrete emotional disturbances, she staidly continues:

> It is not believed that this Emotional Indicator or HFDs reveals pre-schizoid behaviour or necessarily very serious disturbances in children. (1968, p. 59)

She concludes with the observation that diffuse emotional distress underlies the production of disoriented human figures, which signify ". . . an unstable nervous system, labile personality . . . above all it suggests that the child lacks secure footing" (p. 59).

The application of a syndrome-symptom model to children's drawings is based on the hypothesis that personality is expressed to an equal degree in all media of expression, but that drawing can outflank stereotyped defenses, especially in clinical populations who have undergone a great amount of testing. Wolff (1946, p. 30) considers all media to be equivalent as ". . . channels for the expression of personality," invariably acting as conduits through which pass fears, emotions and self-concept.

Frank (1939, p. 394) describes the concept of personality which underlies analysis of drawings.

> . . . a conception of personality as an aggregation of discrete measurable traits, factors or other separable entities, which are present in the individual in different quantity and organized according to individual patterns.

Confusion exists in the field as to the exact relationship between discrete traits and their representation in drawings.

> It is the experience of most clinicians that even untutored and unskilled individuals, including young children, draw figures that convey expressive ideas. The precise way in which this is used by the clinician cannot be specifically formulated. (Levy, 1950, p. 267)

Nor are writers always conservative in their interpretation of drawings. For example, Machover (1949), states that negro children have a predeliction for drawing mouths that are ". . . gaping holes of oral deprivation" (p. 86).

Many of the same criticisms that have been made about rigid cognitive interpretations of drawing have also been levelled at the psychoanalytic model. Freeman (1975b) argues that not only are interpretations such as Machover's untestable, but that researchers have no empirical basis for postulating a discrete one-channel feature-trait or feature-emotion relationship in drawings. He decries the practice of defining drawings as ". . . bundles of features, each one of which can be decoded separately as a homologue of a simple internal unit" (1975b, p. 18). He terms this practice "one-off analysis," and states that until the nature of the production problems inherent in drawing specific features is known, this type of analysis serves no purpose. While accepting that children do instill drawings with their "deeper passions," Freeman contends that there is, as yet, no "royal road" to successful analysis of personality traits in children's drawings.

Concluding that the orientation of children's graphic figures indicates an underlying disfunction is unwarranted for other reasons. The results of diagnostic Draw-a-Person tests have a low correlation with other measures of personality assessment (Roback, 1968; Swenson, 1968).

> People have been analyzing children's figure drawings for some time, and we still do not know how to tell on any particular occasion of drawing whether a child draws hands extra large because they have extra emotional value for him, because he is giving extra thought to the importance of all five fingers, or because he finds them easier to draw large. (Goodnow, 1976, p. 91)

It may not in fact be necessary to postulate an internal determinant to explain "what the child draws from." As Freeman notes, a more pertinent research strategy would be to start with what we can measure.

<u>Judgements of the orientation of form: Two standards</u>. Two factors which relate to children's perceptual

exploration of form will now be presented. Both may affect the orientation of children's HFDs. First, it will be shown that the character of children's visual exploration of form changes between the ages of four and seven years. Children of different ages have very different "judgement standards" (Ghent, 1961) for evaluating the orientation of simple forms. Second, it will be shown that children's evaluation of form orientation does affect their graphic construction of human figures, one result of the graphic construction process being figure orientation.

Evidence about children's judgement of the orientation of form comes from studies by Lila Ghent Braine (Antonovsky & Ghent, 1964; Braine, 1965a, 1965b, 1972, 1973; Ghent, 1961, 1964; Ghent & Bernstein, 1961; Ghent, Bernstein & Goldweber, 1960). Ghent (1961) found that when children younger than five were given abstract forms, they insisted that most of the abstract forms they viewed had one upright and one inverted orientation. Children older than six, on the other hand, considered only a few of these forms to have a particular upright orientation. Ghent et al. (1961) proposed that children younger than six were identifying that area of the form which had the greatest differentiation, or that area with the most salient internal detail, as the top. Ghent (1961) termed this salient feature the "focal point." It was the placement of "intra-figural information" (Vurpillot, 1968, 1976) which determined young children's judgements of form orientation. Ghent et al. stated that children older than six ignored the position of internal detail and judged the orientation of all forms by relating them to external frameworks (either proximate, such as paper edges, or distal, i.e. room co-ordinates). The area of the form nearest to the top of these framework cues acted as form top.

Ghent (1961, 1964; Ghent et al., 1960, 1961) postulated that these different bases for judgement reflected the functioning of a "central mechanism " which organized, scanning, or perceptual exploration, of form. This pattern of exploration changes in children's sixth year, and it is this transition which explains why children younger or older than six employ two distinct judgement standards.

Children younger than six judge the top of a form according to the location of the focal point. When the focal point is "high" the form is judged to be upright, when "low" upside down. In a series of tachistoscopic experiments, Ghent et al. (1960, 1961; Braine, 1965a, 1972) found that forms were recognized with much greater frequency when the point of differentiation was "high" in the form than when it was low. She argued that this was directly a function of how children scan form. She stated that children younger than six initially fixate on the point of highest visual salience, and then scan downwards from this focal point (this scanning "strategy" [Vurpillot, 1968] can be stated as "start at the focal point and scan downwards"). Since the initial point of fixation is the salient feature followed by a downward series of eye movements, a high focal point facilitates this optimal strategy: it enables the child to encompass the figure in one visual sweep of the eyes. However, this is not the case when the focal point appears at the bottom of forms. The child fixates on this point, but his downward sweep leads into empty space. The child must then compensate by redirecting his eyes back up the form (second series of eye movements) and then scan downwards to take in the form (third series of eye movements). A high focal point facilitates exploration of form, and is congruent with the favoured eye movement path. A low focal point interferes with an optimal (for this age) scanning strategy.

Ghent (Braine, 1972, 1973) states that as the central mechanism matures, scanning strategy changes. Children older than six fixate immediately on that part of the form closest to the external framework top, and then scan downwards. Preferred scanning direction is thus constant for both groups, downwards, but point of fixation has changed. Older children disregard all internal details as points of potential initial fixation. Figure 1 illustrates these changes in scanning strategy.

For younger children, the ease with which a form can be visually explored determines judgements of its orientation. Forms are judged to be upright with focal point on top because one series of downward eye movements can encompass the whole form. Low focal points disrupt this smooth pattern of exploration. The placement of internal detail does not interfere with the visual exploration of older children because point of fixation is independent of intra-figural information, centred on the upper (relative to the external framework) contour of form. The resiliency of these two judgement standards has been confirmed by other writers (Kerpelman & Pollack, 1964; Vurpillot, 1976).

A comprehensive definition of focal point is required if this concept is to avoid circular explanation (e.g. young children judge a form to be inverted, therefore the intra-figural details near the bottom are focal). Fortunately, some work has been done to clarify the

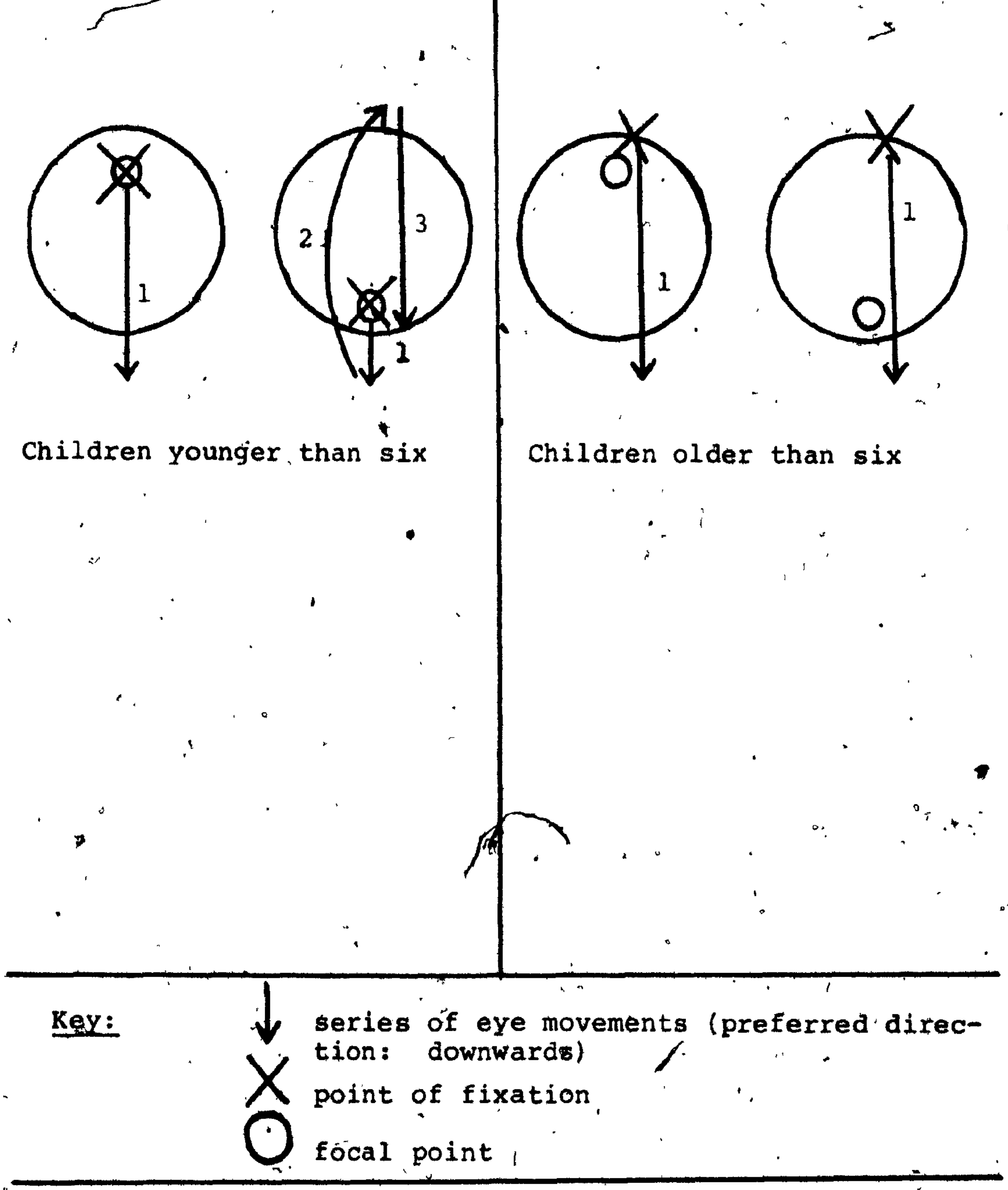

Figure 1. Ghent's (1961) two stage model of children's perceptual exploration of form.

visual properties of focal points.[3]

First, anecdotal evidence indicates that adults judge abstract artworks to have one upright orientation (Arnheim, 1954), which suggests, at least in the case of non-realistic images, that vestiges of an intra-figural standard for judging the orientation of form are present into adulthood.

Second, experimental studies have extracted some salient features that elicit judgements of a form's upright or inverted orientation, depending on their placement within the form.

Ghent (1961) provisionally defined focal point as the area of greatest differentiation within a form. Two types of tasks, tachistoscopic (Ghent et al., 1960, 1961) and paired-comparison (Antonovsky et al., 1964; Ghent, 1961) demonstrated that children younger than six consistently applied a focal point standard for judging form orientation to more than 40 separate forms. Ghent (1961, 1964) tentatively identified the following attributes rendering intra-figure features salient: 1) In figures of unequal area, the smaller portion acts as focal

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[3] Goodnow (Reference Note 1) has cautioned that Ghent (1961) has a specific a priori definition of focal point. Research into the effect of focal point on children's judgement of form orientation must acknowledge the, as yet, relative nature of this definition.

point. 2) The point of interruption of a figure acts as its focal point, e.g. the intersection of one line with another. 3) The area of greatest intensity, e.g. the darkest area, acts as focal point; black is a more "gaze-attracting" colour than gray or white. 4) Areas of high contrast, e.g. closely spaced lines or dots, act as focal points. 5) Colours, and colour hues, can be rated according to their power to attract the gaze. In placing two colours one above the other, one colour is more focal than the other. 6) Given two separate proximal forms of unequal size, the smaller figure acts as focal point.

Wohlwill and Wiener (1964) studied the effect of different dimensions of form on children's judgement of their orientation, specifically directionality, openness vs. closedness, and the position of internal detail inside the form. They found that directionality of form was the dimension most strongly discriminated when children made orientation judgements.

They discovered that vertical lines facilitated a downward scanning path. McGurk (1972) stated that although the directionality of form outweighs location of internal detail as a dimension of discrimination in children's orientation judgements, the location of internal detail plays a role when the directionality of a form is weak.

Howard et al. (1966) further analyzed dimensions of form which elicit orientation judgements. They hypothesized that since most objects in the environment are mono-oriented and bilaterally symmetrical (symmetrical about one axis), children as well as adults judge the vertical orientation of objects by this bisecting axis. They argued that young children judge abstract forms to be upright in one orientation because they generalize from perceptual experience with real objects to all new forms they encounter; experience in abstracting the structural properties of form is applied to all novel forms.

In judging where the top of a form is situated, young children visually evaluate where the "polar features" are located. Since most mono-oriented figures in the environment have their area of greatest differentiation on top and/or bottom, Howard et al. hypothesized that these polar areas acted as children's guide to the top and bottom of realistic and abstract forms. They contended that children judge form with polar features to be either upright or inverted depending on which polar feature was most differentiated (this more differentiated area acted as the top).

Howard et al. defined other dimensions of form which decide young children's judgement of the orientation of novel or non-figurative forms: 1) taper: most objects taper upwards, being broad at the bottom and narrow on top; 2) distribution of visual mass: objects look upside down when their visual mass is predominantly high in the object; 3) light-intensity gradient: the gradient of light intensity is associated with the experience of up and down; 4) points of attachment: if an object is attached at one end of its surface, then usually that end is lowest; 5) reflex eye movement tendencies: the eye first fixates on a) the area of dominant detail, b) the top of the figure in relation to the frame.

Like Ghent, Howard et al. also postulated a central mechanism for guiding sequences of eye movements. As this mechanism matures, eye movement patterns take on a less restricted character, expanding beyond areas of high differentiation to encompass surrounding framework features.

The crux of Ghent's (Braine, 1965b; Ghent et al., 1961) position is that perceptual exploration is a sequential, and not a simultaneous, motor activity. She argues that the sequence of exploration is a function of a developing central processing mechanism; this mechanism decrees that form is always scanned in a top to bottom direction, point of fixation being variable however.

Ghent (1961) acknowledges her debt to Hebb's theory of sequential visual exploration, noting that the concept of sequential perception is not new. Hebb (1949, 1968) describes a process whereby a sequential visual input fires a particular pattern of cell assemblies. As cell assemblies for objects are formed (producing images), covert scanning replaces overt scanning (Hebb, 1968): older children covertly scan the internal representation when encountering exemplars of an object already in stored image form, rather than overtly scanning the object itself. Exemplars of an object are matched with its internal representation to determine if they agree in all dimensions, or differ in some (e.g. orientation). Since non-realistic forms are not represented in image form (a pattern of cell assemblies never having been established for these forms), the form is judged "on its own merits," through overt scanning. The starting point of scanning in the case of new forms thus depends upon "the point of highest differentiation."

Studies of the development of children's eye movement patterns go some way towards explaining why the orientation of form is judged so differently by preschool and school age children. More than one author

(Elkind & Weiss, 1967; Gibson, 1963, 1969; Gibson, Pick & Osser, 1962; Kugelmass & Lieblich, 1970; Vurpillot, 1976) has claimed that early experience in reading improves (or trains) young children's visual search patterns. They have characterized this improvement as the increasing systemization of perceptual exploration.

Assuming that a graphic task requires the child to order a series of forms along an axis parallel to framework features, and to start this ordering near the framework top, the child who does not attend to framework information is at a great disadvantage.[4] If the child is attending to the topographical features of form, i.e. their individual configurational properties, the likelihood of all forms being aligned relative to external cues is greatly reduced. In the battle between internal and external cues for the child's attention (Freeman, 1977), internal cues have won. Studies to be examined in the next section show that young children only intermittently attend to framework cues in drawing, and sometimes treat each form they draw as

[4] The issue of whether children judge the orientation of form relative to retinal, postural or external frameworks is by no means resolved. The reader is referred to studies by Braine (1965b), Rock (1956; Rock & Heimer, 1957; Rock & Leaman, 1964) and Witkin (1959; Witkin & Asch, 1948) for discussion of conditions in which each framework becomes salient in children's orientation judgements.

having its own absolute orientation.

If, as Goodnow et al. (1972) claim, kindergartners are experiencing increasing cultural pressure to draw upright figures, the increasing amount of visual information available to the five year old child (external as well as internal cues) may provide the "raw data" required for this task.

<u>The effect of orientation judgements on the orientation of children's HFDs</u>. The studies described in the previous section indicate that six years is the transition point from one judgement standard of form orientation to a second. Children younger than six judge the orientation of form by the placement of internal details, called focal points. Children older than six judge the orientation of form relative to directional indicators given by an enclosing framework (Ghent, 1961; Ghent et al., 1961; Moeller & Goodnow, 1963; Pick, Klein & Pick, 1966). How then, does the judgement standard employed by young children affect the orientation of their drawn human figures?

There is evidence from a number of studies (Braine, 1973; Eldred, 1973; Fabien, 1945; Serpell, 1971; Shapiro, 1960) that young children graphically rotate forms during copying tasks to a subjectively-determined (cf.

Vurpillot, 1976) upright orientation. These authors contend that such rotations are not random, but are shifts designed to bring the form into a subjective upright orientation. As discussed previously, the subjective upright of abstract forms is determined by the placement of internal details or focal points (Ghent, 1961), vertical directionality and, in some forms, point of closure (Wohlwill et al., 1964). When the focal point or point of closure is near the bottom of a model form, the child "rights" his copied form by placing focal point or point of closure at the top. When the model form features horizontal lines, the child rights his copied form by rotating horizontal lines to the vertical. Abstract forms that children judge to be inverted or horizontal, according to placement of the three within-form criteria described above, are rotated during copying to the orientation judged upright (Braine, 1973). Serpell (1971) and Shapiro (1960) found this phenomenon to exist among populations of African children; Bender (1952) noted that sub-normal adult populations also rotated horizontally-aligned abstract forms to a vertical orientation.

Serpell (1971) writes that rotations are a function of each form's gestalt interacting with perceptual preference for one upright orientation of form.

> . . . when orientation errors occur in copying tasks they are directional rotations influenced by orientation preferences rather than random "disorientations. (Serpell, 1971, p. 238)

Lila Ghent-Braine (1973) gives the following explanation of rotations in copying: a) children do not see (or copy from) a stationary, simultaneously, processed image on the retina. Form is processed sequentially; b) "Any copy is a function of the perceived figure, its apparent size, shape, orientation and the techniques available to the subject for producing the perceived characteristics of the figure." (Braine, 1973, p. 52); c) form is optimally reproduced in the sequential order in which it is scanned, typically from the focal point downwards. When a form is "upside down," e.g. the focal point is "low," the child will subjectively right the form in his copy so that it agrees with an optimal scanning strategy.

Braine (1973) argues that the placement of internal detail or focal points within a provided form (as well as vertical directionality) determines whether the child's copy will be a rotated version of the model form. For example, if the focal point appears low in the form, the child will reproduce the form with the focal point on top: graphic rotation has occurred during the copying process.

A copying task only approximates a natural drawing situation. Do internal cues the children provide in the forms they draw, specifically the within-form placement of cues, affect where later attached forms appear? In copying tasks children copy provided forms, while in drawing children add forms on to those already drawn. The difference in the two responses which are elicited by orientation judgements (in copying tasks rearranging lines, in drawing assembling a series of forms) demand that the differing requirements of the tasks be defined.

The experiments described above provided a model to be copied (Braine, 1973; Eldred, 1973). If a child rotated his copy 90 or 180 degrees from the orientation of the model, it was concluded that he had judged the model to be sideways or inverted. These writers then sought the potential internal cues which had caused their subjects to judge the model sideways or upside down. This was in effect a post facto analysis of potential elicitors of figure rotations.

A more direct method is available for measuring the effect of internal cues on children's figure orientations. In drawing completion tasks (Bassett, 1976; Goodnow, 1977; Goodnow et al., 1972) children are provided with a basal form, or "head", from which they are asked to complete a human figure.

In these studies the hypothesis is that if children judge the head form to be inverted because of the placement of internal cues within its boundaries, they will complete an inverted figure. This type of graphic task is designed to measure the orientation effect of early parts on later parts in a graphic sequence, particularly the effect of the basal form on the orientation of later attached forms. In copying tasks, on the other hand, children are provided with forms and rotating occurs in the spatial-temporal interval between model and copy. In completion tasks this distance is reduced to a minimum: the child's judgement of a form's orientation can be measured by where he adds on the next form, at the "bottom" as determined by within-form directional criterion or at the bottom as defined by framework co-ordinates.

In completion tasks the experimenter can: a) select cues which resemble, or depart from those spontaneously drawn by children; b) position cues anywhere within the basal form in order to measure the effect on orientation of later parts; c) prohibit rotation of the paper or change in the child's position: children cannot relocate the cues at the top of the form before drawing by turning the paper.

Since the task is constrained (the position of the paper remains constant), a new graphic response is required: the capacity to draw a figure in the orientation indicated by cue placement (e.g. draw an inverted figure when the cues are placed low). It must be ascertained that children can actually draw figures in the orientations required by their perceptual judgements.

A germinal, and badly neglected, study by Pearl Gridley (1938) anticipated many of the issues examined today by psychologists interested in children's drawings. Although she did not provide forms for completion, she carefully monitored how children orient each figure part in response to those already drawn; she did so by recording a) the order of parts drawn (the sequence), b) where each part was attached to previous parts, and c) when children rotated the paper during the drawing sequence.

Anticipating such writers as Golomb (1973, 1974) and Ames (1945), Gridley varied the instructions to children ("draw a big man," vs. "draw a little man") in order to ". . . elicit modifications of the child's spontaneous graphic patterns in response to various forms of verbal and visual suggestion" (p. 95). She also kept a meticulous record of the verbal and postural behaviour accompanying drawing, an approach which has only recently become widely used (Korzenik, 1974, 1976, 1977).

Gridley found that four year old children not only ignored the framework of the paper in orienting their human figures, but also had great difficulty in achieving a constant within-figure vertical order of parts.[5] They treated each form as an absolute, rotating the paper to keep the area of each form judged as "top" in agreement with their "top," i.e. their postural (and possibly retinal) top. When they did not rotate the paper, they aligned the axis of their bodies in agreement with the axis of the part being drawn by leaning across the table, or changing their seats. Each part was assigned its own orientation, the configuration of the part indicating its top and vertical axis; the child disregarded the top and vertical axis of the paper.

Gridley discovered that a number of internal, or within-form cues determined children's judgement of the top and vertical axes of drawn forms. Oval forms with accentuated longitudinal axes were completed by the attachment of appendages (legs, arms, bodies) near the

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[5]For discussion of young children's head-to-feet serial orders for drawing human figures, the reader is referred to studies by Ames (1943, 1945; Ames & Ilg, 1963), Arnheim (1954, pp. 182-187), Foellinger & Trabasso (1977), and Kellogg (1969). Arnheim and Kellogg suggest that extended graphic linear orders arise as children become increasingly capable of differentiating form.

tapering ends; only rarely were parts attached on the long sides. This longitudinal axis acted as the vertical axis of the form; the tapering ends acted as top or bottom.

The distribution of the mass of the form also affected its judged orientation. In forms with a broad base and a tapering or "pointy" projection, the next form added was usually attached to the wide base, the tapering area acted as top of the form (cf. Howard et al., 1966).

In agreement with Rouma's (1905) observations, Gridley found that three other factors determined figure orientation: a) forms are added to fill large areas of remaining available space;[6] b) the basal form's point of closure acted as the top of the form (cf. Wohlwill et al., 1964); c) legs, and other extended single lines, were

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[6] Kellogg (1969) has written that even children who scribble seek to achieve balance and harmony within pictorial space; scribblers typically balance areas of scribbling; older children seek to achieve harmony in their placement of simple forms. Three kinds of balance can be distinguished: top-bottom, left-right and over-all. In top-bottom balance, most markings at the top of the configuration are balanced by similar markings at the bottom. In left-right balance most markings at the left are matched by markings at the right. Over-all balance, as in a rectangle or oval, is a combination of the other two kinds of balance (pp. 53-56).

drawn perpendicular to that edge of the paper most proximate to the basal form.

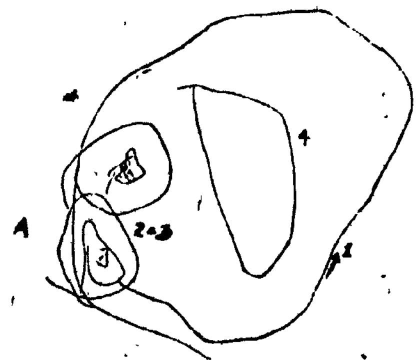
Gridley stated that young children rotated the paper to keep each form upright relative to the child's position; the subjective upright of each form was judged according to the distribution of the form's mass, the longitudinal axis of oval forms, and the point of closure on the form's contour. Four year old children did not generally draw upright figures in this study: 63 per cent of all subjects drew at least one figure which deviated from the conventional norm of agreement between figure and page axes.

Gridley suggested that attention to the forming of each part precluded consideration of their vertical alignment along one axis parallel to page sides. Freeman (1977) has hypothesized that "production problems" (arising during the production of graphic linear orders) are caused by the discrepancy between "intention" and "interpretation." The original intention becomes clouded as the forms drawn by the child suggest new meanings or interpretations. Perhaps many a child who has set out to draw a person has found something in the configuration of his forms, e.g. a horizontal axis, indicating that he <u>really</u> meant to draw a dog or other animal. Interpretation may supplant intention in the drawings of young children, especially when the forms drawn suggest new meaning.

Gridley (1938) contended that two conflicting criteria determined the axis of orientation visible in the completed human figure. Young children seek to achieve mutual agreement in orientation between parts and at the same time maintain a constant within-figure axis of orientation. In the first case, four year old children rotate the paper to keep each form right side up, in the second case they rotate the paper to keep the whole figure upright (relative to their postural upright).

Three drawing protocols from Gridley's (1938) study illustrate the effect of children's judgement of a form's orientation on the point of attachment of later appended forms, and, indirectly, on the orientation of the completed figure.

In Figure 2, a four year old boy drew a form with a broad base and tapering top. He then drew the eyes near the tapering end, which acted as top, and filled in the mouth "below" the eyes, i.e. below relative to a within-form definition of top. Interestingly, he drew the facial features along an axis perpendicular to his own, not rotating the paper to bring the axis of the figure into agreement with his vertical axis until the drawing was completed. In this drawing the top of the form was



Situation 1: *Man.* 1st Day.

Record of Drawing:

"I can draw a boy. No, I can't. Make a funny face."

Lines 1-4 Rotates 90 degrees clockwise; *A* becomes top.

Q. 1 "Face."

Q. 2 "Eye. Eye." When *E* questioned concerning pupil, child said, "Eye. Eye. I told you. Eye just the same," almost screaming with annoyance.

Q. 4 "Mouth."

Q. total "Boy.'

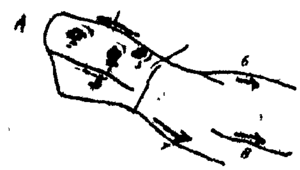
Figure 2. Drawing protocol (From Gridley, P.F.) Graphic representation of a man by four year old children in nine prescribed drawing situations. Genetic Psychology Monographs. 1938, 20, 183-350.

a function of the distribution of the basal form's mass (the broad base acting as bottom, the point of closure and tapering area acting as top).

Figure 3 shows a drawing by a four year old girl. Two figure orientations are evident here. The child drew in the facial features relative to her vertical axis. Then, noticing that the configuration of the basal form (distribution of mass and directionality of the dominant lines) indicates that the figure is "really" sideways, she rotated the paper and finished the legs in a second orientation, 90 degrees to the facial features but in agreement with the orientation dictated by the basal form configuration. Note that this child always rotated the paper to keep the axis of the units she was currently drawing aligned with her vertical axis.

The boy who drew the inverted human figure in Figure 4 drew almost the whole figure (except the arms) upside down before rotating the paper 180 degrees to bring the top of the figure into agreement with his "top." Noticeable here is that the point of closure (near A) and the longitudinal axis depicted, respectively, top of figure and its vertical axis.

Happily, Gridley kept track of paper rotations or changes of position during drawing as children evaluated



Situation 2: *Little Man.* 1st Day.

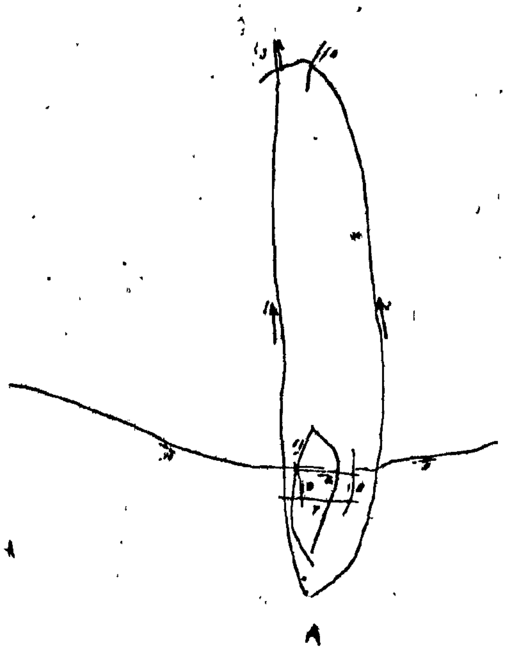
Record of Drawing:

Line 1 "There's a man."

Lines 2-5 Stops as if finished.
Then says, "I'll make his legs."
Paper slips, rotating 45 degrees clockwise;
A becomes top.

Lines 6-8

Figure 3. Drawing protocol. (From Gridley, P.F. Graphic representation of a man by four year old children in nine prescribed drawing situations. Genetic Psychology Monographs. 1938, 20, 183-350. Copyright 1938 by the American Psychological Association. Reprinted by permission.)



Situation 3: *Big Man.* 1st Day.

Record of Drawing:

"I can't . . . you do."
Lines 1-9
Rotates 180 degrees; *A* becomes top.
Line 10 "Arm."
Line 11 "'Nother arm."
Q. 1-2 "That's a big man."
Q. 5 "Ear."
Q. 6-9 "Ear."
Q. 4 "Leg."

Figure 4. Drawing protocol. (From Gridley, P.F. Graphic representation of a man by four year old children in nine prescribed drawing situations. Genetic Psychology Monographs. 1938, 20, 183-350. Copyright 1938 by the American Psychological Association. Reprinted by permission.)

(and graphically responded to) the internal cues in the forms they drew. Other studies (Bassett, 1976; Goodnow, 1977; Goodnow et al., 1972) have provided internal cues (two dots or "eyes"), and measured their effect on placement of later forms and orientation of completed figure while prohibiting rotation of the paper. Using this method, it is easier in many ways to control and observe the drawing process, but it also demands that subjects be able to draw a figure in the orientation indicated by an upside down basal form: an inverted figure.

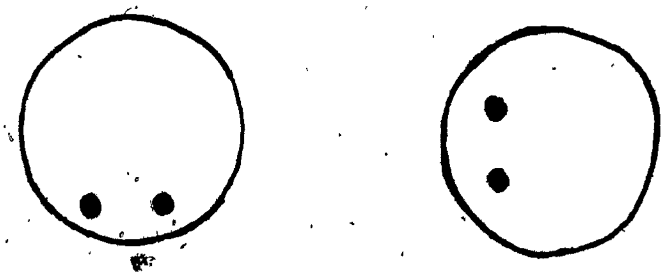
The findings of the study conducted by Goodnow et al. (1972) are described next, and their hypothesis explaining the effect of internal cues on figure orientation examined. Then, on the basis of a study by this author (Smith, Reference note 2), an alternate hypothesis is advanced to account for the utilization of internal or external cues during figure productions.

Goodnow et al. (1972) provided three to six year old children with a circle containing two dots (or "eyes") and asked them to draw a human figure ("finish this person"). In one version of the stimulus the dots were situated low in the circle, aligned along a horizontal axis near the bottom periphery of the stimulus; the second version featured "sideways" eyes, the dots here being located near the side of the circle along a vertical axis. Figure 5 illustrates the stimuli and results of this study.

These authors found that children younger than seven produced inverted and horizontal figures in response to, respectively, the eyes low and eyes sideways stimuli, in addition to upright figures. The frequency of inverted and horizontal figures varied as a function of age. The eyes sideways stimulus elicited a decreasing frequency of horizontal figures as a function of development. The eyes low stimulus elicited more inverted figures in the four and six year old groups than in the five year old group.

Goodnow et al. hypothesized that two graphic principles determined the type of figure orientation drawn. Children who drew figures is non-standard orientation were obeying an agreement between parts principle: the orientation of the later parts of a figure agree with the orientation of the initial unit. Children who drew figures in standard orientation were obeying a standard page principle: all parts of the figure are aligned along an axis agreeing with the vertical axis of the page.

Goodnow et al. stated that five year old children produced upright figures rather than inverted figures



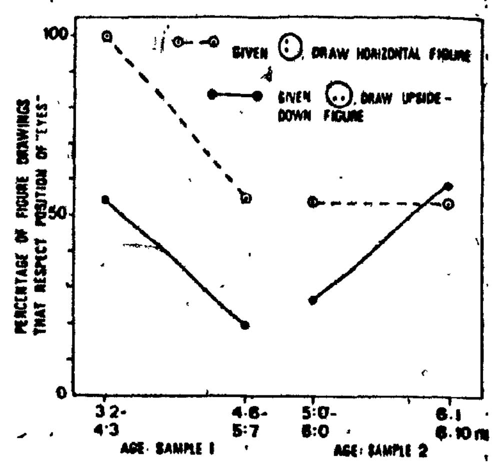


FIG. 1. Percentage of Type 1 drawings (figures that agree with eye position but not standard orientation) as a function of stimulus, age, and sample.

Figure 5. Top: Stimuli provided to children for completion in the study by Goodnow et al. (1972). Bottom: Age changes in figure orientation types as a function of stimulus. (Figure from Goodnow, J.J. and Friedman, S. Orientation in children's human figure drawings: an aspect of graphic language. Developmental Psychology, 1972, 7(1), 10-16. Copyright 1972 by the American Psychological Association. Reprinted by permission.)

when given an eyes low stimulus, because ". . . they have fewer meanings available than first graders and may be more exposed to stress on standard orientation than prekindergartners" (p. 15). Thus, four year olds draw more inverted figures than five year olds because they are not yet aware that inverted figures are an incorrect solution to this graphic "problem;" seven year olds drew more inverted figures than five year olds because, although aware of the standard figure orientation convention, they could provide more meanings to explain why their figures looked "funny." Inverted figure production was thus based on the interaction of two factors: a) awareness or unawareness that inverted figures were unacceptable according to the drawing convention; b) ability to provide new meanings to inverted figures drawn, to explain their divergence from the convention. Five year olds possessed an awareness of the convention (experienced "stress" to produce upright figures) but did not have a repertoire of meanings to apply to their inverted figures: therefore, they produced fewer inverted figures.

Inherent in the formulation of these conclusions is the concept that young children, given internal cues resembling those they spontaneously draw, rigidly respond to the placement of these cues (using an agreement between parts principle) with the corresponding figure orientation. It is the meaning value of cues which elicits orientation response, i.e. the fact that these children were given "eyes." Conversely, if these children were given more "abstract" cues, they should be expected to draw upright figures. Six year olds, according to Goodnow et al. are more flexible in their orientation responses: those who draw inverted figures either explain why they are inverted or else modify the given cues to accommodate an upright figure. They do not, like the four year olds, either rigidly obey the cues or ignore them (drawing upright figures). It is thus rigidity vs. flexibility in modifying the meanings of cues which determines figure orientation.

Goodnow et al. invited other researchers to test the effect of cue placement on figure orientations by providing children with other parts (mouths, ears, hats) they commonly draw. The extent to which these parts resemble those spontaneously drawn by children, as well as their placement, would determine whether non-standard figures are drawn.

> We do not know, for instance, how some early parts of a drawing, for example, the eyes, come to depart from standard position, or whether all early parts of a drawing would have the same effect (a slanted mouth, for example, might not have as strong an effect as a slanted eye axis) (1972, p. 16).

Younger children's orientation responses should be governed by the nature and placement of the cues, older children's responses by capacity to employ ". . . meanings or devices that enable them to correct or make deliberate use of an unusual shape or position in the course of drawing" (Goodnow et al., 1972, p. 116). Goodnow[7] has termed these devices "repair strategies."

Goodnow et al. are adamant that young children's graphic figure orientations are determined by factors inherent in the sequential construction of figures and not by incapacity to visually discriminate the varying orientation of graphic forms.

> The alternatives offered in the present article avoids these difficulties. It allows for early sensitivity and for differential response to different orientations, and it implies no identity between drawings and visual discrimination.

However, Goodnow et al. allow that they may not have found the "final solution;" dismissal of a "perception

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[7] Goodnow (Reference Note 1) describes repairs strategies as follows. . . .at least two conditions appear to me to influence the constraints exercised by an early unit. One of these is the child's sense that agreement with the first unit is the "right" thing to do. The other is the sense of being unable to do anything else. A possibility: What would happen if children were given two early features, in conflict, and were told that they could erase part if they wished (another child didn't like it, but couldn't fix it, etc.). . .

factor" may in fact be premature, as the results of another study show.

Before examining this study, certain methodological lacunae in the Goodnow et al. study are evident. Goodnow et al. did not provide a pre-test to determine whether children in this study could, in a situation where paper rotation is prohibited, actually draw an inverted figure. If paper rotation is not permitted, drawing an inverted figure demands reorganization of the drawing sequence, i.e. a reordering of the parts in a new direction (away from the child). Four year olds may not have been able to accomplish one of the two potential figure orientations (upside down) that could have been drawn in response to the basal form. If young children cannot draw an inverted figure in this type of constrained task, the graphic principle employed may be a matter of necessity and not choice (the child draws an upright figure because he cannot draw figures in any other orientation). In terms of the Goodnow et al. (1972) study, the approximately 50 per cent of four year olds who drew an inverted figure may have been those who could choose from a repertoire of at least two orientation types; upright figure drawers were drawing figures in the only orientation available to them.

The findings of an unpublished study by this author[8] (Reference Note 2) indicate that the visual salience of cues, as well as the "meaning" assigned to cues, may elicit non-standard figures when the cues appear low or sideways in a circle. That is, cues may be elicitive even in cases where they are not identified by children as a feature of their drawing sequences.

Table 1 shows the results of this study. According to the hypothesis set forth by Goodnow et al. (1972), children employing an agreement between parts principle should be expected to draw inverted figures in response to the horizontally-aligned forms (Stimuli 1, 2 and 3) and horizontally-to-the-right figures in response to the vertically-aligned forms (Stimuli 4, 5 and 6).

Differences in figure orientation responses, according to the Goodnow et al. hypothesis, should be a function of a different assignation of meaning to the given cues. For example, more children would draw inverted figures in response to Stimulus 2 than to Stimulus 3 if "hat" was more meaningful than "hair" (i.e. a function

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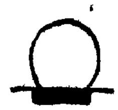
[8]This study (see Note 2) provided four and five year old children with circle stimuli containing features like those routinely drawn by young children (mouth, hat and hair). Each of these internal cues was provided in two locations: a) near the bottom of the circle, aligned along a horizontal axis or, b) near the left side of the form, aligned along a vertical axis. All subjects were then asked to "finish a person." Table 1 illustrates the stimuli, provides data about the subjects, and gives the original data.

Table 1

The figure orientation responses of four and five year old children to horizontally- and vertically-aligned stimuli

		Figure Orientation Response	
		Upright	Inverted
Stimuli:			
1.		13	3
2.		4	12
3.		2	14
		Upright	Horizontal
4.		4	12[a]
5.		5	11
6.		2	14

[a]10 of these figures were drawn horizontally leftwards. All horizontal figures drawn in response to Stimuli 5 and 6 were oriented towards the right.

of the resemblance of the provided cue to parts the child habitually draws, or is used to seeing in drawings).

However, children in this study produced qualitatively different orientation responses to stimulus four than to the other vertically aligned stimuli 5 and 6. Although the differences in response between the other "mouth" stimulus (1) and its "upside down" counterparts (2 and 3) can be explained by the Goodnowian model (hair and hat were more meaningful than mouth, or else less easy to modify in order to draw an upright figure), this is not the case for Stimulus 4 vs. Stimuli 5 and 6.

Although more than half of the children in this study drew horizontal figures in response to each of the vertically-aligned stimuli, they drew horizontally leftward figures in response to Stimulus 4 (ten of twelve horizontal figures were towards the left) and horizontally rightward figures in response to Stimuli 5 and 6. It appears that this feature, instead of acting as mouth (and therefore bottom of form), acted as top of form. Its status as an internal cue would therefore be as a focal point, and not as a common unit in children's drawings, i.e. a mouth. In other words the salience or focalness of this cue determined judgement of the form's upright orientation (focal point = top) and the corresponding figure orientation. This result would also suggest that differential response to Stimulus 1, i.e. a greater frequency of upright figures, may also have been determined by identification of the line as focal point.

In order to test the hypothesis that young children judge the orientation of basal forms by the placement of internal cues, i.e. the basal form's visual properties, experiments were designed in this study to compare judgement of and graphic orientation response to a basal form stimulus containing a visually prominent focal point cue. This cue is ambiguous in meaning, being equally adequate as a top or bottom feature of a young child's drawing. These experiments measure the effect of children's judgement of the orientation of form on graphic figure orientation. The next chapter describes the purpose of this study and the design of these experiments.

Chapter III

Purpose and Design of the Study

This study has been primarily designed to measure the interaction of perceptual and graphic factors during the production of HFDs. Children's unfolding graphic sequences are closely monitored as they draw human figures in both upright and inverted orientations. Additionally, forms for which some children have "orientation preferences" (Ghent, 1961) are introduced at the beginning of graphic human figure sequences, and their effect on the resulting orientation of the figure then measured. The method used in the drawing experiment is a constrained drawing task.

The population examined in this study, children four to seven years old, represent the age range during which the graphic transition from horizontal, oblique, inverted and upright figures to uniformly upright figures occurs (Goodnow, 1977; Wilson & Wilson, 1980). The purpose of this study is to link this drawing development with another transition occurring in the realm of perceptual development. Children in this age range are also developing their visual exploration of form: they are extending the area of fixations beyond the limits of forms, fixating other areas beside the salient features of forms, and, in short, gathering more accurate information about the visual display they "search" (Vurpillot, 1976). Children older than six employ not only intra-form information, but also information provided by framework features in judging the orientation of abstract forms. This study examines how the expansion of visual exploration (one effect of which is a transition in standards for judging form orientation) affects the graphic sequence of HFDs.

As in the Goodnow et al. (1972) study, a drawing problem has been set in this study by the provision of an initial, or basal, form to each subject. This drawing problem is described in detail in the next chapter. For the present, the rationale and design of a screening test and two experiments, which address different aspects of the problem of graphic figure orientation, will be described.

This study has been designed as a screening test and two experiments. The screening test establishes a baseline, ensuring that all children in the study understand the concepts upright and upside down. Only those children who can verbally employ these concepts, and manipulate objects according to the concepts, are admitted to the later judgement and drawing experiments. The purpose of this screening test is twofold: a) to ensure that children are judging the orientation of form with a complete comprehension of the terms being used and b) that graphic figure orientations produced in the drawing experiment (upright or inverted) are independent of non-attainment of these concepts. The inability to produce an inverted figure could otherwise be blamed on a cognitive factor; e.g. the child who does not understand what an upside down person is cannot comply with the request to draw such a figure.

The judgement experiment (Experiment 1) measures the judgement standard used by each child in this study to evaluate the orientation of non-realistic forms. Children who judge form by the placement of focal points judge forms with "high" focal points as being upright; they judge forms with low focal points as inverted. Children who judge form by its relation to the enclosing pictorial framework consider the area of the form's contour nearest the framework top to equal the form top; they are making a form-framework comparison, and, necessarily, all abstract forms are upright (if the framework is upright).

A drawing experiment (Experiment 2) measures the effect of children's standards for judging form orientation on the orientation of their HFDs. One of the forms, for which an orientation judgement was elicited in Experiment 1, is given in Experiment 2 as the basal form. Each subject is then asked to complete a human figure from this head or head-body unit. This basal form is provided for completion as a human figure in the two orientations in which it was judged in the Perception Experiment, i.e. one version with focal point on top, the other with focal point on bottom.

A premise underlying Experiments 1 and 2 is that orientation judgements determine which of Goodnow's graphic principles are followed in orienting graphic human figures. Children who judge the orientation of the first form they draw according to the internal placement of self-produced cues will align the later parts of the figure in agreement with this judgement. Accordingly, children in this category (focal point standard) judge basal forms containing cues in sideways, slanted, low and high placement as being respectively in horizontal, oblique, inverted and upright orientations. Obeying an agreement between parts principle, they align the later parts of the figure in agreement with these judgements. Furthermore, it may not be necessary that these cues resemble features the child draws: cues which are focal or salient, but not meaningful as figure parts, may also elicit orientation judgements. It is one objective of this study to provide such cues within graphic basal forms.

Similarly, children who have transcended this perceptual stage, situating forms within a framework, have the basic prerequisite visual skill necessary to draw human figures in agreement with page co-ordinates (Goodnow et al.'s standard page orientation principle). Considering the orientation of all drawn basal forms to be determined by the framework co-ordinates, they align the figure accordingly, i.e. vertically downwards along an axis parallel to the framework edges.

Whereas previous studies (Bassett, 1976; Goodnow et al., 1972) have been designed to provide internal cues variously located within basal forms (e.g. near the top, bottom or sides), no attempt has been made to ascertain whether a) these cues are "meaningful" (Goodnow et al., 1972) as graphic features to the children being studied, b) evaluation of these internal cues is cognitively or perceptually based, or c) the children can perform the graphic orientation responses which their assessment of cue placement demanded (i.e. actually draw an inverted or sideways human figure). There has been, in this study, an attempt to control (a) by making the internal cue ambiguous as a graphic feature, to test (b) by measuring each child's perceptual evaluation of the basal form when the internal cue is variously located within the form, and to control (c) by pre-testing each child's capacity to draw figures in the orientation which his or her evaluation of the basal form may require.

The screening test and Experiment 2 have been specifically designed, then, to address some of the methodological problems in the Bassett (1976) and Goodnow et al. (1972) studies.

The screening test establishes a cognitive baseline, admitting into the judgement and drawing experiments only those children who understand the concepts of inversion and upright. This test serves two purposes: a) it establishes that children's judgements of form orientation are based in an understanding of upright and upside down and, b) it rules out "conceptual syncretism" as an explanation of why some children may not be able to draw an inverted figure. All children in this study are shown capable of discriminating "inverted humans" and producing a facsimile of an inverted human (turning a doll upside down). The subjects in Experiments 1 and 2 were thus children who could verbally employ the term "upside down," discriminate examples of inverted figures and perform simple tasks using the concept of inversion. Neither Bassett (1976, 1977) nor Goodnow et al. (1972) established that the youngest children in their groups could differentiate upright from inverted; it is conceivable that these children may not have considered their inverted figures to be upside down.

In the Drawing Experiment (Experiment 2), a pre-test establishes the initial capacity of each child to draw an inverted figure in a situation approximating a natural one, the difference being that rotation of the paper is prohibited. The purpose of the pre-test is to determine what effect a constraining factor, i.e. inability to draw an inverted figure, has on performance during the drawing experiment. It is expected in the drawing experiment that children who judge the basal form to be inverted will draw "upside down" human figures. Obviously, this response will not occur if a child is incapable of drawing an inverted figure when paper rotation is not permitted. In addition, a post-test, where children are again asked to draw an inverted figure, monitors any learning that occurs as a result of general drawing practice (control group) or an inverted figure response to the provided stimulus (experimental group).

The design of each experiment is described next, followed by the hypotheses underlying this study.

Design of the experiments

The Screening Test. In this experiment, children are evaluated to determine whether they can verbally employ the terms upright and inverted and manipulate a doll using these concepts. Each subject thus undertakes two tasks, one verbal and one motor. Only children who could employ these terms correctly, and manipulate objects using these concepts, were admitted to Experiments 1 and 2.

Experiment 1. In the Perception Experiment each child is asked to select the upright and inverted examples of three animal pictures and three abstract forms. The method employed is a paired comparison test, each subject viewing pairs of animals or abstract forms.

A previous study (Moeller et al., 1969) has shown that the alignment of pairs of stimulus cards in paired-comparison tests affects children's judgements of the orientation of abstract forms. In vertical (one above the other) presentations of card sets, children preferentially chose the upper card as being upright; in horizontal (side by side) presentations, the right card was more often chosen as being upright. These authors hypothesized that card placement interacted with the stimulus configuration to produce orientation judgements. Moeller et al. found that stimulus alignment was a factor in orientation judgements only when the salient features of form were weak. Therefore, in this study one-half of the subjects were asked to judge vertically-aligned card pairs while the other half viewed horizontally-aligned pairs.

As will be recalled, Ghent Braine (1961, 1965a) contended that younger and older children use different judgement standards for evaluating the orientation of form. Her conclusions were based on group performances in judging a series of forms. She stated that a large percentage of four and five year olds judged low focal point forms to be inverted and, conversely, high focal point forms to be upright. There was also a <u>decreasing tendency</u> with development for forms to be judged upright or inverted according to the criterion outlined above. However, her results were ambiguous in that, with some forms, older children seemed to be using a "reverse standard" from that employed by four and five year olds, i.e. a low focal point equals upright, high focal point equals inverted formula. Ghent did not examine individual subjects' judgements across all stimuli in order to determine whether young children consistently use one perceptual standard (focal point) while older children consistently use a second (form-framework). Therefore, in this study a score has been kept of the number of times each child chose a focal point top or bottom form in the three judgement tasks. It is thus feasible to measure a) whether a child consistently uses one standard or other at different age levels and, b) whether consistent employment of one judgement standard is a valid predictor of graphic figure orientation.

Experiment 2. The Drawing Experiment is divided into four tasks: a pre-test (Task 1), two intermediary tasks which measure graphic orientation response to focal point stimuli (Tasks 2 and 3), and a post-test (Task 4). These tasks are given to each subject in that order.

The intervening tasks (2 and 3) compare the graphic orientation responses of two groups, an experimental group receiving focal point top and bottom basal forms and a control group receiving the same stimulus without the salient features, (i.e. visually "neutral" stimuli). The frequency with which each group produces upright or inverted figures in response to the salient feature or neutral stimulus is then compared. Since instructions in Tasks 2 and 3 are designed not to elicit either figure orientation, i.e. are neutral, orientation response is a function of stimulus (see Figure 8, Chapter IV).

The purpose of the pre-test and post-test is to measure improvement in the capacity to draw inverted figures as a result of performance in Tasks 2 and 3 (figure orientation response to focal-point-top and bottom stimuli). The pre-test establishes which children are capable of drawing inverted figures in a constrained drawing task, i.e. where rotation of the paper is prohibited. Logically enough, experimental group subjects who cannot consistently draw inverted figures cannot be expected to draw inverted figures in response to a low focal point stimulus (not possessing one of the potential orientation responses).

The post-test measures whether the capacity to draw inverted figures improved (learning occurred) as a function of inverted figure responses in Tasks 2 and 3, i.e. in response to the focal point or neutral stimuli.

In pre- and post-test the instructions are designed to elicit inverted figures, the purpose of these tests being to measure inverted figure capacity. The stimuli, however, are neutral (non-visually salient circles). In Tasks 2 and 3, the reverse is true. The instructions are neutral, or non-elicitive of inverted figures. However, the stimuli provided to the experimental group, containing low or high focal point cues, may indicate to some children that an inverted figure is called for.

In Task 2 and 3, the stimuli provided to the experimental group, low and high focal point stimuli, are given in two orders. One-half of the experimental group receives focal point top then focal point bottom stimuli. The other half receives the reverse order. Control group subjects receive neutral stimuli in both tasks. Order of stimulus presentation and illustration of stimulus forms are found in Chapter IV.

The degree to which judgements of form orientation

(Experiment 1) inform graphic figure orientation responses (Experiment 2) can be measured in the case of the experimental group children. These children respond to one stimulus form, i.e. one form acts as both a stimulus for orientation judgements and a graphic initial form. It is thus possible to measure the extent to which graphic orientation responses conform to previous judgements of the basal form's orientation. Similarly, the consistency with which experimental group children use one or the other judgement standard in Experiment 1 can be compared with the type of figure orientation they draw in Experiment 2.

Hypotheses

In the Perception Experiment (Experiment 1), it is hypothesized that children younger than five will judge forms containing focal points in the top portion of the form to be upright. They will judge forms containing focal points in the bottom portion to be inverted. Children older than six will judge all abstract forms to be upright, regardless of the position of focal points.

In the Drawing Experiment (Experiment 2), it is hypothesized that the ability to draw inverted figures will increase in children between four and seven years, in a situation where children are asked to complete a circle stimulus as a human figure and where paper rotation is prohibited. Children who cannot draw an inverted figure in the pre-test will not learn to do so during Tasks 2 and 3, i.e. as a result of drawing practice (control group) or exposure to the focal point stimuli (experimental group). As in the pre-test, these children will continue to draw upright and partially-inverted figures (or refuse to draw any figure at all) in the post-test (Task 4).

It is hypothesized that the type of figure orientation drawn in Tasks 2 and 3 (in response to basal forms containing, respectively, a focal point bottom and focal point top internal cue) is dependent on the "perceptual standard" (Ghent, 1961) employed by the child.

More precisely, it is expected that children using Ghent Braine's "focal point standard" will judge a form with focal point on top to be upright, and a form with focal point on bottom to be inverted. If given a focal point top form for completion as a human figure, it is hypothesized that these children will complete an upright figure; given a "low" focal point form, these children will complete an inverted figure. The top of the form, indicated by an internal cue, is in this case incongruent with framework top. Graphic figure construction, and figure orientation, are dependent on the "reading" of the initial provided form; this visual assessment indicates to these children that the basal form is inverted.

It is expected that children using Ghent Braine's form-framework standard for judging form orientation (visually relating all forms to the enclosing pictorial framework) will complete upright figures regardless of the placement of internal cues within a form they are given for completion; they ignore internal cue placement when making orientation judgements. Identifying the area of the form most proximate to the framework top as its upper area, they will complete a figure downwards from this area.

Consequently, it is expected that children who draw inverted, oblique or horizontal human figures do so because they orient each part in agreement with indicators of top (focal points) contained in the initial unit in the sequence. They visually attend to within-form orientation criterion because they judge form according to the spacial placement of its contents (Braine's focal point standard of judgement).

Children who draw figures that are constantly upright do so because they have transcended this level of perceptual judgement. Comparing each form to external cues, such as framework top, they align all parts along an axis parallel to the right and left sides of the paper, producing one vertically upright figure orientation (Ghent Braine's form-framework standard) (Ghent, 1961, 1964).

Framing this hypothesis in terms of Goodnow et al.'s "two orientation principles" model, children who obey an "agreement between parts principle," attaching each form to preceding forms according to within-form directional indicators, do so for a very specific reason: they assess the orientation of graphic forms while disregarding top, bottom, left and right directional cues given by the pictorial framework. They make no attempt to linearly construct a figure parallel to the paper edges, and do not align the top of their figures with the top of the page. Children who obey a standard page orientation principle are again orienting graphic figures in agreement with judgement of form orientation. But, in this case, considering the top of each form to be that area of the form most proximate to framework top, they order their figure downwards from the framework-given top. They ignore internal cues, which for other children indicate "top of form."

To summarize, children who judge a low focal point stimulus to be upside down and a high focal point stimulus to be upright (using a focal point standard of judgement) will draw an inverted figure when given the first stimulus as a graphic basal form, and an upright figure when given the second stimulus as a basal form.

On the other hand, children who judge both low and high focal point forms to be upright (using a form-framework standard of judgement) will draw upright figures regardless of the orientation of the provided basal form.

In its most general form, the issue being discussed and empirically tested is the effect of perception on drawing performance. The hypothesis is that the way young children visually assess the orientation of graphic forms determines the orientation of the completed figure. This assessment is perceptual in nature, based on a visual processing of the placement of internal details within the form. It is not necessarily, or only, based on a priori identification of the provided cues as graphic features, or a "cognitive assessment," as Goodnow et al. (1972) asserted.

For purposes of this study, two terms will be commonly employed. Those children who can draw inverted figures, as measured in the Drawing Experiment pre- and post-test, will be referred to as possessing a repertoire of figure orientations, or being <u>repertoire</u> subjects (i.e. they can draw figures in two orientations, upright and inverted). Children who can draw only upright figures will be referred to as <u>non-repertoire</u> subjects.

Chapter IV

Method

This study consists of a screening test and two experiments. The purpose of the screening test is to ensure that all subjects in the judgement and drawing experiments possess an understanding of upright and inverted; the purpose of the judgement experiment is to measure judgement standards for discriminating upright and inverted forms; the purpose of the drawing experiment is to measure orientation responses arising from these judgements. In the drawing experiment a pre-test and post-test measure each child's capacity to produce an inverted graphic figure (which is one of the potential graphic orientation responses which certain judgements of form orientation demand).

Details concerning method, materials, procedure and measures are provided in the following pages.

Subjects

Each subject participated in the screening test and the two experiments. 189 four to seven year old children were randomly selected from four nursery or pre-schools and two elementary schools in middle-class areas of Montréal, Québec. 160 subjects who passed the cognitive test were admitted to Experiments 2 and 3. These subjects were divided into four groups: one group each of four, five, six and seven year olds. In each age group there were twenty boys and twenty girls.

28 four year old children attended pre-school and nursery school classes for half a day, the remainder of the four year olds attending for a full day. The five year olds attended kindergarten classes for half a day, while six and seven year olds attended full day classes in grade one and two respectively.

To keep age and school experience consistent, there was an attempt to obtain four year old pre-schoolers, five year old kindergartners, six year old first graders and seven year old second graders. With the exception of two five year olds, still in nursery school, this was accomplished. Children not fluent in English were screened from the study in the first experiment, usually because of inability to understand the terms used. Of the 29 subjects who did not perform adequately in the Screening Test 22 were four years old and 7 were five years old.

The Screening Test

Method. Two tasks measured different aspects of the child's conceptualization of upright and inverted. Task 1 evaluated the child's ability to verbally describe orientation differences. Task 2 evaluated the child's ability to manipulate objects using the concepts of "upright" and "upside down."

Materials. Three identical dolls, commonly known in the Montreal area as "Strumpf" dolls, were arranged on a table facing each child. From left to right these dolls were upright, standing on their plastic base; inverted, held in position on the table by a strip of tape; horizontal on the table surface, or "lying down." Facsimiles of these dolls, as they appeared in the Screening Test, are shown in Figure 6.

Procedure. Task 1: Conversation was informal throughout this test. Each child's attention was directed towards the doll display. The experimenter commented that the dolls all "looked different," or that some "looked funny." The child was asked to describe how they looked different from each other. Acceptable criteria of response included any accurate indication that the inverted doll was upside down in comparison to the other dolls: e.g. "One's on its head," "one's upside down," or "one's turned around on its head."

Task 2: The experimenter righted the dolls and asked the child to "turn them all upside down."

Figure 6. Graphic facsimiles of "Strumpf" dolls used in the Screening Test.

The experimenter gave each child three strips of tape to attach the dolls to the table.

All children who demonstrated a capacity to verbally use the terms for upright and inverted, and manipulate objects employing the concepts of upright and inverted, were admitted to Experiments 1 and 2.

Table 2 shows the age range, mean and standard deviation for the 160 subjects admitted to Experiments 1 and 2.

Experiment 1

Method. Each child viewed three pairs of animal picture cards and then three pairs of abstract form cards. The two cards in a pair were identical, except that one was rotated 180 degrees to the other. This method of paired-card comparison is the same as that used by Ghent (1961) and Antonovsky et al. (1964).

Materials. Six pairs of cards included three pairs of animal pictures and three pairs of abstract forms. The animal pictures showed a mouse, a kangaroo and an elephant. In these cases, one version of the card displayed the animal in its habitual upright orientation while the other showed the animal in an inverted position.

Of the three abstract forms used in this study, two are identical to stimuli designed by Ghent (1961, p. 182),

Table 2

Age range, mean and standard deviation for each age group in Experiments 1 and 2

GROUP	GRADE	n	AGE RANGE	MEAN AGE	S.D.
1	Pre-school/ Nursery	40	4.0-4.11	4.5	3.50
2	Kindergarten	40	5.0-5.11	5.7	2.65
3	First	40	6.0-6.11	6.6	2.48
4	Second	40	7.0-7.11	7.7	3.02

while a third is a modified version of Ghent's circle stimulus. The three stimuli are shown in Figure 7: the square (Stimulus 1) and cross (Stimulus 3) forms are copies of Ghent's stimulus forms, while the circle form has been redrawn to make the focal point a) more salient or noticeable and b) to render it less suggestive of a feature seen in children's drawings, i.e. more graphically ambiguous.

The following method was used to redraw Ghent's circle stimulus. The circle was bisected with a vertical line, this vertical axis was bisected into five equal parts, then a perpendicular line was drawn to intersect the vertical axis at its topmost mark. The area between the perpendicular line and the uppermost circumference of the circle was then darkened.

As with the animal card pairs, each pair of cards consisted of two versions of the same form, rotated 180 degrees to each other along a vertical axis. One form of each pair contained the focal point in the top position, the other form the focal point in the bottom position. The pairs of abstract forms are shown in Figure 7 in the orientations and stimulus alignments (i.e. the vertical and horizontal alignment of card pairs) viewed by the subjects. The circle stimulus (Stimulus 2) acts as the basal form in the next experiment (Experiment 2), where

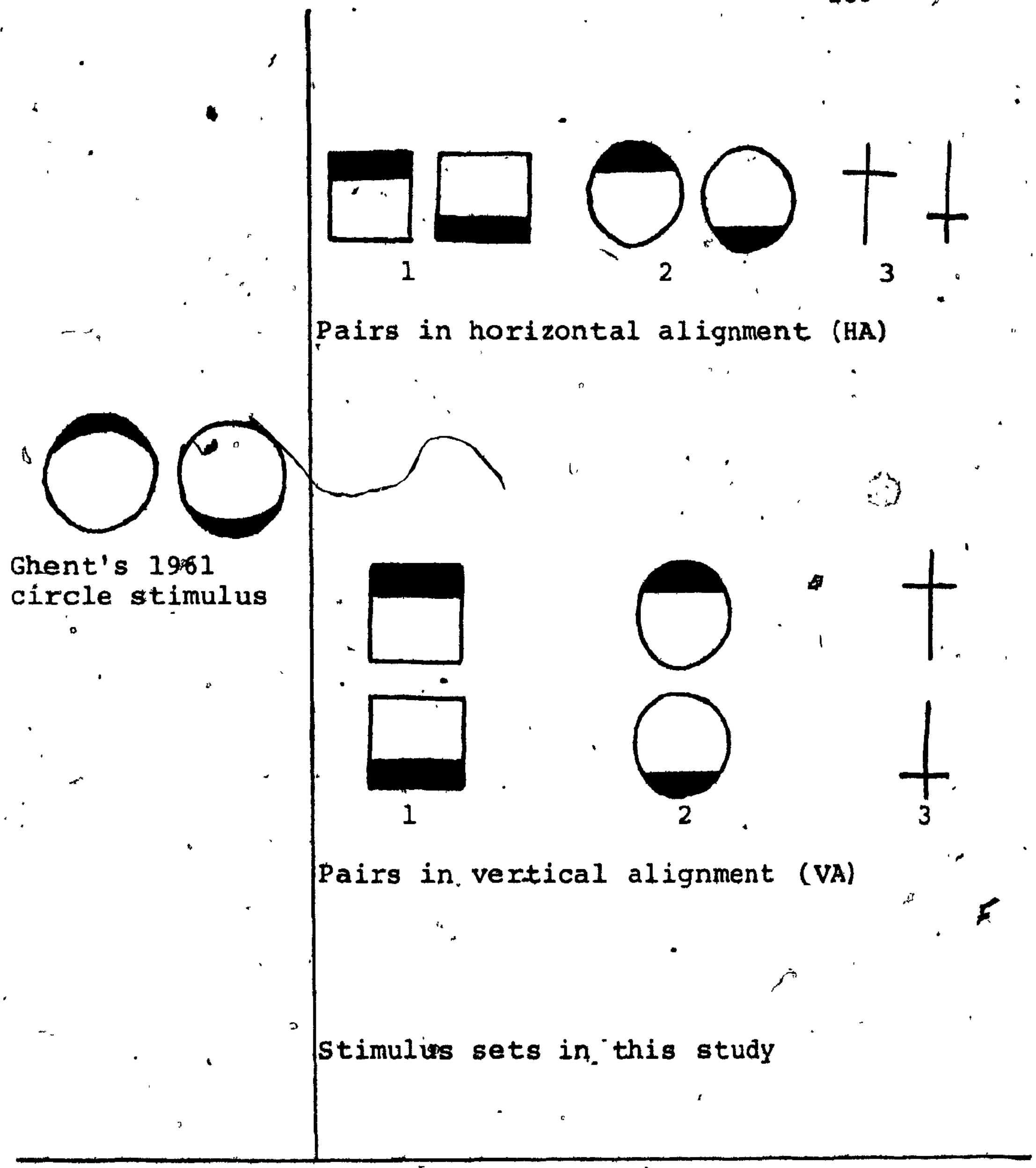


Figure 7. Stimulus sets (after Ghent, 1961) presented for orientation judgements in Experiment 1, with Ghent's circle stimulus from which the present circle stimulus was derived.

it was given to each subject for completion as a human figure in the two orientations shown in Figure 7.

Procedure. A paired comparison method of card presentation, identical to that used by Ghent (1961) was employed in this experiment. Six pairs of pictures were shown to each subject, who was first asked to point to the one that was upright or "standing up the right way," and second to point to the one that was upside down or "standing upside down." Each child was shown the animal card pairs and then the abstract form card pairs. Presentation of the animal card pairs served as a "warming up" exercise before presentation of the abstract card pairs.

The abstract form card pairs were presented to each subject in one of two possible alignments. In the vertical alignment, the bottom card of the pair rested on the table while the top card was aligned directly above it, held by the experimenter. In the horizontal alignment, the bottom edges of both cards rested on the table. Four to six inches of space separated the closer edges of the cards. One half of the subjects viewed the cards one above the other (vertical alignment), while the other half viewed the cards side by side (horizontal alignment). Figure 7 shows the card pairs as they appeared to children in the two alignments.

The instructions differed slightly throughout the judgement test, and were more detailed when beginning the animal pictures than later. Younger children generally needed longer and more explicit explanation of the task than the older children.

The instructions, prior to the presentation of the animal card pairs were:

> We are going to look at some animals. I'm going to show you two pictures of the same animal. In one picture he's standing up the right way, on his feet. He'll look just like he does when you see him in the zoo. The other time he'll be upside down; he'll look funny, like he's standing on his head (showing the card pairs). Now tell me which one is standing up the right way. Good. Now tell me which one is standing upside down.

During the presentation of each new card pair the child was told to point to the animal that was right side up and then to the upside down animal.

When a subject made an error, the sets were run through again. No child required more than three presentations of the animal card pairs before achieving an errorless performance. General encouragement was provided throughout the presentation, and when a child made an error the experimenter corrected him or her. Each child had to achieve an error free performance on all of the animal card comparisons, before being shown the abstract form card pairs.

The instructions prior to presentation of the abstract forms were:

> Now we're going to look at some different pictures, not animals this time, but some shapes. I want you to look at them carefully and tell me which one is standing up the right way. Good; now tell me which one is upside down.

No mention of "standing on its feet" or "on its head" was made during the presentation of the abstract form cards, to avoid children associating the abstract forms with real objects. However, many children immediately called the cruciform a "cross." Spontaneous verbal assignations of meaning were not aroused by the other forms.

<u>Measures</u>. As each child chose one version of the stimulus as upright and the other as inverted, his or her responses were entered on a data sheet. In addition, the stimulus alignment presented to each child was scored at this time. Table 12(Appendix A) shows the data sheet used for the screening test and Experiments 1 and 2.

Also scored was the frequency with which each child selected either focal-point-top or focal-point-bottom forms as being upright. A child who selected a focal-point-top stimulus as being upright in all three tasks is considered to be consistently using Ghent's (1961) focal point standard. Children who select a focal-point-top stimulus as being upright less often, i.e. 0, 1 or 2 times during 3 presentations, is considered to be using Ghent's form-framework standard. Children who choose focal-point-top forms in all three presentations score 4 points; children who choose focal-point-top forms 0, 1 or 2 times score, respectively, 1, 2, or 3 points.

Experiment 2

Method. This experiment is divided into four tasks, a pre-test, two intermediary tests in which the experimental stimuli are introduced, and a post-test. The 160 children were divided into experimental and control groups. Of the 40 children in each age group, 20 were in the experimental group and 20 were in the control group. Of the 20 children in the experimental and control groups at each age level, 10 were male and 10 were female.

Materials. In the pre- and post-test (Tasks 1 and 4) both experimental and control groups received the same stimulus, a circle (one and a quarter inches in diameter) centred on a square sheet of paper (eight and one half inches on each side). In Tasks 2 and 3, the control group again received the circle stimulus twice. The experimental group received two circles of the same diameter as above, one circle containing a darkened focal point in the top portion the other containing a darkened focal point in the bottom portion. This focal point stimulus is identical to Stimulus 2 of the judgement experiment, and was constructed using the method described on page 129. The control group always received the circle stimulus, while the experimental group received rotated versions of the focal point stimulus in Tasks 2 and 3. Figure 8 shows order of tasks, stimulus forms and instructions in Experiment 2.

<u>Procedure</u>. <u>Pre-test and Post-test</u>: In the pre- and post-test both control and experimental group subjects were given a neutral circle stimulus. The instructions, and not the visual properties of the stimulus, were intended to elicit inverted figures. The purpose of the pre-test and post-test was to measure, respectively, initial capacity to draw inverted figures in a constrained drawing task, and changes in this capatity as a function of experience in Tasks 2 and 3. The instructions in pre- and post-test (Tasks 1 and 4 respectively) were:

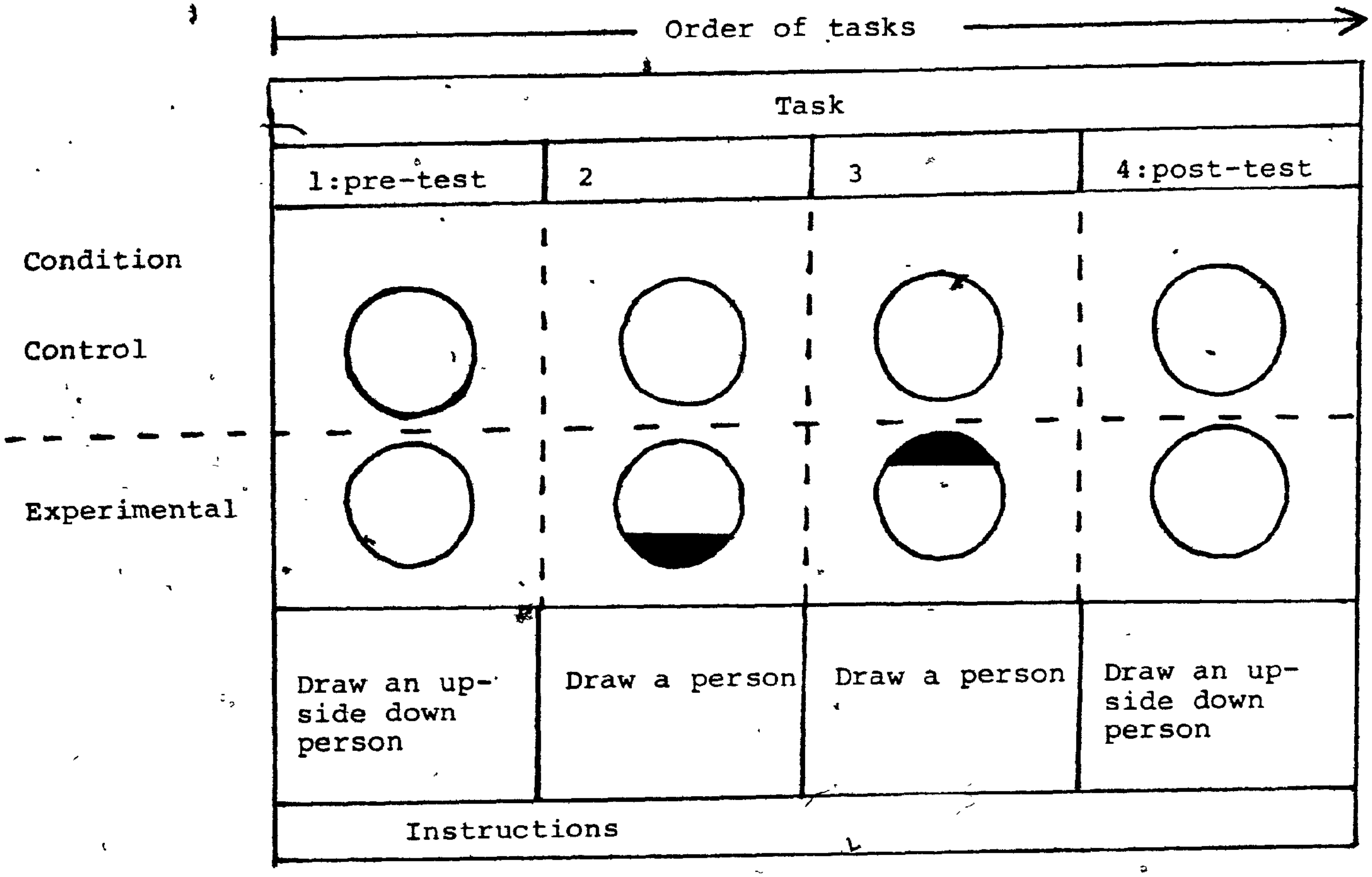


Figure 8. Drawing Experiment: Stimuli, stimulus order of presentation and instructions to subjects.

> We're going to play a new drawing game. Someone started drawing this person, but didn't finish it. I want you to draw a person, but not the kind of person you draw in school or at home. I want you to draw an upside down person. Sometimes you see a clown who is upside down, or an acrobat. Draw me a person like that, upside down. There's only one rule in this game. You're not allowed to turn or move your paper, and you've got to stay in your seat. Alright, go ahead and draw me an upside down person.

Children who attempted to rotate the paper or tilt their bodies were reminded about the game "rule." Two children who surreptitiously managed to rotate their papers were asked to start over. Most of the children entered readily into the spirit of the "game," and seemed to find nothing very surprising about such an unorthodox request.

<u>Tasks 2 and 3:</u> The purpose of Tasks 2 and 3 was to determine whether children would draw different figure orientations when given focal point stimuli as compared to a visually neutral stimulus. Accordingly, the control group in Tasks 2 and 3 was given two circle stimuli identical to those provided in Tasks 1 and 4. The experimental group was given one circle form containing a focal point in the top portion, and one circle form containing a focal point in the bottom portion.

These stimuli are identical to those given the control group, except for the presence of focal points (see Figure 8).

The order of presentation of the focal point forms was counter-balanced: one-half of the experimental group subjects in each age group (5 boys and 5 girls) received the focal point top form, and then the focal point bottom form. The other half of the experimental group subjects received the reverse order.

In Tasks 2 and 3 any inverted figures were elicited by the visual properties of the stimulus forms provided. Here the instructions were neutral, i.e. non-elicitive of a figure in any particular orientation.

> Now we're going to play another game. Someone started this drawing, too, but never finished it. Draw me the very best person you can, and do it the way <u>you</u> think is best. Don't forget that this is only a game, so do what you want.

Interestingly, of the four children who asked "should I draw it upside down or standing up," all had just been given the low focal point form. This suggests that a conflict was occurring between the figure orientation demanded by low focal point placement (i.e. an inverted figure) and the orientation demanded by the pictorial framework (i.e. an upright figure).

To summarize, in pre- and post-test the forms are visually neutral, i.e. do not indicate that the basal form is oriented in any particular way; the instructions, however, demand an inverted figure. In Tasks 2 and 3 the stimuli given to the experimental group indicate to some subjects (those who judge form using a focal point standard) that one version (focal point bottom) of the basal form is inverted, and that an inverted figure is required; in Tasks 2 and 3 the instructions are neutral; not demanding an inverted figure. Differential orientation responses by control and experimental groups in Tasks 2 and 3 therefore must reflect a differential evaluation of the visual properties of the provided forms.

Measures. Previous studies (Goodnow, 1977; Goodnow et al., 1972) indicated that four responses in the drawing tasks could be expected: inverted, upright and partially-inverted figures, as well as refusals. Examples of the three figure orientation types are shown in Figure 9. Type 1 figures are upright; Type 2 figures are partially-inverted (or partially-upright); Type 3 figures are inverted. R indicates refusal.

All figures shown in Figure 9 were drawn in the pretest by five year old children. The space surrounding each figure has been reduced for reproduction purposes.

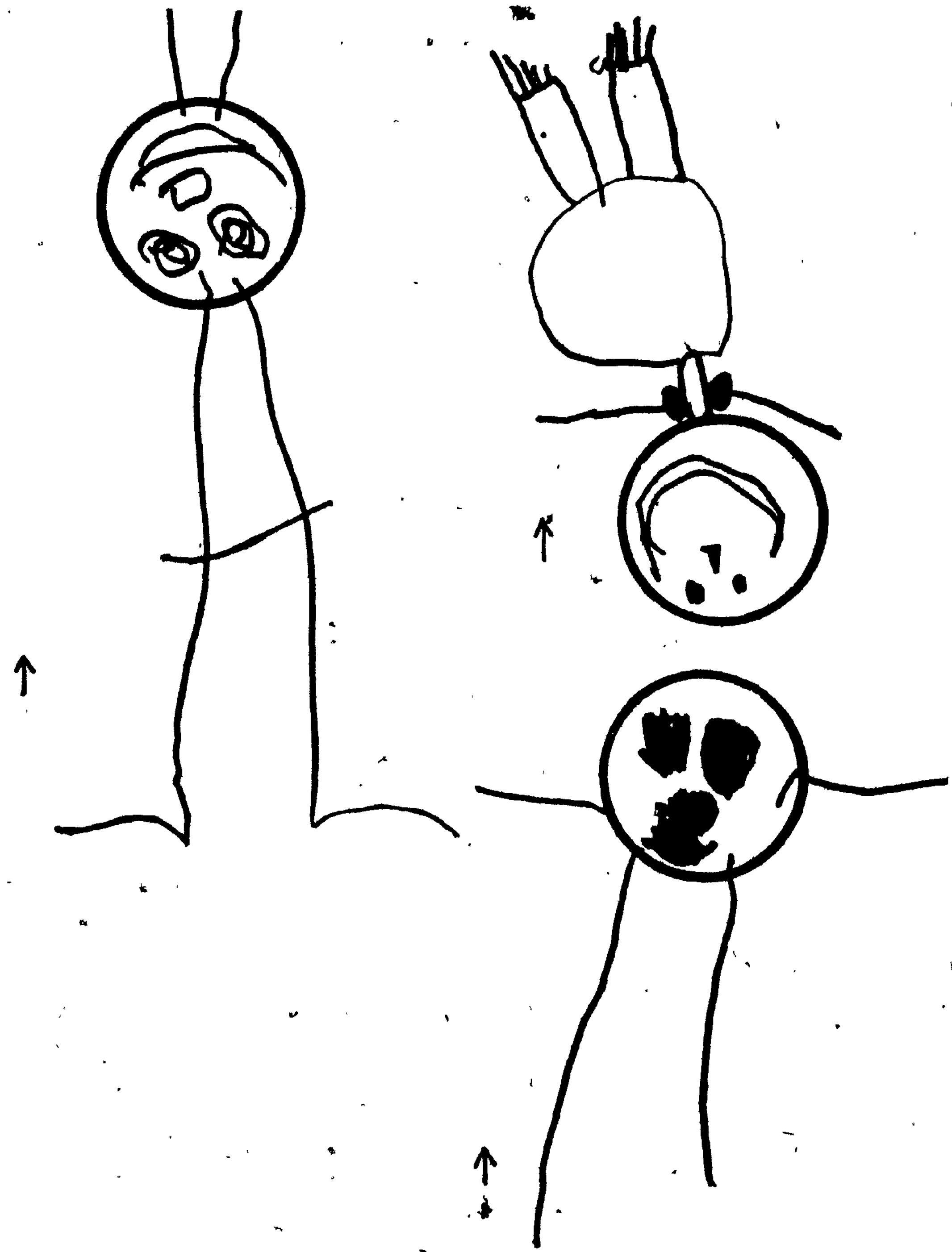


Figure 9. Examples of the three figure orientation types. Reading clockwise from top left: Type 2, partially-inverted; Type 3, inverted figure; Type 1, upright figure.

Partially-inverted figures could be of two types. In the first type the facial features indicate an upright figure, but body features indicate an inverted figure; in the second type facial features indicate an inverted figure, but body features indicate an upright figure.

As each figure was drawn, the experimenter, seated to the right of the child, copied the child's drawing, indicating on his sketch a) the order in which parts were drawn, b) the direction in which the child "travelled" between parts and the direction in which he formed each part. After the testing session, using an acetate sheet which divided the drawing surface into spatial sections, the experimenter recorded the order in which parts were drawn (or sequence of drawing), the spatial location of each part and the direction in which the child moved his hand between parts drawn and in forming the parts. Appendix A shows the data sheet on which the information for each drawing was entered. Also recorded, after the termination of each child's drawing session, were the orientation of each figure and stimulus order (experimental group subjects only).

The abbreviations uf, pif and if represent, respectively, upright figure, partially-inverted and inverted figure; Id., Sp.Lo., and Dir. represent, respectively, identity, spatial location and direction of parts drawn.

This recording device was developed by this author during pilot studies. When it was applied to the figure drawings of Experiment 2, a number of suggestive findings came to light. It is not possible at this time to describe them in detail; a fuller treatment must await a later paper.

The analyses applied to the data and the results obtained are described in the following chapter.

Chapter V

Analysis and Findings

This chapter is organized in three sections. First, the analysis and results of the judgement and drawing experiments are reported separately. Second, the subjects' performance in the drawing tasks (Experiment 2) is examined in relation to their capacity or incapacity to draw inverted figures. Third, there is a comparison of subjects' performance (i.e. the child's perception and drawing responses) in the two experiments.

Experiment 1

Analyses. The original data for Experiment 1 was first analyzed using the Kolomogorov-Smirnov one sample test (Siegel, 1956, pp. 47-52). This test is used to compare a sample population with a theoretical population. In this case a theoretical population, having no preference for one upright version of the stimulus form, would choose either version of the form to be upright 50 per cent of the time. Secondly, the original data was analyzed using the Chi-square test for K independent samples (Siegel, 1956, pp. 175-179) to determine whether children in the four age groups chose focal point top versions of the stimuli as upright to a significantly different degree.

Thirdly, the mean scores for each age group in judging the focal point top versions of the forms as being upright was computed, and the Median Test (Siegel, 1956, pp. 179-184) applied to this data.

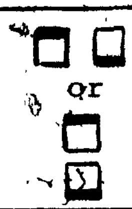
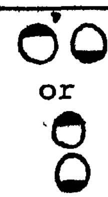
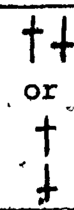
Results. Table 3 shows the original data for the Perception Experiment. Analyzing this data using the Kolomogorov-Smirnov Test (Table 4) reveals that four and five year olds in this study were significantly different in their orientation judgements from a theoretical population. They judged all three stimulus forms with the focal point on top to be upright. Six year olds judged only one (Stimulus 3) of the focal-point-top stimuli to be upright, while the seven year olds judged two stimuli (2 and 3) with focal point on top to be upright.

An inspection of Table 4 seems to indicate that four and five year olds choose the focal-point-top forms as upright more often than six and seven year olds. However, when the Chi-square test is applied to the original data (see Table 3), it shows that there is no significant difference between age groups in choice of the focal-point-top versions of the forms as upright (df = 6, x^2 = .57).

There is thus no evidence that preference for the focal point top versions of these forms as being upright

Table 3

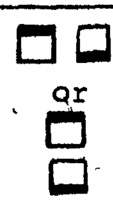
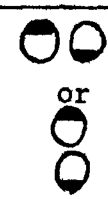
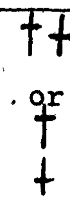
Original data for the Perception Experiment. Number of children in each age group who judged the focal point top version of each form to be upright.

	Stimulus		
Age group[a]	1 	2 	3 
1	29	30	36
2	33	31	37
3	27	28	37
4	24	30	34

[a]n=40 in each age group

Table 4

Kolomogorov-Smirnov Test of the Perception Experiment data. Comparison between distribution of sample and theoretical populations.

Age group	Stimulus 1 	Stimulus 2 	Stimulus 3 
1	.225*	.25*	.4***
2	.325**	.27**	.42***
3	.17	.2	.42***
4	.1	.25*	.35**

Note: all data indicates the Maximum Deviation (D) between observed and theoretical populations.

*$p < .05$

**$p < .01$

***$p < .001$

decreases with development. Looking individually at each stimulus form it can be seen that only Stimulus 1 elicits fewer focal point top=upright judgements with development (see Table 3). This decrease in focal point top=upright judgements is non-significant in the case of Stimulus 1, however. Stimuli 2 and 3 are judged by nearly all age groups (exception: 6 year olds' judgements of Stimulus 2) to be upright with the focal point on top: again, there is no significant decrease with development in use of a focal point standard for judging form orientation. This runs counter to Ghent's hypothesis that children increasingly as they develop discard a focal point standard in favour of a form-framework standard when they judge the orientation of form.

Similarly, looking at the judgement scores obtained by children in each age group (Table 5), i.e. examining the number of children judging the focal-point-top versions of the three forms to be upright 0, 1, 2 or 3 times, it becomes evident that the distribution of scores is similar across all age groups; the mean score for all age groups varies from 3.2 to 3.42. A tendency to use a focal point standard for judging the three forms in this experiment persists right into the child's eighth year. The findings concerning judgement scores are further confirmed when the Extension of the Median Test is applied to the

Table 5

Number of children in each age group obtaining each of the judgement scores in the Perception Experiment

	Score				
Age group[a]	1	2	3	4	Mean Score
1	2	2	12	24	3.45
2	2	2	9	27	3.28
3	0	8	11	21	3.35
4	1	12	5	22	3.2

Note: The score assigned to each child indicates the number of times the child chose the focal point version of the three forms as being upright.

[a] n = 40 in each group

data in Table 5. The Median Test distributes the scores in each age group as to whether they fall above or below the median for all age groups. Chi-square analysis applied to these distributions shows a non-significant difference in scores between age groups (df = 9, x^2 = 4.36).

To summarize the findings of Experiment 1, there is no decrease in use of a focal point standard in children between four and seven years. This contradicts Ghent's findings that children gradually assume a form-framework standard in judging form orientation during their fifth and sixth years, replacing previous use of a focal point standard. However, the findings of this study are based on response to only three stimuli, whereas in Ghent's series of experiments (Antonovsky & Ghent, 1964; Ghent, 1961, 1964) more than 30 forms were judged.

Experiment 2

Analyses. The Chi-square Test for K independent samples (Siegel, 1956, pp. 175-179) is used to analyze the data of each drawing task. Differences in the responses of each age group (in some cases of youngest versus oldest children) and of the groups in each experimental condition were analyzed using the Chi-square Test for two independent samples (Siegel, 1956, pp. 104-111).

Results. Pre-test (Task 1). Children in the pre-test responded in four ways when asked to draw an inverted figure in Task 1. They refused, or drew upright, partially-inverted or inverted figures (Figure 9 illustrates the three orientation types). Table 6 shows the number of figures in each orientation drawn by children in the four age groups in Task 1.

Applying the Chi-square Test to this data (df = 9, $x^2 = 37.64$) shows a probability of less than $\alpha = .001$. There is a significant difference in orientation types as a function of age. Moreover, it is apparent that children acquire the capacity to draw inverted figures during their fifth year: only 38% of the four year olds could draw an inverted figure in this task, as compared to 70% of the five year olds. Over 90% of the children older than six could draw inverted figures. Using the Chi-square Test for two independent samples to compare adjacent age groups (e.g. four versus five year olds), it is found that only the orientation responses of four and five year olds are significantly different (df = 3, $x^2 = 9.16$, $p < .05$).

Task 2. Task 2 required experimental group subjects to complete a basal form stimulus containing a bottom focal point; control group subjects completed a neutral (circle) stimulus. Table 7 shows

Table 6

The number of figures in each orientation drawn in the pre-test (Task 1)

	Figure Orientation Types[a]			
Age group[b]	Refusal	Upright	Partially-inverted	Inverted
1	7	12	6	15
2	5	5	2	28
3	0	1	2	37
4	0	1	3	36

[a]Figure illustrates the three figure orientation types.

[b]n = 40 in each group.

Table 7

The number of figures in each orientation drawn by children in each age group in two experimental conditions in Task 2

Condition	Age group[b]	Upright	Partially-inverted	Inverted
		Figure Orientation Type[a]		
Experimental	1	13	1	6
	2	10	-	10
	3	8	-	12
	4	8	-	12
Control	1	20	-	-
	2	20	-	-
	3	20	-	-
	4	20	-	-

[a]There were no refusals

[b]n = 20 (10 males, 10 females) in each condition at each age level.

the original data for Task 2, giving the number of figures in each orientation drawn by children in each age group in the two experimental conditions. Also shown are the stimuli to which children in each experimental condition responded.

The Chi-square Test for two independent samples shows a significant difference between children in the two experimental conditions (df = 3, x^2 = 34.62, $p < .001$). Children uniformly responded to the circle stimulus by drawing upright figures. When responding to the low-focal-point stimulus, however, 30% of the four year olds, 50% of the five year olds, and 60% of the six and seven year olds drew inverted figures. The two stimuli elicited different orientation responses. Although inverted figure response to the low-focal-point stimulus (experimental group children only) increased with age, this difference in orientation responses between age groups was non-significant (df = 3, x^2 = 3.34).

Since instructions do not demand any specific figure orientation (in contrast to pre- and post-test where an inverted figure is demanded), the different orientation responses by control and experimental group subjects in Task 2 must be attributed to the different visual properties of the two stimuli. If there had been a "generalization effect" from the pre-test (where inverted figures were demanded), inverted figures would have been drawn by the control group as well as the experimental group. This was not found. Thus, for at least some children in each age group, a low-focal-point stimulus elicited inverted figures.

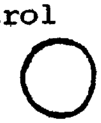
Task 3. Performance in Task 3 further defines the effect of focal points on orientation responses. In Task 3 experimental group subjects received a high-focal-point stimulus while control group subjects received the neutral circle stimulus. Table 8 shows the frequencies of figure orientation types drawn by each age group in the two experimental conditions in Task 3.

There were no significant differences between experimental and control groups in types of figure orientations drawn in Task 3 (df = 1, x^2 = 2.52). The focal-point-top form and the circle stimulus both overwhelmingly elicited upright figures. Interestingly, 5 children in the older groups drew inverted figures, treating the focal point as if it indicated the bottom of the form instead of the top.

Children of all ages, in Tasks 2 and 3, produced upright figures when given a focal point top form and, variably, inverted figures when given a focal point bottom form; the placement of focal point within the basal form

Table 8

Frequencies of figure orientation types drawn in each age group and experimental condition in Task 3

Condition	Age group[b]	Figure orientation types[a]		
		Upright	Partially-inverted	Inverted
Experimental 	1	20	-	-
	2	20	-	-
	3	18	-	2
	4	17	-	3
Control 	1	20	-	-
	2	20	-	-
	3	20	-	-
	4	20	-	-

[a]There were no refusals

[b]n=20 (10 males, 10 females) in each condition at each age level.

affected graphic figure orientation. Figure 10 illustrates these findings.

The crucial question thus becomes why some children drew upright or inverted figures when given a low focal point form. To illuminate the reason for these differing orientation responses, it is incumbent to introduce the original judgements of this form's orientation, made by children in the Perception Experiment. Is the type of figure orientation they drew in Experiment 2 in agreement or disagreement with judgements of the low focal point form's orientation they made in the previous perception experiment (i.e. is a perception judgement informing graphic figure orientation)? Before comparing performance in the two experiments, the results of Task 2 are compared with the findings of Goodnow et al. (1972).

In Task 2 (this study) and in the study by Goodnow et al. (1972) the instructions were the same: "Draw a person." The stimuli differed, however. Task 2 provided a darkened low-focal-point form, while the Goodnow et al. study provided an "eyes low" form. Figure 11 shows the percentage of total figures which were inverted in this study and in the Goodnow et al. study.

The results of this study do not agree in some respects with those of Goodnow et al. (1972). It will be recalled that Goodnow et al. gave their subjects an "eyes

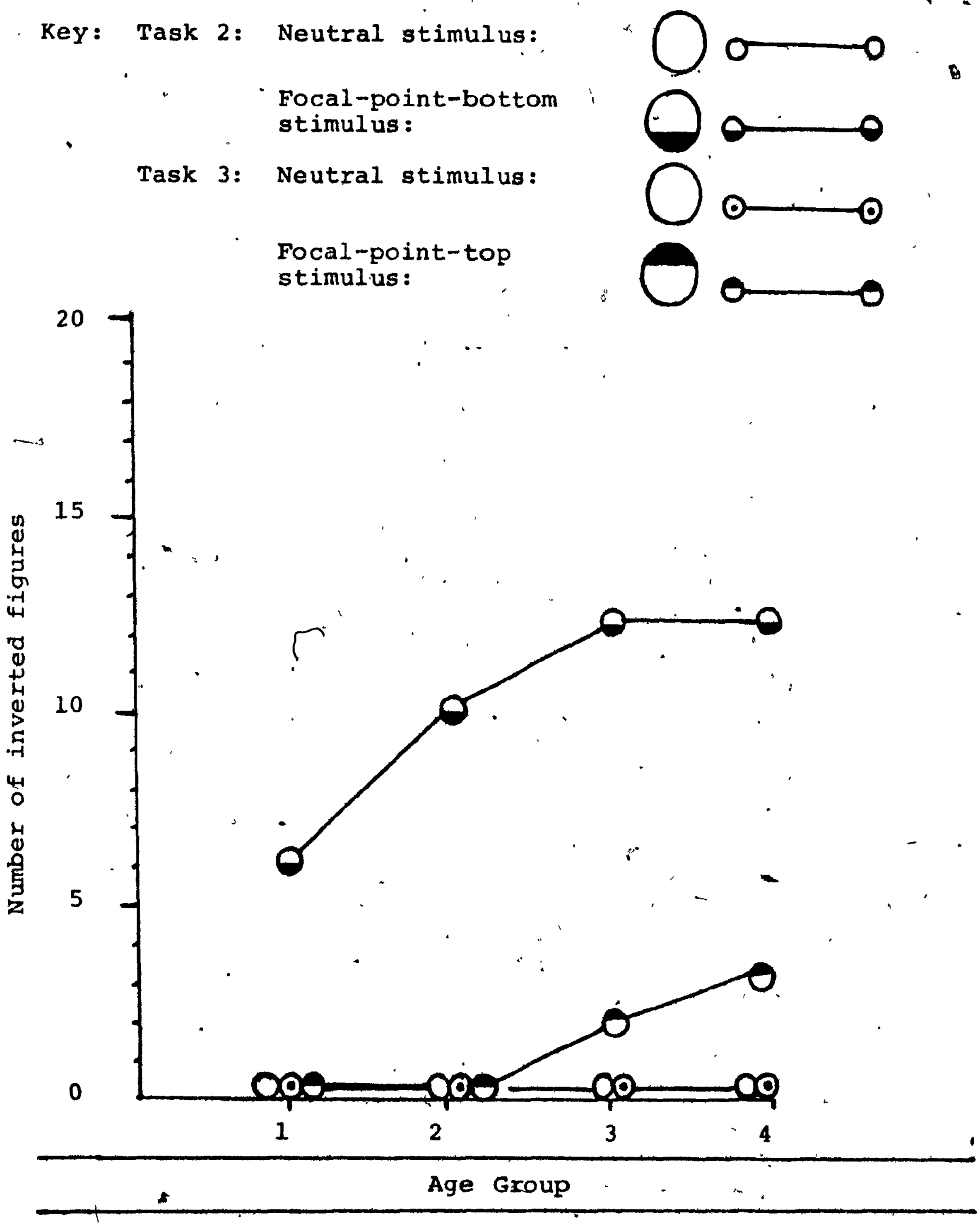


Figure 10. Frequency of inverted figures drawn in response to three stimuli in Tasks 2 and 3.

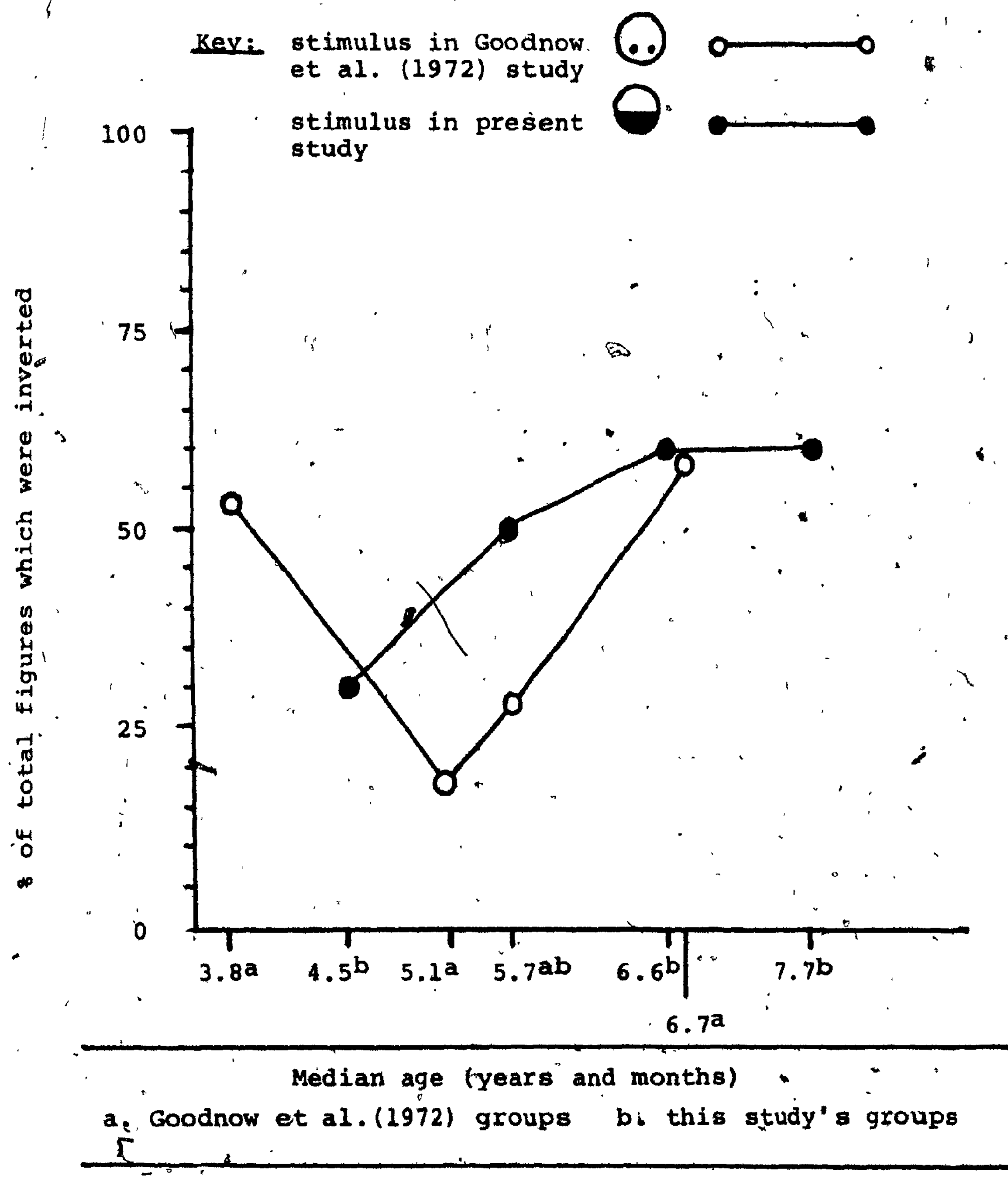


Figure 11. Comparison of the results of this study and those of Goodnow et al. (1972); the percentage of total figures which were inverted in each task are shown.

low" stimulus to be completed. When Goodnow et al. plotted their results, they found a u-shaped curve in inverted figure orientation responses to the "eyes low" stimulus, i.e. a decrease in inverted figure drawings in the five year old group as compared to the levels found in the younger and older groups. This study, on the other hand, found a steady developmental increase in inverted figures. A number of questions arise from the different findings of the two studies. Are these differing results a function of the different stimuli presented? How did children in both studies judge the orientation of the forms they were asked to complete? Were children obeying their previous orientation judgements when they drew, or contradicting them? Before attempting to deal with these questions, the post-test drawing results are examined and compared with those of the pre-test, and then subjects' performance in all four tasks is analyzed.

<u>Post-test (Task 4)</u>. As in the pre-test, this task demanded an inverted figure; the stimulus is neutral. Table 9 shows the frequency of each orientation type in the post-test. Chi-square analysis reveals that there is a significant difference between age groups in orientation responses (df = 9, x^2 = 48.09, $p < .001$);

Table 9

The number of figures in each orientation drawn in the post-test (Task 4)

	Orientation Type			
Age group[a]	R	1	2	3
1	3	13	7	17
2	1	6	2	31
3	-	1	1	38
4	-	1	-	39

[a] n=40 in each group

42.5%, 77.5%, 95% and 97.5% of the four, five, six and seven year olds, respectively, drew inverted figures in the post-test. The greatest increase in the capacity to draw inverted figures occurs (as in the pre-test) during the child's fifth year: the difference between the four and five year old groups in orientation types produced is significant (df = 3, x^2 = 9.94, $p < .02$).

The ability to draw inverted figures did not improve during the three drawing tasks which preceded the post-test. There were no significant differences in inverted figure production between pre- and post-test within any of the age groups (df = [illegible], x^2 = 2.39). Those children who could not draw inverted figures in the pre-test (27.5%) did not learn to do so as a result of being exposed to the neutral or focal point stimuli in Tasks 2 and 3; in the post-test approximately the same percentage of children (21.3%) still could not draw an inverted figure. Orientation response in the post-test, then, was unaffected by the type of stimulus (focal point or neutral) subjects received in Tasks 2 and 3; learning to draw an inverted figure did not occur during Tasks 2 and 3.

The figure orientations drawn in each of the four tasks in Experiment 2 are illustrated in Figures 12 to 20.

<u>Performance in the four drawing tasks in Experiment 2</u>

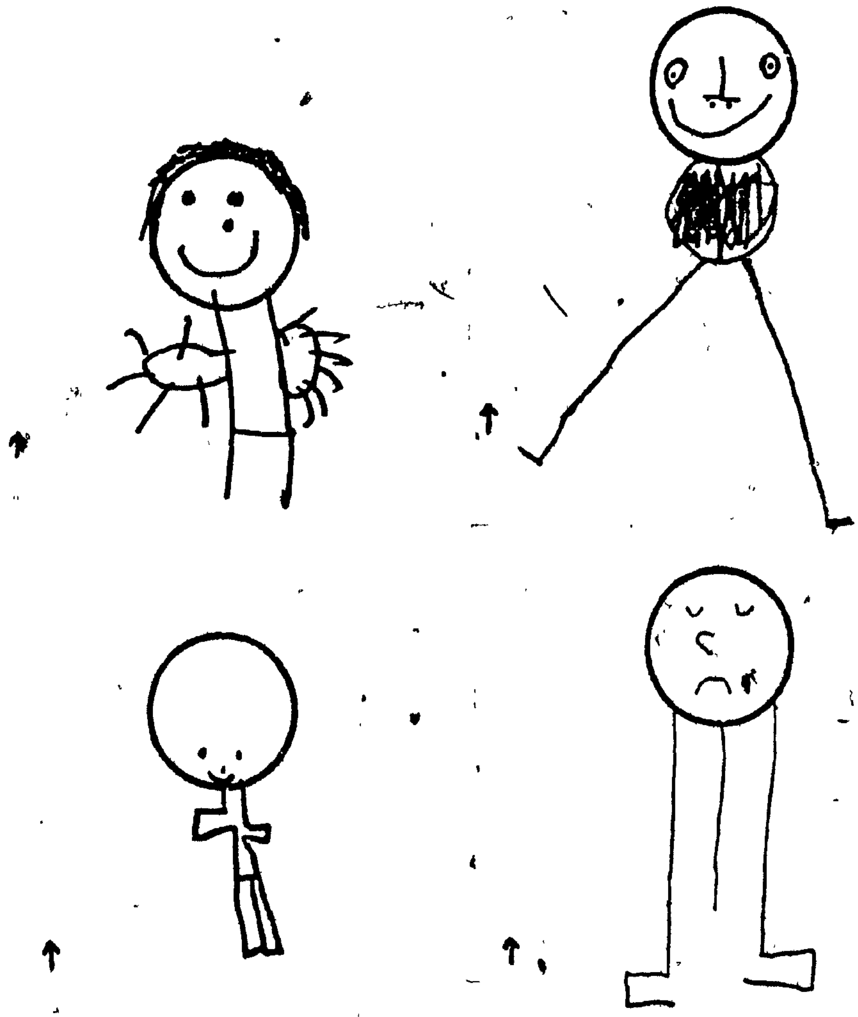


Figure 12. Upright figures by children in each age group, drawn in the pre-test. Reading clockwise from top left, the figures are by a girl, 4 years; a boy, 5 years; a girl, 7 years; a girl 6 years.

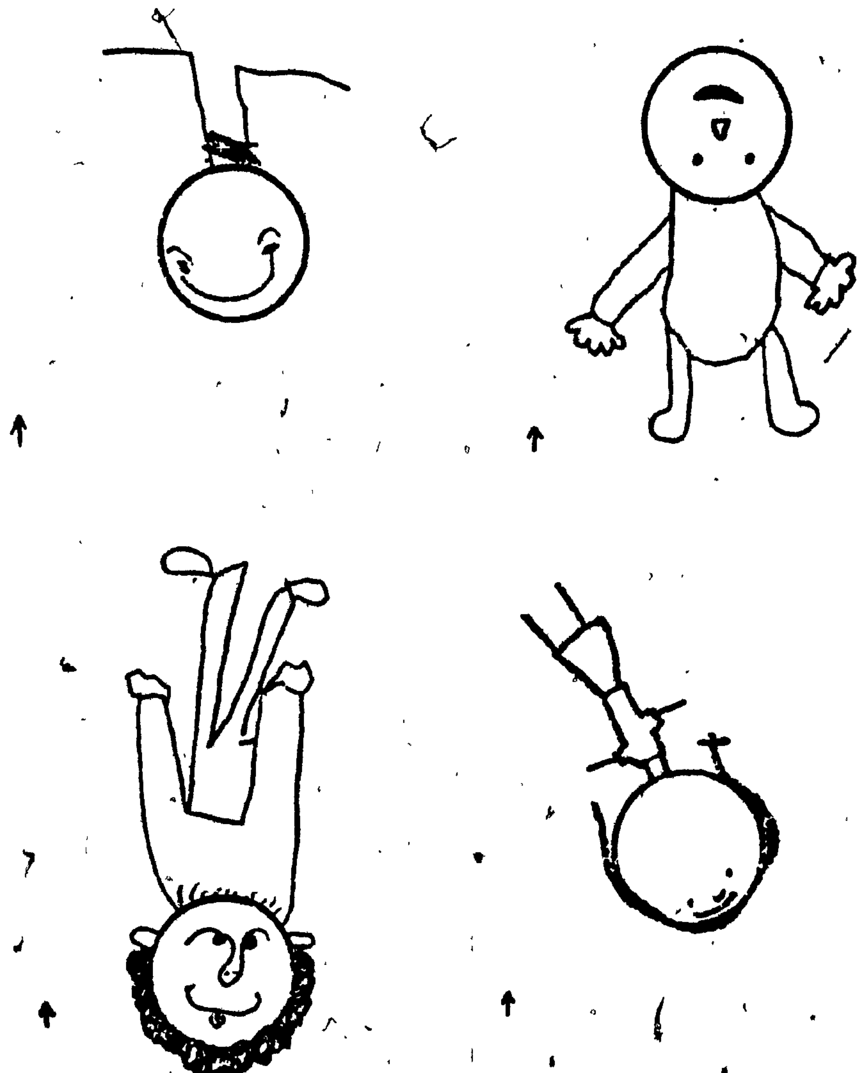


Figure 13. Partially-inverted figures by children in each age group, drawn in the pre-test. Reading clockwise from top left the figures are by a girl, 4 years; a boy, 5 years; a girl, 7 years; a boy, 6 years.

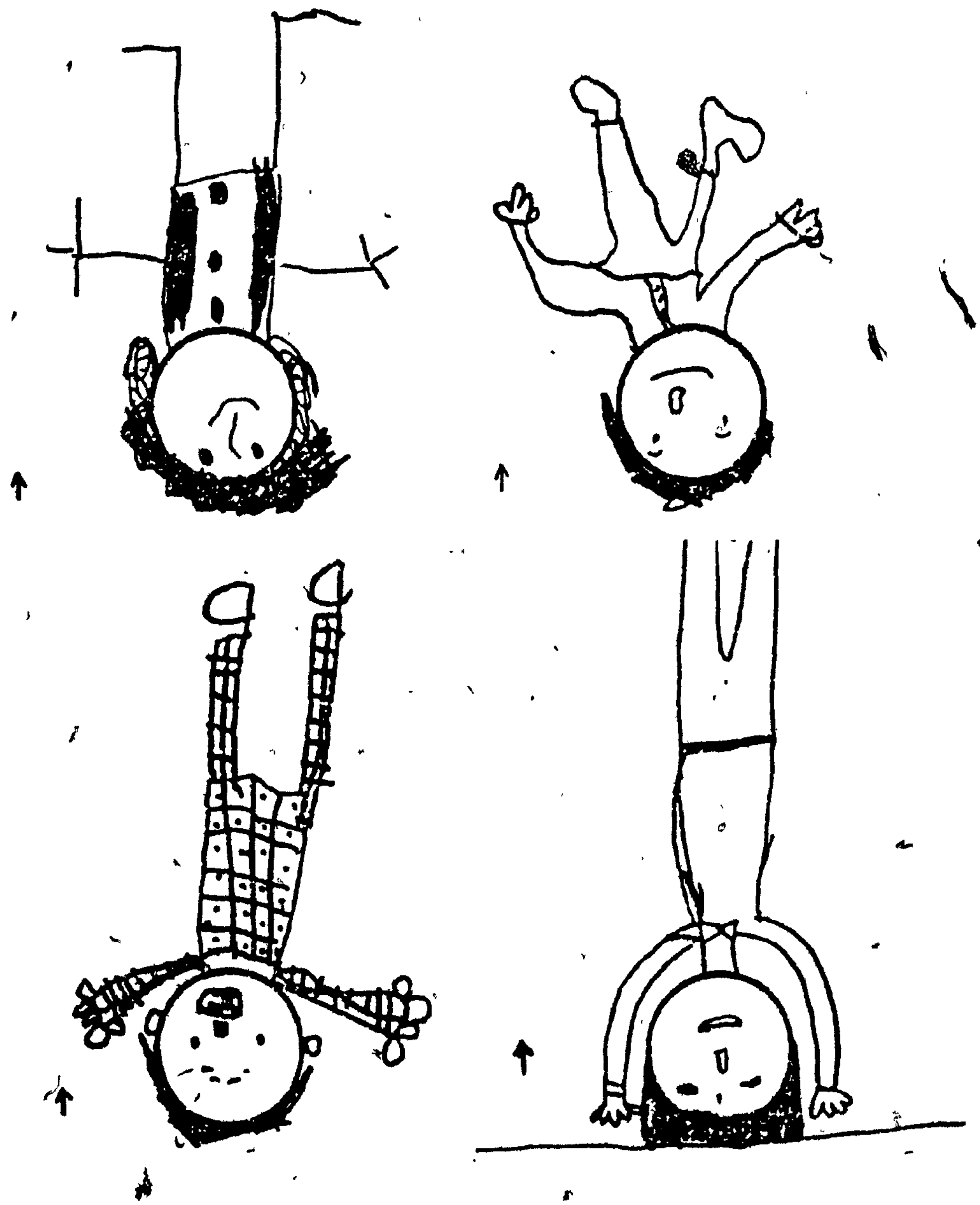


Figure 14. Inverted figures by children in each age group, drawn in the pre-test. Reading clockwise from top left, the figures are by a girl, 4 years; a boy, 5 years; a girl, 7 years; a boy, 6 years.

Figure 15. Two upright figures drawn by children in Task 2. The top figure is by a boy, 4 years; the bottom figure is by a girl, 6 years.

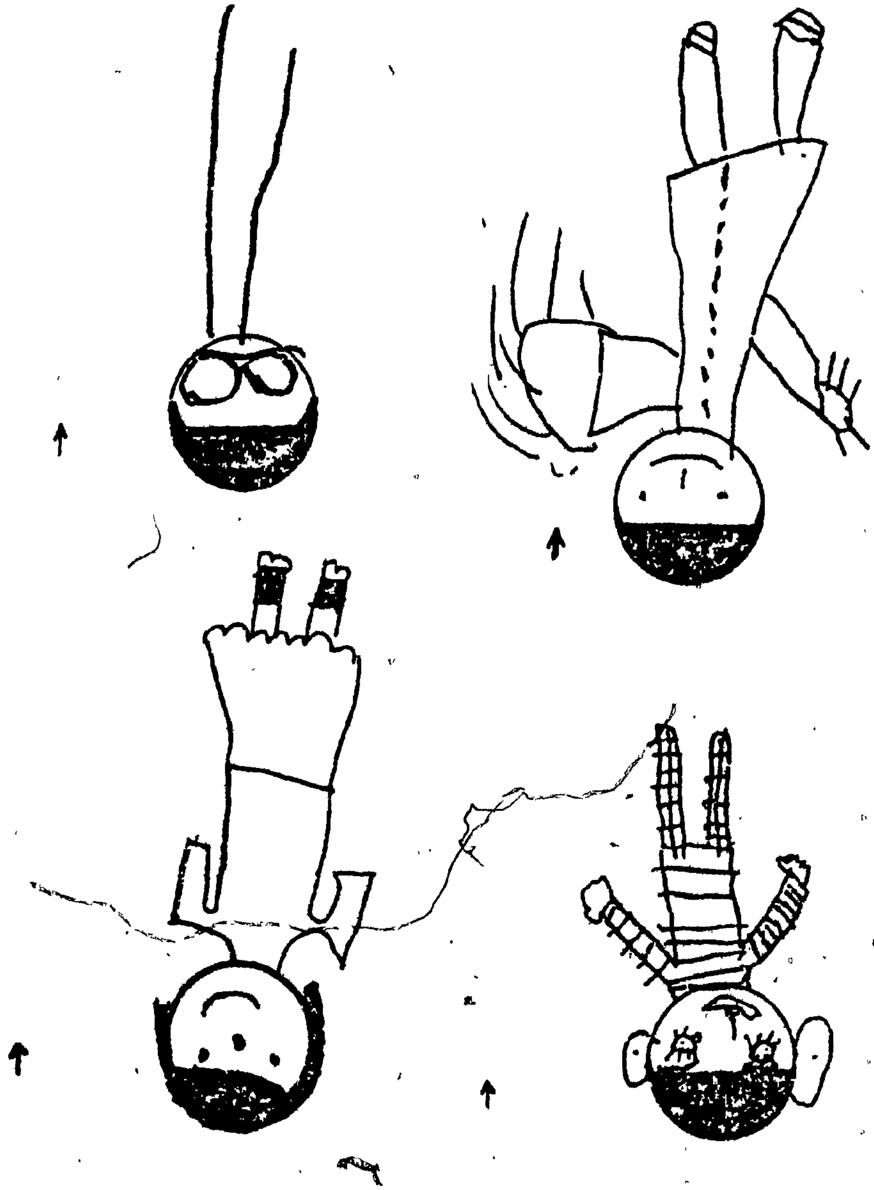


Figure 16. Inverted figures drawn by children in each age group during Task 2. Reading clockwise from top left, the figures are by a boy, 4 years; a girl, 5 years; a boy, 6 years; a girl, 7 years.

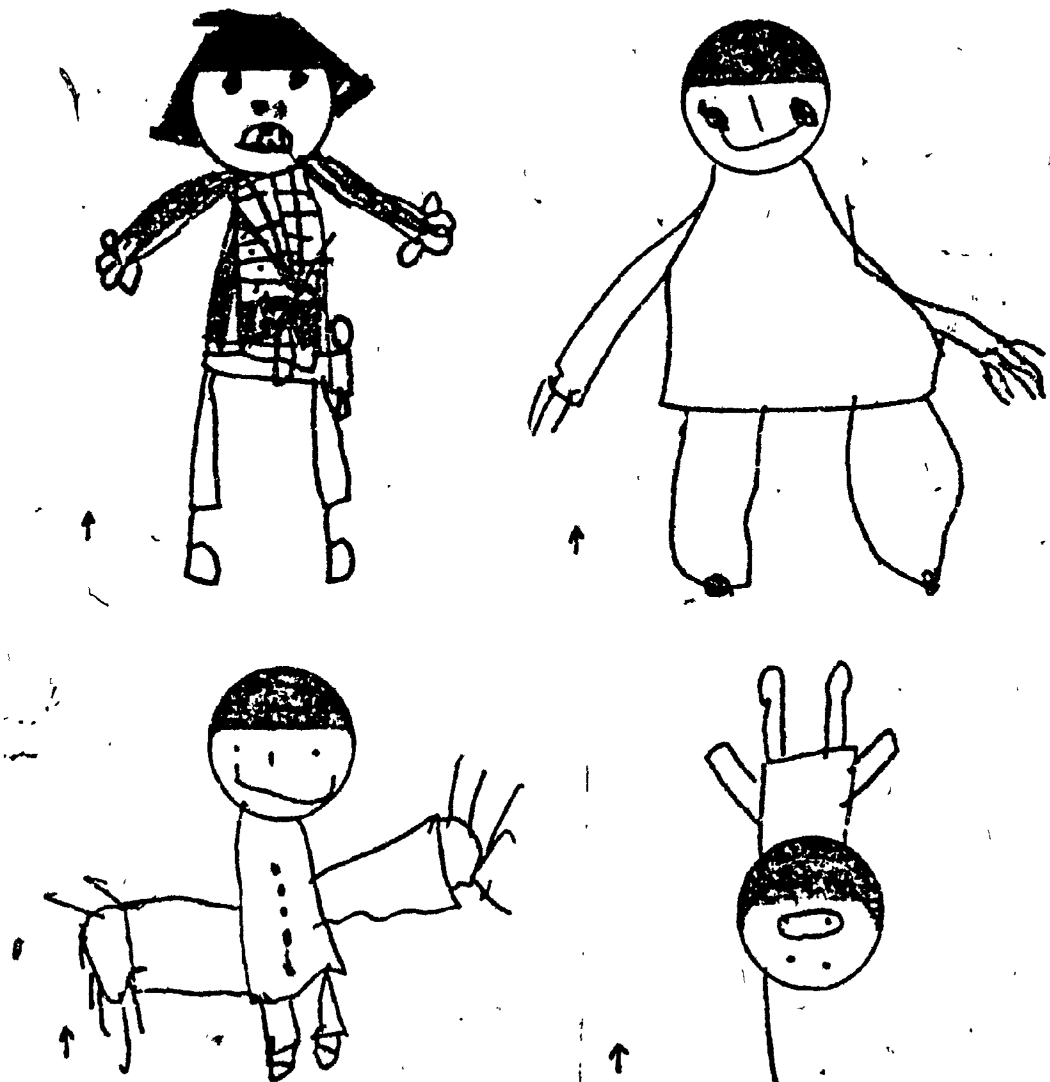


Figure 17. Upright and inverted figures by children in each age group, drawn in Task 3. Reading clockwise from top left, the figures are by a boy, 6 years; a girl, 4 years; a boy, 7 years; a girl, 5 years.

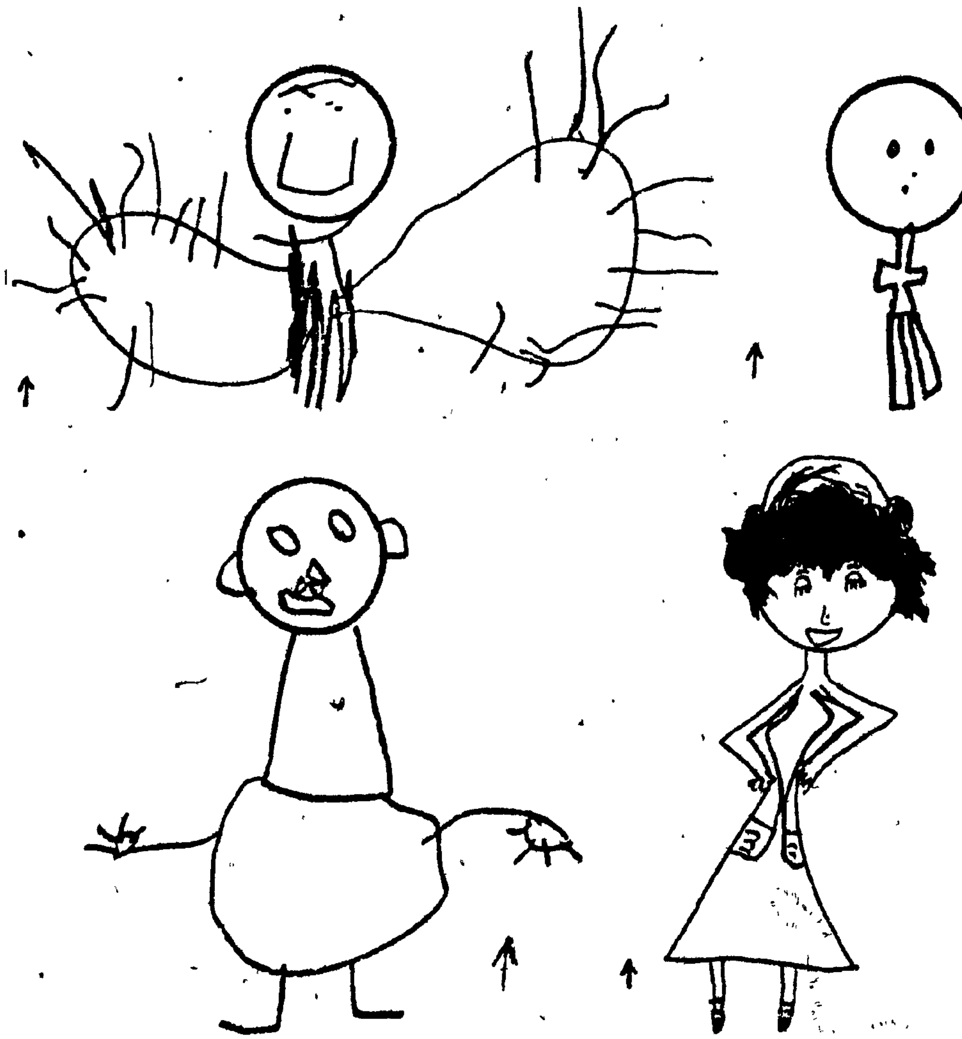


Figure 18. Upright figures drawn by children in each age group during the post-test. Reading clockwise from top left, the figures are by a boy, 4 years; a girl, 6 years; a girl, 7 years; a boy, 5 years.

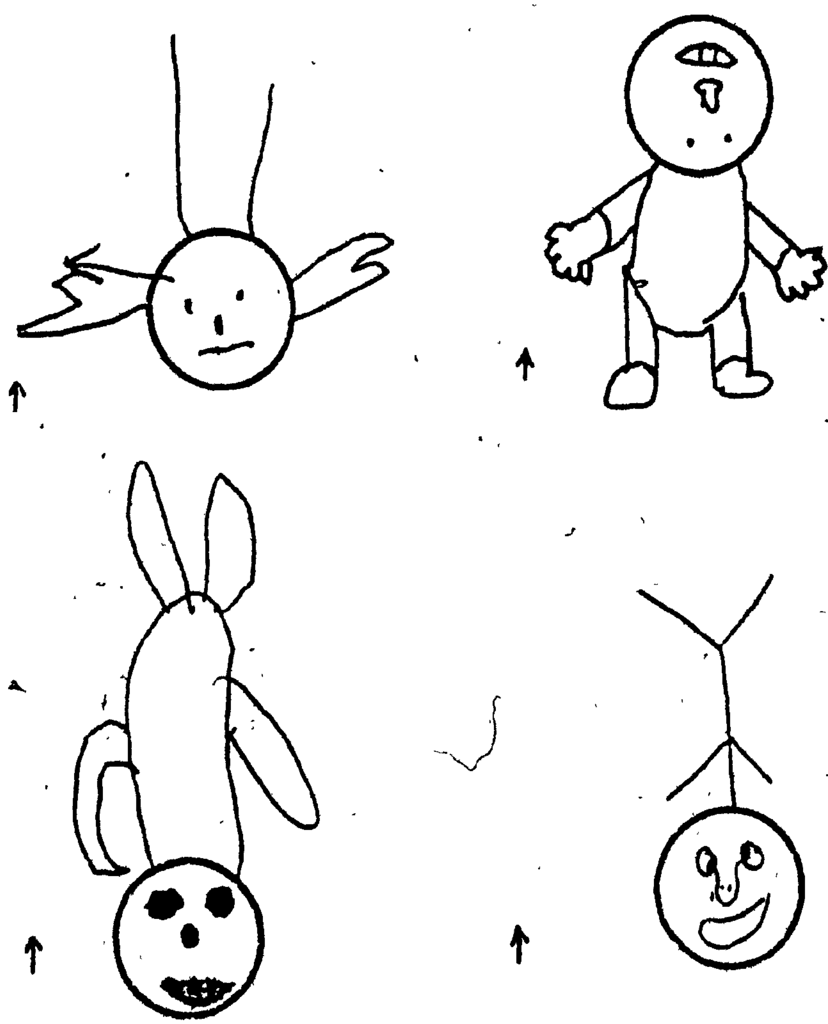


Figure 19. Partially-inverted figures drawn by children in each age group during the post-test. Reading clockwise from top left, the figures are by a girl, 4 years; a boy, 5 years; a girl, 7 years; a boy, 6 years.

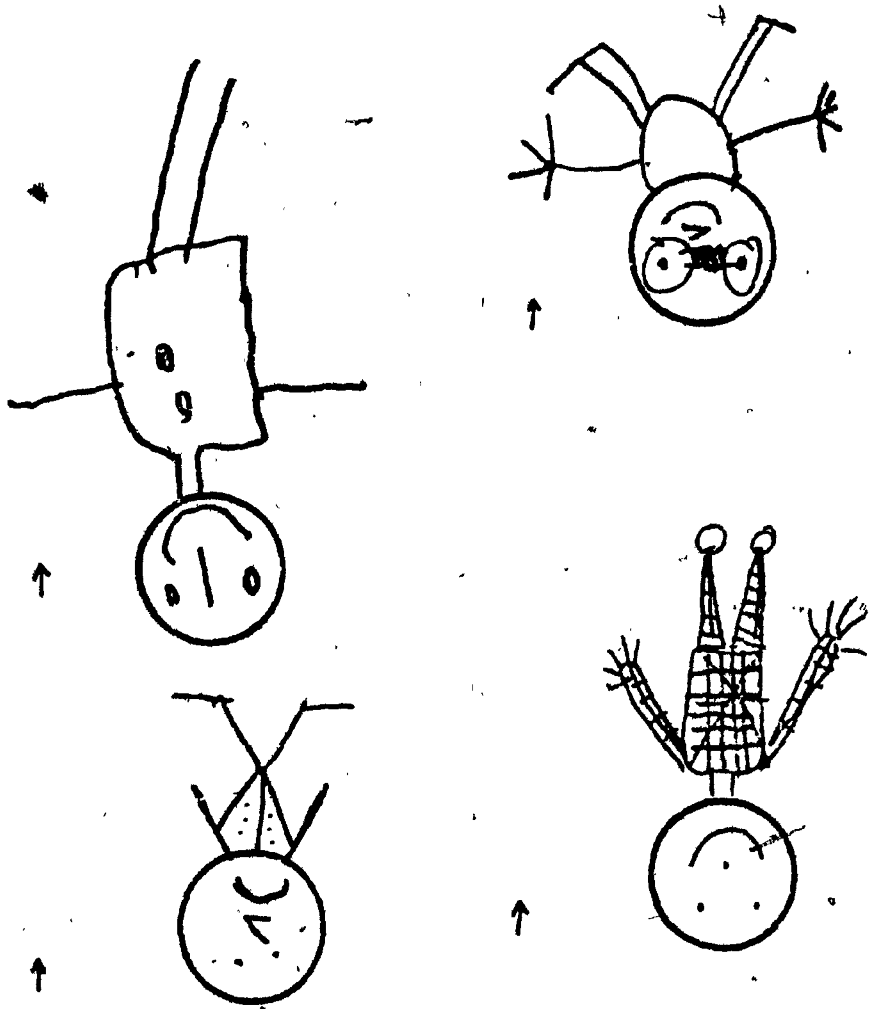


Figure 20. Inverted figures drawn by children in each age group during the post-test. Reading clockwise from top left, the figures are by a girl, 4 years; a boy, 5 years; a girl, 6 years; a boy, 7 years.

By studying the performance of the experimental group in Tasks 1, 2 and 4, it can be determined whether an inverted figure response in Task 2 (stimulus: a low-focal-point form) was prohibited by a basic inability to draw an inverted figure at all. It is feasible to suggest that some subjects may a) have identified the low-focal-point form as inverted in the Experiment 1 and b) have wanted to draw an inverted figure when given the same stimulus in Task 2, Experiment 2, but c) were unable to do so because they could not draw an inverted figure when paper rotation is prohibited. Before comparing performance in the drawing and judgement experiments, it is crucial to exclude from further discussion children who could not draw inverted figures, which is, after all, one of the potential graphic figure orientations which may be dictated by perceptual judgements of form orientation.

For purposes of this discussion, children are classified in two ways. Children who can draw both upright and inverted figures are categorized as possessing a repertoire of figure orientations, or as being repertoire subjects. Children who can draw upright, but not inverted, figures are classified as not possessing a repertoire of figure orientations, or as being non-repertoire subjects. The capacity to draw inverted figures is measured by performance in the pre- and post-test (where inverted figures were demanded of each subject): repertoire subjects drew inverted figures in both tests, while non-repertoire subjects drew upright or partially-inverted figures (or refused) in either, or both, pre-test and post-test.

By looking at the responses of the experimental group children in pre-test, Task 2 and post-test it is possible to discover whether only those children who had mastered the production of inverted figures (as measured in pre- and post-test) drew inverted figures in response to a low-focal-point form (Task 2). Table 10 shows that, within the experimental group, it was essentially repertoire subjects who drew inverted figures in Task 2. Children who could not draw an inverted figure (non-repertoire subjects) did not respond to the low-focal-point form with an inverted figure. Chi-square analysis shows that inverted figure response in Task 2 was a function of a consistent capacity to draw inverted figures. Figure 21 illustrates these findings.

One of the prerequisites for responding to a low-focal-point form with an inverted figure is a consistent capacity to draw inverted figures. This finding poses problems for Goodnow and Friedman's (1972) conclusion that approximately 50% of four year olds in their study drew upright figures in response to the eyes "low" stimulus because they were experiencing pressure to produce a conventionally-acceptable figure orientation. However,

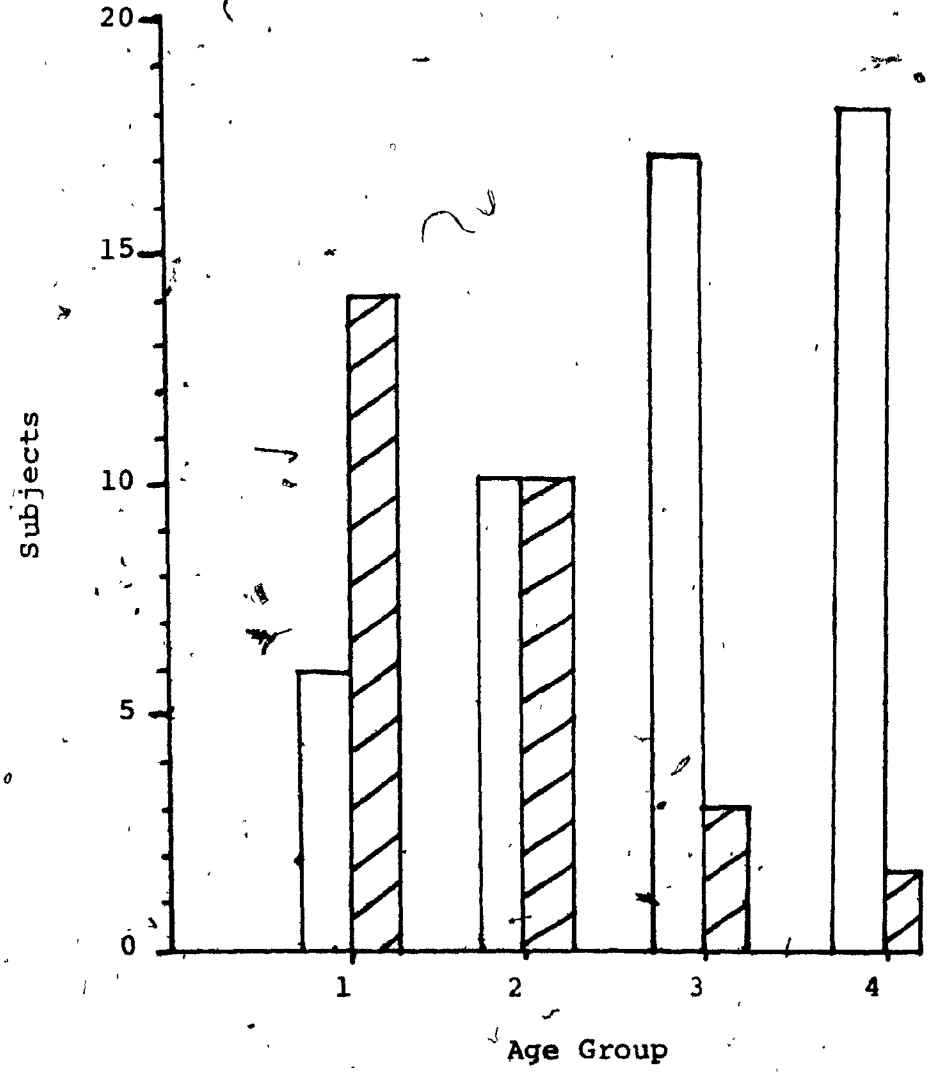
Table 10

Frequency of inverted figure responses in Task 2[a] by repertoire and non-repertoire experimental group subjects

Figure Orientations Available	Age group[b]			
	1	2	3	4
Repertoire	6(5)	10(8)	17(12)	18(11)
Non-repertoire	14(1)	10(2)	3(0)	2(1)
	df = 1	$x^2 = 5.08$	$p < .01$	

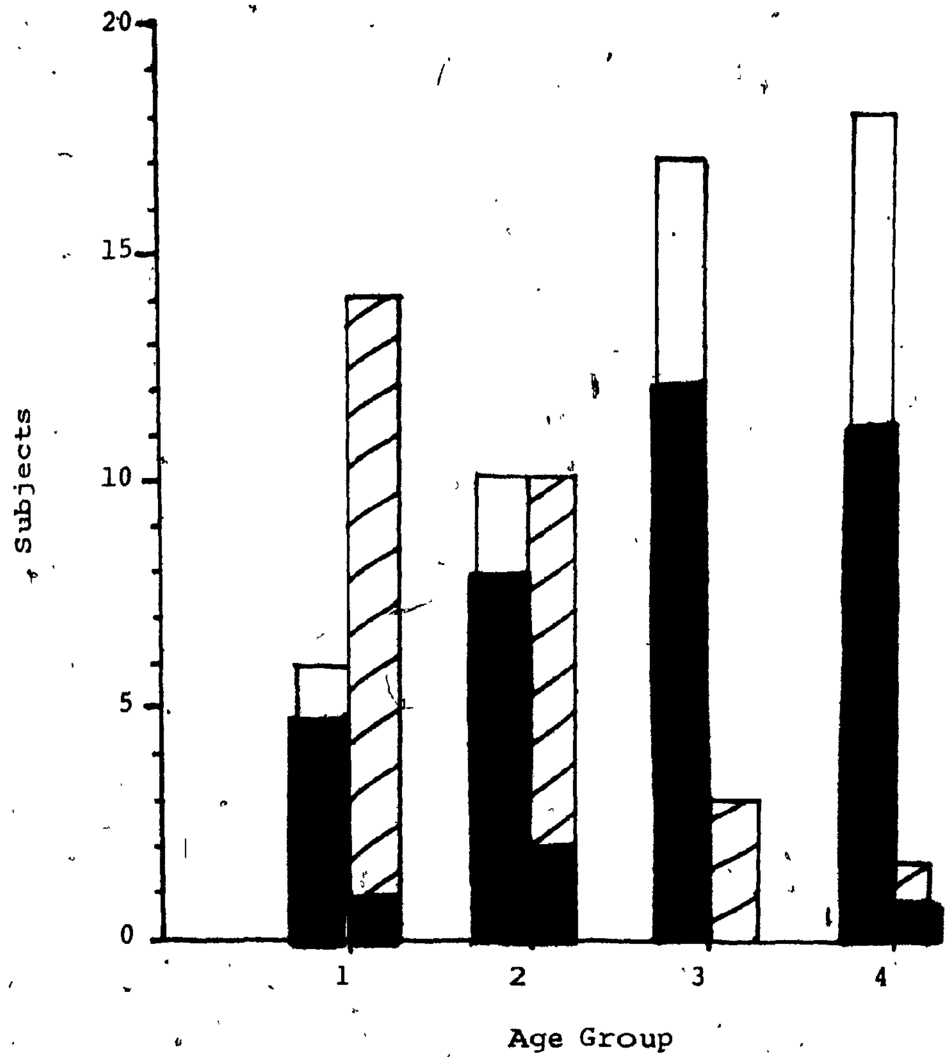
[a]indicated by number in parentheses.

[b]experimental groups only, n=20 in each group.



Key: ☐ repertoire subjects (consistently drew inverted figures in pre- and post-test.)
▨ non-repertoire subjects (did not, or only inconsistently drew inverted figures in pre- and post-test.)

Figure 21. The number of repertoire and non-repertoire experimental group subjects who drew inverted figures in Task 2.



Key: repertoire subjects (consistently drew inverted figures in pre- and post-test.)

non-repertoire subjects (did not, or only inconsistently drew inverted figures in pre- and post-test.)

subjects who drew inverted figures in task 2.

Figure 21. The number of repertoire and non-repertoire experimental group subjects who drew inverted figures in Task 2.

in light of the present findings, it can be asked whether children in their study drew upright figures in response to an eyes "low" stimulus because they were "sensitive" to the convention of upright figures or because they couldn't draw inverted figures In other words, it is possible that the youngest subjects in their study who drew upright figures may not have been able to produce an inverted figure, although identifying the "eyes low" stimulus as inverted (and requiring an inverted figure response).

Although not all children in this study who could draw inverted figures in pre- and post-test actually did so when confronted with a low focal point form, children who could not draw inverted figures in pre- and post-test rarely (13%) attempted to do so when presented with the low focal point form. It now becomes crucial to determine why a subject who could draw inverted figures did not draw one when given a low focal point form.

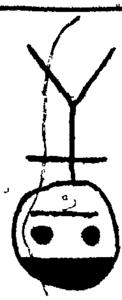
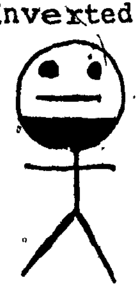
To determine why subjects who could draw inverted figures did not choose to do so when given a low focal point form, it will be necessary to examine these subjects' previous judgements of the form in this orientation (Experiment 1).

Comparison of responses in the perception and drawing experiments

Excluding from further discussion all of the non-repertoire subjects (those who did not consistently draw inverted figures), the judgement and drawing responses of the remaining repertoire subjects are shown in Table 11. Subjects in the top left cell of this table judged the form to be inverted with focal point low, and, accordingly, drew inverted figures; subjects in the top right cell judged the form in this orientation to be inverted but later drew upright figures; subjects in the bottom right cell judged the form to be upright and, accordingly, drew upright figures; subjects in the bottom left cell judged the form to be inverted, but later drew upright figures. It should be recalled that all of these subjects could draw an inverted figure if they so desired. Put another way, these subjects could make a <u>choice</u> of figure orientation from a <u>repertoire</u> of at least two orientation types (upright and inverted). Children in the top left and bottom right cells show <u>consistency</u> of judgement and drawing responses: their figure orientations are in alignment with their previously-made assessment of the basal form's orientation; children in the top right and bottom left cells show <u>inconsistency</u> of judgement and drawing responses: their figure orientation response contradicts their previously-made judgement of the basal

Table 11

Within-subject relation of judgement and drawing responses, in repertoire subjects[a] only

	Judgement Response		
Drawing Response	 Inverted	 Upright	n=
 Inverted	32	4	36
 Upright	6	9	15
n=	38	13	

[a]n=51

form's orientation.

Chi-square analysis of the relation between judgement and drawing responses shows a significant correlation (df = 1, x^2 =13.36, p < .001). Children who judged the form to be inverted tended to draw an inverted figure when asked to complete it as a person; children who judged the form to be upright tended to draw an upright figure when asked to complete it as a person. Figure orientation is therefore, to a large extent, a function of the orientation judgement performed on the basal form. The orientation judgements and graphic figure orientations agreed (i.e. form judged upright, figure drawn upright, or, form judged inverted, figure drawn inverted) in the case of 80.4% of the repertoire subjects. There was disagreement between the two responses (i.e. form judged upright, figure drawn inverted, or, form judged inverted, figure drawn upright) in the remaining 19.6% of the repertoire subjects. Judgement of the orientation of the basal form determined the orientation of the completed graphic figure. It should be recalled that children judged the experimental form (Stimulus 2) in the judgement experiment without an awareness that it would appear later as a graphic "head." They were not judging the orientation of the form by assigning a meaning of "hair" or "beard" to the focal points. The judgement experiment always preceded the drawing experiment. It follows, then, that if children had switched in the drawing experiment to assignation of a graphic "hair" or "beard" value to the focal points, there would be little agreement between orientation judgement and figure orientation. In fact, this may have been what happened in the case of the ten children whose orientation judgements and figure orientations did not agree. They may have judged the forms according to the salience of focal point or the framework in Experiment 2, but graphically completed the figure according to an assignation of beard or hair to the focal points. The findings of the study are summarized below.

Summary of results

It was found that children's judgements of the orientation of basal forms determines the alignment of the later parts of their drawing. Comparing the results of a judgement and drawing test, it was found that children were generally consistent in orienting their human figure drawings in agreement with judgement of the initial form's orientation.

A potentially confounding variable was controlled in this study: all children were pre-tested to determine if they could draw one of the figure orientations which their judgements may have required, i.e. produce an inverted human figure drawing. Analysis of performance in the judgement and drawing experiments was then concentrated on subjects who could draw both of the potential orientation types, upright and inverted figures.

Children judged the orientation of, and oriented graphic figures from, a form which was visually salient but neutral as a drawing feature (and if not neutral at least ambiguous: it could act as either a top or bottom feature, i.e. hair or beard, respectively). This suggests that although placement of internal cues underlies some children's judgement of the orientation of their drawn forms, these cues need not resemble parts the child habitually draws (i.e. be "graphically" meaningful). In this study non-meaningful but visually salient internal cues placed in the bottom of a basal form elicited inverted figures. Judgement of form orientation during the drawing process is thus a function of a perceptual process, visual exploration of form, as well as cognitive associations between internal cues and features the child commonly draws.

In the judgement experiment, it was not found that use of a focal point standard decreased with development, as Ghent (1961) contended. Children four to seven years old employed a focal point standard in judging the orientation of a series of forms, equating the top of the forms with the area of greatest visual salience. Since previous studies (Antonovsky et al., 1964; Ghent, 1961; Moeller et al., 1969) provided many more forms for judgement than were offered in this study, the present findings do not necessarily invalidate Ghent's conclusion.

In the pre- and post-test of Experiment 2, it was found that an ability which previous studies (Bassett, 1977; Goodnow et al., 1972) assumed had been attained by all four and five year olds (i.e. capacity to draw an inverted figure) is not present in the majority of four year olds nor all five year olds. In fact, Bassett (1977, p. 55) equated capacity to "turn a cardboard tree upside down" with the ability to draw an inverted figure. This study, more precisely the cognitive test (Screening Test), demonstrated that even a complete understanding of "upside down" is an insufficient basis for completing an inverted graphic figure. The Goodnow et al. (1972) study provided no pre-test at all to determine whether four year old children could draw inverted figures; this calls into question both the results, and the interpretation of results, in that study. At least some of the children who drew upright figures in response to an "eyes low" stimulus (see Figure 5) may have been drawing a figure in the only orientation open to them (i.e.

upright).

In this study, children in all age groups drew inverted figures when given a low focal point. There was a non-significant increase with development in this figure orientation response. Whereas Goodnow et al. (1972) found that four and six year olds drew more inverted figures than five year olds when given a form with low placement of internal cues (see Figure 11), resulting in a U-shaped curve, it was found in this study that plotting inverted figure responses produced a linear increase with development. Differences in these two response patterns may be a function of the different stimuli presented for completion, or of methodological problems in the Goodnow et al. study. (Their population of three and four year olds may not have been representative of the ability of this age group to draw inverted figures; no pre-test was given to determine which of their youngest subjects could produce inverted figures in a constrained drawing task.) Children in this study drew inverted figures only in response to the low focal point form; given a circle stimulus or a focal point top form they drew upright figures in almost all cases.

Examining the relation between judgement and graphic orientations responses, it was found that children who originally (Experiment 2) judged the low focal point form to be inverted drew inverted figures when given the form in this orientation for completion as a human figure. Similarly, children who had judged the form to be upright in this orientation (low focal point) drew upright figures. Only 19.6% of the children's graphic orientation responses contradicted their previous orientation judgements. Only subjects with a proven capacity to consistently draw inverted figures, as measured in pre- and post-tests, were included in this analysis of judgement and drawing responses. In the following chapter a few of the problems raised by these findings will be addressed.

Chapter VI

Interpretation and Implications

This study investigated the effect of behaviours in three domains, cognition, perception and drawing, on the orientation of children's human figure drawings. Since children in this study were asked to discriminate the upright and inverted versions of a series of abstract forms, and the two graphic figure orientation responses considered were upright and inverted, an experiment was designed to ensure that all children were cognizant of these concepts. It was found that children ranging in age from four to seven years applied these concepts to a series of abstract forms, forms which adults judge to have no specific upright or inverted orientation (Ghent, 1961). However, although all children understood the concept of inversion, only the six and seven year old children could consistently draw inverted figures on demand. It is evident that children "knew" the appearance and at least some of the attributes of "an upside down person;" this knowledge was insufficient for the task of drawing an inverted person.

The verbal responses in the cognition experiment confirm this discrepancy between conceptualization and graphic performance. Children could describe the characteristics of an inverted doll which differentiated it from the dolls in other orientations. The most frequently voiced descriptions were "he's on his head," or "his feet are on top, his head on bottom." It is clear that conceptualization of the inverted figure's differentiating attributes was inadequate for successful graphic reconstruction of the inverted figure.

This study attempted to elucidate how the initial forms in a graphic sequence influence the orientation of later forms. It was predicted that children who judged the orientation of the graphic basal form (Stimulus 2, Perception Experiment) according to the placement of the focal point inside the form would align the later parts of the figure in agreement with the placement of this internal cue. When the cue was "high," the form was judged to be upright: the child therefore would draw an upright figure. Conversely, children who judged the orientation of form by relating it to framework cues were expected to judge any given basal form to be upright: the child here would draw an upright figure regardless of the placement of internal cues.

It was hypothesized that the way children judge the orientation of the basal form affects the orientation of the later figural parts and ultimately (because the orientation of each part contributes to the orientation of the whole figure) the whole figure.

It was found that this hypothesis veridically describes the interaction between judgement of form orientation and graphic figure orientation response. Eliminating subjects who could not draw inverted figures, a high degree of consistency was revealed between these two responses. Children drew figures which agreed in orientation with their judgements of the provided basal form's orientation. Furthermore, older as well as younger children attended to internal cues in the basal form, aligning their figures in agreement with a within-form cue. This does not conform to the hypothesis of Freeman (1977) and Goodnow (1977), who state that as children develop they increasingly attend to external cues for orienting graphic figures. In this study, six and seven year olds (60% in both age groups) oriented their figures using the placement of the focal point as "top of head" marker: when this cue was in the bottom of the "head" form, these older children drew inverted figures. They showed no reluctance to violate the accepted convention of top of figure, top of framework alignment. This does not suggest, of course, that children younger than seven cannot attend to framework cues in orienting their figures, but merely that in this particular conflict between internal and external framework cues, internal form cues were more salient (cf. Freeman, 1977).

Goodnow et.al. (1972) hypothesized that visual discrimination of the placement of cues within graphic forms is not a factor in the orientation of children's human figure drawings, but that employment of two graphic principles (i.e. principles exclusive to working in the graphic medium) underlies figure orientation. Goodnow et al. stress that it is identification of internal cues <u>as graphic features</u> which determines figure orientation. The child will not draw horizontal, oblique or inverted figures in response to, respectively, sideways, slanted or low cues unless he or she identifies them as a plausible graphic unit (eyes, mouth, nose and so on). In this study, however, cues which were visually salient but graphically ambiguous elicited inverted graphic figures when they appeared low in the initial basal form. It appears that even generalized markers (e.g. the darkened area of Stimulus 2 in this study) can act as top of head form; they need not exactly resemble graphic features found in young children's drawings.

Moreover, according to Goodnow et al., children who orient their graphic figures obeying an "agreement between parts principle" do so because a) they do not have the graphic skills to modify misplaced internal cues (e.g. turn eyes low into a mouth by connecting the dots with a line), and b) they are unaware of the graphic convention of upright figures. Older children, again according to Goodnow et al., are able to modify the internal cues they draw in order to produce an upright figure, and are also aware of the convention of upright figures. If they do not choose to draw an upright figure, they often feel constrained to provide the viewer with a verbal explanation of why the figure deviates from the upright.

Goodnow et al. (1972) repeatedly refer to the idea that older children increasingly choose the orientation of their figures, modifying cues to produce upright figures or verbalizing to explain inverted figures. Younger children, on the other hand, seem doomed to figure orientation responses dictated by type of internal cue and it's placement. Goodnow et al. (1972, p. 15) concluded that

> The major factors are probably the degree of importance attached to standard orientation and the availability of meanings that can be assigned to non-standard orientations.

While admirable in its clarity and in its parsimonious reduction of the problem to an interaction of two purely graphic principles, the interpretation of Goodnow et al. goes beyond the limits of its findings. It may not be possible to eliminate a "perception factor" interacting with graphic principle, or to postulate the "meaningfulness" of the cues as the sole determinant of standard or non-standard figures. The present study provided a visually salient, but graphically ambiguous, form for completion as a human figure. It was found that some children's judgements of the form's orientation were based on an assessment of the cue placement within the form. Furthermore these judgements were derived from a perceptual exploration of the form (Ghent, 1961) and not on a cognitive assessment of the cues, graphic meaningfulness. Given a graphically ambiguous form, their figure orientation responses agreed with a previously-made assessment of the form's orientation.

The differences in the findings of this study and that of Goodnow et al. (1972) can be explained as follows.

The stimulus used in these experiments (Stimulus 2) was visually salient, but lower than Goodnow's in associational meaning as a graphic feature. The Goodnow et al. stimulus was a configuration commonly found in children's drawings (two dots, or "eyes"). Inverted figure response in the Goodnow et al. study could have been a function of either the "focalness" (a perceptual criterion of judgement) or the "meaningfulness" (a cognitive criterion of judgement) of the internal graphic cue (eyes). Certainly the Goodnow et al. within-form cue was more modifiable than the stimulus presented in this study. A simple line connecting the two dots created a bottom feature (a mouth) and made possible an upright figure. In this study, the low focal point stimulus was eminently unmodifiable. The darkened portion of the stimulus took up the whole area reserved for mouth or nose; the children who drew upright figures when given the low focal point form tended to disregard the darkened area at the bottom. They crammed in the facial features above the darkened space. Few children attempted to verbally or graphically incorporate the darkened area into their figures either by naming it as a beard or accentuating its "beardedness" with lines. It may be true, then, that for some features children spontaneously produce in their drawings (i.e. those features that closely resemble parts which are routinely drawn), the extent to which the features are left untouched or are altered may depend on how easy they are to graphically modify. If they cannot be easily modified, the figure will be aligned in agreement with the placement of the features within the basal form. If they can be easily modified, the features may be adapted to accommodate the drawing of an upright figure. However, this hypothesis may not cover all types of internal configurations children draw within their basal forms. Children, especially young children, often mark or scribble in cues which are more generalized, i.e. features which are salient but do not strictly resemble routine features.

A survey of the Kellogg Child Art Collection (1967) suggests that children emerging from the scribble stage mark in solid areas, irregular lines, small enclosed details and other features which, although visually salient, are not strictly speaking identified as eyes, nose or mouth. Given the young child's level of visual exploration of form, it can now be stated that these forms may act as generalized "tops of form" and only afterwards (if ever) be assigned a meaningful connotation. This study showed that children as old as seven years oriented graphic figures in alignment with strongly salient cues. Given a cue which was salient enough, even elementary school children disregarded the directional cues of the pictorial framework (and the cultural convention which dictates that these external cues must be obeyed) in order to draw inverted figures.

Children who judge the orientation of form according to the placement of internal cues (using a focal point standard for judging orientation) are more likely to orient figures in response to these cues than children who relate form to framework in making orientation judgements. However, if an internal cue is salient enough (in the sense of being visually salient) children as old as seven years may orient their figures in response to the placement of the cue, ignoring framework top and bottom. Strong internal cues (strong in the sense of being meaningful as graphic features or visually salient) may overcome framework features as the child draws the human figure.

The method of this study attempted to correct what this author perceived as deficiencies in the design of previous studies. As discussed earlier, success on a simple conceptual test of inversion was an inadequate predictor of success in drawing an inverted figure. Bassett (1977) had assumed incorrectly that capacity to turn a cardboard tree upside down was equivalent to drawing an inverted figure.

The evidence from this study indicates that not all four or five year olds can consistently draw inverted figures in a constrained drawing task: only 33% of the four year olds and 65% of the five year olds drew inverted figures in both pre- and post-test. This finding calls into question the Goodnow et al. (1972) interpretation of their U-shaped curve, describing the production of inverted figures by children three to seven years old (see Figure 11). If an undetermined number of four and five year old children in their study could not draw inverted figures when paper rotation was prohibited, there is no way of knowing whether young children drew upright figures because they a) were "resilient" to the eyes low cue, and thus ignored its placement or, b) were experiencing "stress" to produce upright figures, or c) could not, in fact, draw an inverted figure. Some of the "upright figure drawers" may thus have been responsive to the low placement of the eye cues (i.e. wanted to draw an inverted figure) but were thwarted by an incapacity to draw inverted figures.

If these authors (Bassett, 1976; Goodnow et al., 1972) had determined which of the younger children could draw inverted figures, it would have been possible to distinguish between children who had a choice (or repertoire) of orientations and those who did not. Ideally, they should also have determined which children actually judged the eyes low form to be inverted. There is a possibility that some children did not identify the dots as eyes.

One finding which is hard to account for in the present study is the frequency with which children of six and seven years continued to use a focal point standard. This is well beyond the age, according to Ghent (Braine, 1965a; Ghent, 1961), when children have adopted a form-framework standard for judging form orientation. However, if the cross stimulus in the perception experiment is disregarded (which is permissible considering that preference for one upright orientation of this stimulus may be a result of its familiarity), it becomes apparent that children in all age groups consistently judged only the circle stimulus to be upright with the focal point on top. A focal point standard may thus be more developmentally long-lived or persistent in the case of some more visually salient forms. This also would explain why this form elicited (when focal-point-low) inverted figures by even the oldest children in this study. It is conceivable that other less salient forms would not have had the same "inverted figure eliciting" effect.

Some writers (Bryant, 1969, 1972, 1974; Ibbotson & Bryant, 1974, 1976; Rock, 1956; Rock & Heimer, 1957) state that children as young as three years can "infer" (Bryant, 1974) the orientation of form by comparing it to framework cues. Other writers (Braine, 1966; Forgus, 1966; Gibson, 1950; Gibson & Mowrer, 1938) have claimed that children and adults rely on proprioceptive stimulation and form-retinal framework comparisons, as well as framework cues, for making judgements of form orientation. Werner and Wapner (1949, 1952) attempted to show that both proprioceptive (input from the organism) and framework (input from the environment) indicators underly orientation judgements. According to Werner et al. the organism balances information from both the senses and body "tone" (proprioception) in assessing the orientation of forms and objects (hence "sensori-tonic theory"). Evidence from drawing studies (Gridley, 1938; Goodnow et al., 1972) reveals an interaction of internal (posture, retinal frameworks) and external (framework) standards for judging the orientation of self-produced graphic forms. Freeman (1977, p. 22) has defined this as an "opposition" between internal and external cues during the drawing process.

> The conclusion is that the match or mismatch between internal and external cues can powerfully influence orientation in drawing; it is still an open research question as to the conditions under which one or the other cue will exert maximal effect on different aspects of drawing.

One of the conditions may be how children evaluate the orientation of form, i.e. whether they relate form to an internal or external framework.

What is required at this point are large-scale studies in which children are asked to judge the orientation of, and graphically complete, forms containing a variety of internal cues in a wide range of placements. It would then be possible to tease out the relative effects of salience and meaning on graphic figure orientation.

Figure 22, taken from a pilot study by this writer, shows the consequences of an internal cue-external cue conflict during the production of a human figure. This 5 year old boy was given a basal form with obliquely-aligned "ears" afixed to the form. The facial features are aligned in agreement with these cues, while the body "bends" toward an agreement with a framework cue, the left edge of the paper.

A constrained drawing task, such as was given in this study, can demand a radical transformation of a routine sequence. A previous study (Goodnow, 1977) indicates that horizontal figures may be easier for young children to draw than inverted figures, suggesting that ordering the parts of a figure along an axis perpendicular to the child's vertical axis may be easier than ordering the parts along an axis that is 180° to the child's vertical axis. The frequency with which children will change their position, or rotate the paper, may depend on the degree to which the vertical axis indicated by internal cues deviates from the child's vertical axis. That is, if the axis dictated by the cue deviates less than 90° from the child's vertical axis, he may complete the figure without re-aligning a) his vertical axis relative to the form axis (change of position) or b) the form's axis relative to his vertical axis (rotation of

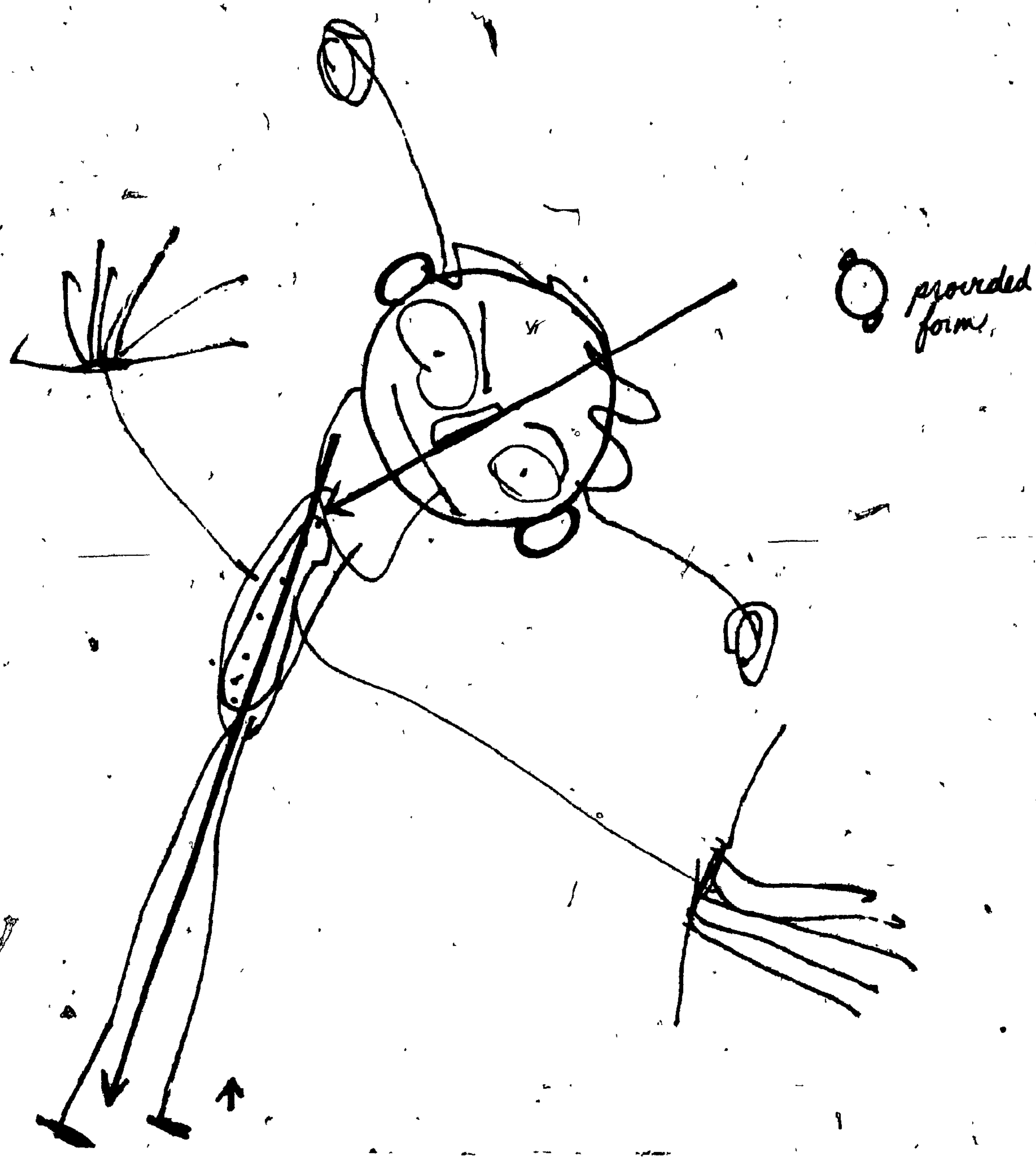


Figure 22. Drawing by a five year old boy, showing a figure oriented in agreement with both internal and external cues. Lines indicate the two axes of orientation.

paper).

The following model is put forward to describe the process by which young children orient their drawn figures.

Children younger than six typically start their figures with a head or head-body unit (Ames, 1945; Ames & Ilg, 1963; Freeman, 1975a). Four year olds then go on to fill in facial features while older children begin their figures with a greater variety of starting points (Goodnow, 1977). Children younger than six may not place their starting points in the habitual position (e.g. eyes near the top of the head, hair on the top of the head, or mouth near the bottom of the head) because of inattention (Freeman, 1976), accidental shift of the paper (cf. Gridley, 1938) or inaccuracy due to undeveloped motor control (Abercrombie, Lindon & Tyson, 1964, 1968). Looking at these initial marks, the young child (following Ghent's focal point standard) assesses the location of the top of the head according to the placement of these cues. If the cues do not resemble habitually made marks, their visual salience operates: the cues become generalized markers of top. At this point young children realign the top of the basal form with retinal or postural top (i.e. the child's top as defined by postural or retinal indicators). Oblique, bottom and side cues are rotated so that they will appear at the top of the form. There are two ways of realigning the top of the form with the position of the child: the paper can be rotated or the child can change his position vis a vis the paper. Once form top and retinal/postural top agree, the child orders the parts "downwards" (relative to his or her upright vertical axis only). The child, after either paper rotation or change of position, can deploy his routine upright figure sequence. The figure is thus "upright" relative to the child's upright, but not upright in relation to page indicators of directionality.

This hypothesis can be summarized as follows. The degree of paper rotation or change in child's position is a function of the interaction of two factors: a) the disparity in angle between the vertical axis of the initial form, as defined by internal cue placement, and the child's vertical axis, defined by proprioceptive cues and, b) the capacity of the child to serially order figure parts along an axis that deviates from his vertical axis. Children will increasingly rotate the paper or change their position as the vertical axis of the basal form (given by internal cues) deviates from the child's postural/retinal vertical axis.

Those children who do not define the top of the head form or the top of the figure by placement of internal cues will be less inclined to draw non-standard figures. For them, all "heads" are upright if the framework is upright. Misplaced starting points are either ignored or modified as older children seek to produce figures that are consistently upright (Goodnow, 1977). The extent to which even older children will use internal or external cues depends on the salience, meaningfulness, and modifiability of the internal cues. Children who judge form orientation using a form-framework standard may switch to a focal point standard in cases where the focal point is especially salient.

The main objective of this study was evaluation of which type of cues, internal or external, children respond to when orienting their graphic figures. A perception experiment described some cues children respond to when judging the orientation of non-realistic forms. A close correlation was found between judging form and orienting figures: children who judged form orientation according to internal cue placement also oriented their graphic figures in agreement with internal cue placement; children who judged form orientation by comparing the relation of form to framework aligned their graphic figures in agreement with framework, or external cues.

That children are aware of the conflicting demands of the conventional standard for orienting figures and the "upside down head" given in the drawing experiment was perhaps best revealed in the comments of a six year old girl: "Should I draw him upside down or like he's supposed to be." After some deliberation, she drew her person upside down.

If research in drawing development is to be considered on an equal standing with research endeavours in other areas of development, more effort must be expended in establishing that children can actually perform the graphic responses serving as independent variables. Furthermore, the tendency to automatically equate performances in two different domains (e.g. cognition and drawing) must be avoided. Finally, if performance in two domains is to be compared (e.g. judgement standards of form orientation and graphic figure orientation), it is imperative that each variable be independently measured before causal relationships between variables are postulated.

Chapter VII

Summary

This study investigated the effect of children's judgement of form orientation on the orientation of their graphic human figures. A cognitive screening test, perception and drawing experiments were designed to measure children's understanding of the concepts of inverted and upright, judgement standards children employ in assessing the orientation of abstract forms, and the relation of standards to drawing sequences in the construction of graphic human figures. One result of drawing sequence is figure orientation.

Children in this study were asked to judge the orientation of three stimuli. Each stimulus (a circle, a square and a cross) contained a salient feature or focal point in two positions, in the top or in the bottom portion of the form. They were then presented with the circle stimulus, once with focal point on top and once with focal point on bottom, and asked to complete it as a human figure. Within-subject analysis compared judgement and graphic responses.

A total of 160 children participated in the judgement and drawing experiments. There were 20 boys and 20 girls in each of the following age groups: four, five, six and seven year olds. All children completed each experiment. The experiments were carried out over a period of three (not necessarily consecutive) days: day one: Screening Test; day two: Judgement Experiment; day three: Drawing Experiment.

The perception experiment showed that children used two judgement standards for evaluating form orientation. One group judged the orientation of form according to the placement of focal point. When the focal point was "high" in the form it was judged to be upright, when it was "low" the form was judged to be inverted. A second group judged the orientation of form according to its relation to the enclosing pictorial frame; the area of the form most proximate to framework top was judged to be top of the form. These results further confirmed the findings of Lila Ghent Braine (1961, 1964) concerning children's judgements of form orientation.

A significant correlation was found between judgement of a form's orientation and graphic figure orientation response to the same form in the drawing experiment.

It was found that children oriented their graphic figures in agreement with previously-made orientation judgements: children who had judged a form to be inverted with focal point in the bottom portion drew an inverted figure when asked to complete this form as a human figure; children who had judged this low focal point version of the form to be upright completed an upright figure. Both groups aligned the later parts of their figure in agreement with their assessment of the initial, or basal, form's orientation. Children who drew inverted figures based their assessment on the placement of a low focal point; children who drew upright figures based their assessment on the relative position of the form to pictorial frame. The two graphic figure orientations exemplify utilization of either internal or external cues during figure drawing; Freeman (1977) has described this as the conflicting demands of internal vs. external cues.

It was hypothesized in this study that children's level of visual exploration of form underlies attention to either internal or external cues during graphic sequences. According to this view, inverted figures would result from children judging the orientation of their graphic forms on the basis of internal cue placement. It was suggested that the internal cues eliciting judgements of orientation need not be graphically meaningful.

i.e. even scribbles in a low placement could elicit inverted figures. In this study, a cue which was visually salient but graphically ambiguous caused children to draw inverted figures when it was located "low" in the initial graphic form.

This study controlled three variables which were not controlled in previous studies on graphic figure orientation; the Screening Test established that children understood the concept "upside down"; the Judgement Experiment identified which standard children used to judge the orientation of abstract graphic forms; the Drawing Experiment pre- and post-tests assessed which children were capable of producing one of the potential figure orientations (i.e. which children could draw an inverted figure).

A model describing the production of disoriented as well as "standard" figures was advanced. It was suggested that young children who judge form orientation by assessing the placement of internal cues rotate the paper, or change their position relative to the paper, in order to align the top of the first "head" form they draw with a posturally- or retinally-determined top. Top of form is aligned with top of child. The degree to which vertical axis of the form departs from the child's vertical axis determines the degree to which the paper will be rotated, or position changed: the child attempts to bring the two vertical axes into alignment. Children who judge form according to the co-ordinates provided by either distal or proximate frames modify or ignore internal cues from the very onset of the drawing sequence.7

Appendix A

Data Sheet used during testing sessions

Table 12

Data Sheet Used During Testing Sessions

#

________ Name ________ Age Mos. Sex: M F

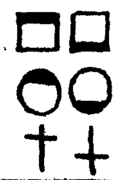
School ________ Grade P K 1 2

Experimental Condition [E] [C] Handedness R L

Experiment 1:
Passed test: [yes] [no]

Experiment 2: Stimulus Alignment [V] [H] Order 1-2-3 [ ]
2-3-1 [ ]
3-1-2 [ ]

Judged as upright 1
2
3



Consistency Score: 1 2 3

Experiment 3: Experimental group, stimulus order
[ ] Focal pt.top→focal pt. bottom
[ ] Focal pt.bottom→ focal pt. top

Task	Orientation	Id.Sp.Lo						
1	UF PIF IF							
2	UF PIF IF							
3	UF PIF IF							
4	UF PIF IF							

References

Abercrombie, M. L. J., Lindon, R. L. and Tyson, M. C. Associated movements in normal and psychically handicapped children. Developmental Medicine and Child Neurology, 1964, 6, 573.

Abercrombie, M. L. J., Lindon, R. L. and Tyson, M. C. Direction of drawing movements. Developmental Medicine and Child Neurology, 168, 10, 93-97.

Ames, L. B. The Gesell Incomplete Man Test as a differential indicator of average and superior behaviour in pre-school children. Journal of Genetic Psychology, 1943, 62, 217-274.

Ames, L. B. Free drawing and completion drawing: a comparative study of pre-school children. Journal of Genetic Psychology, 1945, 66, 161-166.

Ames, L. B. and Ilg, F. L. The Gesell Incomplete Man Test as a measure of developmental status. Genetic Psychology Monographs, 1963, 68, 247-307.

Antonovsky, H. F. and Ghent, L. Cross-cultural consistency of children's preferences for the orientation of figures. American Journal of Psychology, 1964, 77, 295-297.

Arnheim, R. Art and visual perception: a psychology of the creative eye. Berkeley, Calif.: University of

California Press, 1954.

Arnheim, R. Toward a psychology of art: collected essays. Berkeley, Calif.: University of California Press, 1966.

Arnheim, R. Visual thinking. Berkeley, Calif.: University of California Press, 1969.

Barry, J. The works of James Barry: I. London, 1809.

Bassett, E. M. The young child's perception and representation of the human figure. Unpublished M.A. Thesis, University of Lancaster, 1976.

Bassett, E. M. Production strategies in the child's drawing of the human figure: Towards an argument for a model of syncretic perception. In G. Butterworth (Ed.) The child's representation of the world. New York: Plenum Press, 1977.

Bender, L. Gestalt principles in the sidewalk drawings of children. Journal of Genetic Psychology, 1932, 41, 192-210.

Bender, L. Child psychiatric techniques. Springfield, Ill.: Charles C. Thomas, 1952.

Bee, H. L. and Walker, R. S. Experimental modification of the lag between perceiving and performing. Psychonomic Science, 1968, 11, 127-128.

Braine, L. Ghent. Age changes in the mode of perceiving geometric forms. Psychonomic Science, 1965, 2, 155-156.(a).

Braine, L. Ghent. Disorientation of forms: An examination of Rock's Theory. Psychonomic Science, 1965, 3, 541-542.(b).

Braine, L. Ghent. A developmental analysis of the effect of stimulus orientation on recognition. American Journal of Psychology, 1972, 85, 157-187.

Braine, L. Ghent. Perceiving and copying the orientation of geometric shapes. Journal of Research and Development in Education, 1973, 6(4), 44-55.

Brainerd, C. J. Imagery as a dependent variable. American Psychologist, 1971, 26, 599-600.

Brian, C. A. and Goodenough, F. L. The relative potency of colour and form perception at various ages. Journal of Experimental Psychology, 1929, 12, 197-213.

Bryant, P. E. Perception and memory of the orientation of visually presented lines by children. Nature, 1969, 224, 1331-1332.

Bryant, P. E. The understanding of invariance by very young children. Canadian Journal of Psychology, 1972, 26, 78-96.

Bryant, P. E. Perception and understanding in young children. New York: Basic Books, 1974.

Bugelski, B. R. Words and things and images. American Psychologist, 1970, 25, 1002-1012.

Caramaussel, E. Ce que voient des yeux d'enfant. Journal de Psychologie, 1924, 21, 161-170.

Davidson, H. A. Study of reversals in young children. Journal of Genetic Psychology, 1934, 45, 452-465.

DiLeo, J. Young children and their drawings. New York: Bruner/Mazel, 1970.

DiLeo, J. Young children's drawings as diagnostic aids. New York: Bruner/Mazel, 1972.

Eldred, C. A. Judgements of right-side up and figure rotation by young children. Child Development, 1973, 44(2), 395-399.

Elkind, D. and Weiss, J. Studies in perceptual development. III: Perceptual exploration. Child Development, 1967, 38, 553-561.

Eng, H. The psychology of children's drawings. London: Routledge and Kegan Paul, 1931.

Fabian, A. A. Vertical rotation in visual-motor performance - it's relationship to reading reversals. Journal of Educational Psychology, 1945, 36, 129-154.

Fehrer, E. V. An investigation of the learning of visually perceived forms. American Journal of Psychology, 1935, 47, 187-221.

Foellinger, D. B. and Trabasso, T. Seeing, hearing and doing: A developmental study of memory for actions. Child Development, 1977, 48, 1482-1489.

Frank, L. K. Projective methods for the study of personality. Journal of Psychology, 1939, 14, 389-413.

Freeman, N. H. Process and product in children's drawing. Perception, 1972, 1, 123-140.

Freeman, N. H. Why do children draw men with arms coming out of their heads? Nature, 1975, 254, 416-417.(a).

Freeman, N. H. Drawing conclusions. New Behaviour, 1975, 3, 17-19.(b).

Freeman, N. H. Children's drawings: Cognitive effects. Journal of Child Psychology and Psychiatry, 1976, 17, 345-350.

Freeman, N. H. How young children try to plan drawings. In G. Butterworth (Ed.). The Child's representation of the world. New York: Plenum Press, 1977.

Furth, H., Ross, B. and Youniss, J. Operative understanding in children's immediate and long-term reproduction of drawings. Child Development, 1974, 45, 63-70.

Gardner, H. The arts and human development. New York: Wiley, 1973.

Ghent, L. Form and its orientation: a child's eye view. American Journal of Psychology, 1961, 74, 177-190.

Ghent, L. Effect of orientation on recognition of geometric forms by retarded children. Child Development, 1964, 35(4), 1127-1136.

Ghent, L. and Bernstein, L. Influence of the orientation of geometric forms on their recognition by children. Perceptual and Motor Skills, 1961, 12, 95-101.

Ghent, L., Bernstein, L. and Goldweber, A. M. Preferences for orientation of form under varying conditions. Perceptual and Motor Skills, 1960, 11, 46.

Gibson, E. J. Perceptual development. In H. W. Stevenson (Ed.) Child Psychology, Yearbook of the National Society for Studies in Education, 1963, 62(I), 144-195.

Gibson, E. J. Principles of perceptual learning and development. New York: Appleton-Century-Crofts, 1969.

Gibson, E. J., Gibson, J. J., Pick, A. D. and Osser, H. A developmental study of the discrimination of letter-like forms. Journal of Comparative and Physiological Psychology, 1962, 55(6), 897-906.

Gibson, J. J. The senses considered as perceptual systems. Boston: Houghton-Mifflin, 1966.

Gibson, J. J. The Information available in pictures. Leonardo, 1971, 4, 27-35.

Gibson, J. J. and Mowrer, O. H. Determinants of the perceived vertical and horizontal. Psychological Review, 1938, 45, 300.

Golomb, C. Children's representation of the human figure: The Effects of models, media and instructions.

Genetic Psychology Monographs, 1973, 87, 197-251.

Golomb, C. Young children's sculpture and drawing: A study in representational development. Cambridge, Mass.: Harvard University Press, 1974.

Golomb, C. The child as image-maker: The invention of representational models and the effect of the medium. Studies in Art Education, 1976, 17(2), 19-27.

Gombrich, E. H. Art and illusion: A study in the psychology of pictorial form. London: Phaidon, 1972.

Goodenough, F. L. Measurement of intelligence by drawing. Yonkers, N. Y.: World Book, 1926.

Goodenough, F. L. and Tyler, L. E. Developmental psychology: An Introduction to the study of human behaviour. New York: Appleton-Century-Crofts, 1959.

Goodnow, J. J. Rules and repertoires, rituals and tricks of the trade: Social and informational aspects of cognitive representational development. In S. Farnham-Diggory (Ed.) Information - processing in children. New York: Academic Press, 1972.

Goodnow, J. J. Children drawing. Cambridge: Harvard University Press, 1977.

Goodnow, J. J. Visual thinking: Cognitive aspects of change in drawing. Child Development, 1978, 49, 637-641.

Goodnow, J. J. and Friedman, E. Orientation in children's human figure drawings: An aspect of graphic language. *Developmental Psychology*, 1972, *7*, 10-16.

Gridley, P. F. Graphic representation of a man by four-year old children in nine prescribed drawing situations. *Genetic Psychology Monographs*, 1938, *20*, 183-350.

Hammer, E. F. *The clinical application of projective drawings*. Springfield, Ill.: Charles C. Thomas, 1958.

Harris, D. B. *Children's drawings as measures of intellectual maturity*. New York: Wiley, 1963.

Hebb, D. O. *The organization of behaviour*. New York: Wiley, 1949.

Hebb, D. O. Concerning imagery. *Psychological Review*, 1968, *75*, 466-477.

Howard, I. P. and Templeton, W. B. *Human spatial orientation*. New York: Wiley, 1966.

Hunton, V. D. The recognition of inverted pictures by children. *Journal of Genetic Psychology*, 1955, *86*, 281-288.

Ibbotson, A. and Bryand, P. E. The perpendicular error and the vertical effect. *Perception*, 1976, *5*, 319-326.

Inhelder, B. Operational thought and symbolic imagery. In P. H. Mussen (Ed.) European research in cognitive development. *Monographs of the Society for Research in Child Development*, 1965, *30*(2), 4-18.

Ivanoff, E. Recherches expérimentales sur les dessins des écoliers de la Suisse Romande: Corrélation entre l'aptitude au dessin et les autres aptitudes. Archives de Psychologie, 1908, 8, 97.156.

Ives, S. W. and Rovet, J. The role of graphic orientations in children's drawings of familiar and novel objects in motion. Merril-Palmer Quarterly, 1968, 25(4), 281-292.

Jolles, I. A study of the validity of some hypotheses for the qualitative interpretation of the H-T-P for children of elementary school age. Journal of Clinical Psychology, 1952, 8, 113-118.

Kellogg, R. The Rhoda Kellogg child art collection. Washington, D. C.: Microcard Editions Inc., 1967.

Kellogg, R. Analyzing children is art. Palo Alto, Calif.: National Press Books, 1969.

Kerpelman, L. C. and Pollack, R. H. Developmental changes in the location of form discrimination cues. Perceptual and Motor Skilds, 1964, 19, 375-382.

Kohler, W. Gestalt psychology. New York: Liveright, 1929.

Koppitz, E. M. Psychological evaluation of children's human figure drawings. New York: Greene and Stratton, 1968.

Korzenik, D. Role-playing and children's drawing. Studies in Art Education, 1974, 15(3), 17-24.

Korzenik, D. Creativity: Producing solutions to a problem. Studies in Art Education, 1976, 17(2), 29-35.

Korzenik, D. Saying it with pictures. In D. Perkins and B. Leondar (Eds.) The Arts and cognition. Baltimore: John Hopkins University Press, 1977.

Kugelmass, S. and Lieblich, A. Perceptual development in Israeli children. Child Development, 1970, 41, 1125-1131.

Levy, S. Projective figure drawings. In E. F. Hammer (Ed.) The clinical application of projective drawings. Springfield, Ill.: Charles C. Thomas, 1958.

Lowenfeld, V. and Brittain, W. L. Creative and mental growth. New York: MacMillan, 1964.

Lukens, H. A. A study of children's drawing in the early years. Pedagogical Seminary, 1896, 4, 79-110.

Luquet, G. H. Les dessins d'un enfant. Paris, 1913.

Luquet, G. H. Les bonhommes tetards dans le dessin enfantin. Journal de Psychologie, 1920, 17, 684-710.

Maccoby, E. E. What copying requires. In D. R. Olson and S. Pagliuso (Eds.) Special Issue: Ontario Journal of Educational Research, 1968, 10(3), 163-170.

Maccoby, E. E. and Bee, H. L. Some speculations concerning the lag between perceiving and performing. Child Development, 1965, 36, 367-377.

McGurk, H. The salience of orientation in young children's perception of form. Child Development, 1972, 43, 1047-1052.

Machover, K. Personality projection in drawings of the human figure. Springfield, Ill.: Charles C. Thomas, 1949.

Machover, K. Human figure drawings by children. Journal of Projective Techniques, 1953, 17, 85-91.

Machover, K. Sex differences in the developmental pattern of children as seen in human figure drawings. In W. Rabin and M. Haworth (Eds.) Projective techniques with children. New York: Grune and Stratton, 1960.

Millar, S. Visual experience or translation rules: Drawing of the human figure by blind and slighted children. Perception, 1975, 4, 363-371.

Miller, G. A., Galanter, E. and Pibram, K. Plans and the structure of action. New York: Holt, Rinehart and Winston, 1966.

Moeller, C. E. and Goodnow J. J. Orientations called "right-side up": Effects of stimulus alignment. Psychonomic Science, 1969, 16, 213-215.

Newhall, S. M. Identification by young children of differentially oriented visual forms. Child Development, 1937, 8, 105-111.

Osterreith, P. A. Le test de copie d'une figure complexe: Contribution à l'étude de la perception et de la mémoire. Archives de Psychologie, 1949, 30, 119-120.

Olson, D. R. Cognitive development: The child's acquisition of diagonality. New York: Academic Press, 1970.

Passy, J. Notes sur les dessins d'enfants. Revue Psychologique, 1898, 32, 614-621.

Piaget, J. Play, dreams and imitation in childhood. New York: Norton, 1963.

Piaget, J. The mechanisms of perception. Translated by G. N. Seagrim. New York: Basic Books, 1969.

Piaget, J. and Inhelder, B. The child's conception of space. London: Routledge and Kegan Paul, 1956.

Piaget, J. and Inhelder, B. Memory and intelligence. London: Routledge and Kegan Paul, 1963.

Pick, H. L., Klein, R. E. and Pick, A. D. Visual and factual identification of form orientation. Journal of Experimental Child Psychology, 1966, 4, 391-397.

Rice, C. Excellence of production and types of movement in drawing. Child Development, 1930, 1, 1-14.

Rice, C. The orientation of plane figures as a factor in their perception by children. Child Development, 1931, 2, 111-143.

Roback, H. B. Human figure drawings: Their utility in the clinical psychologist's armamentarium for personality development. Psychological Bulletin, 1968, 70(1), 1-19.

Rock, I. The orientation of forms on the retina and in the environment. American Journal of Psychology, 1956, 69, 513-528.

Rock, I. and Heimer, W. The effect of retinal and phenomenal orientation on the perception of form. American Journal of Psychology, 1957, 70, 493-511.

Rock, I. and Leaman, W. An experimental analysis of visual symmetry. Acta Psychologica, 1963, 2, 171-183.

Rouma, G. Le langage graphic de l'enfant. Brussels, 1913.

Ruskin, J. Modern painters: Volume I., Part II. London, 1843.

Salome, R. A. The effects of perceptual training upon the two-dimensional drawings of children. Studies in Art Education, 1965, 7(1), 58-67.

Salome, R. A. and Reeves, D. Two pilot investigations of perceptual training of four and five year old kindergarden children. Studies in Art Education, 1972, 13(2), 3-10.

Salome, R. A. and Szeto, J. W. The effects of search practice and perceptual training upon representation development. Studies in Art Education, 1976, 18(1), 49-54.

Serpell, R. Preferences for specific orientation of abstract shapes among Zambian children. Journal of Cross-Cultural Psychology, 1971, 2, 225-239.

Shapiro, M. B. Rotation of drawings by illiterate Africans. Journal of Social Psychology, 1960, 52, 17-30.

Siegel, S. Non-parametric statistics for the behavioural sciences. New York: McGraw-Hill, 1956.

Smedslund, J. The effect of observation on children's representation of the spatial orientation of a water surface. Journal of Genetic Psychology, 1963, 102, 195-202.

Smith, N. R. Development origins of structure and variation in symbol form. In N. R. Smith and M. B. Franklin (Eds.) Symbolic functioning in Childhood. Hillsdale, N. J.: Erlbaum, 1978.

Stern, W. The psychology of early childhood. New York: Holt, 1930.

Swenson, E. H. Empirical evaluations of human figure drawings: 1957-1966. Psychological Bulletin, 1968, [illegible]0(1), 20-44.

Takala, N. Asymmetries of visual space. Helsinki: Soumalaisen Kirjallisuuden, Seuren Kirjapainon Oy, 1951.

Thorndike, E. L. The measurement of achievement in drawing. Teachers College Record, 1913, 14(5), 63-97.

Vereecken, P. Spatial development: Constructive praxia from birth to the age of seven. Groninger: Wolters, 1961.

Vernon, M. D. The psychology of perception. Baltimore: Penguin, 1962.

Vurpillot, E. The development of scanning strategies and their relation to visual differentiation. Journal of Experimental Child Psychology, 1968, 6, 632-650.

Vurpillot, E. The visual world of the child. New York: International Universities Press, 1976.

White, J. The birth and re-birth of pictorial space. London: Faber, 1972.

Wilson, B. and Wilson, M. The persistence of the perpendicular principle: Why, when and where innate factors determine the nature of drawings. Proceedings of the National Symposium for Research in Art, 1980.

Witken, H. A. The perception of the upright. Scientific American, 1959.

Witken, H. A. and Asch, S. E. Studies in spatial orientation: III. Perception of the upright in the absence of a visual field. Journal of Experimental Psychology, 1948, 38, 603-614.

Witken, H. A., Lewis, H. B., Hertzman, M., Machover, K., Meisner, B. and Wapner, S. Personality through perception. New York: Harper, 1954.

Wohlwill, J. F. Development studies of perception. Psychological Bulletin, 1960, 57, 249-288.

Wohlwill, J. F. and Wiener, M. Discrimination of form orientation in young children. Child Development, 1964, 35, 1113-1125.

Wolff, W. The personality of the pre-school child. New York: Greene and Stratton, 1946.

Reference Notes

1. Goodnow, J. J. Personal communication, September 1, 1980.

2. Smith, R. Sequence and syntax in the drawings of four and five year old children. Unpublished manuscript, 1980 (available from author).