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Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

by
Marcella D. Woods, B.S., M. Ed.

The Ohio State University
1966

Approved by
Margaret A. Ford
Adviser
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DEDICATION

To my parents who taught me a way of life, to those teachers and colleagues who challenged and encouraged me throughout my educational pursuits, and to my friends who comforted me, thank you.

It is with gratitude, respect, and love that I dedicate this dissertation to you.
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CHAPTER I

INTRODUCTION

Little appears in the literature pertaining to the relationship between the body percepts of children and their performance in gross motor activities. Studies do appear which investigate these areas as independently organized and functioning phenomena and have made significant contributions to our knowledge about and understanding of children. It is conceivable that the practice of separating these behavioral phenomena might have served to obscure meaningful relationships. Since the human child is a complex of interdependent systems in an ever-changing environment, one readily acknowledges the overwhelming presence of variables and their infinite number of combinations as being influential in the manner in which the child perceives himself and functions within his environment.

It is generally accepted that the child has fewer personality resources available to him along the lines of dealing with abstractions and instrumenting his intelligence than does the adult. Within these limitations, the child tends to function primarily on the basis of large muscle activity, and his ability to satisfy his needs and wishes is dependent to a great extent upon his ability to move with control and assurance. Thus, it is conceivable that his evaluation of himself, in
the absence of other well-defined personality resources, might reasonably be expected to depend upon the effectiveness with which he can control and use his body. It is with this significant aspect of consciously directed human movement behavior that the physical educator is concerned but he is not alone. The developmental psychologist is also interested in human movement but, unlike the physical educator, the focus has been primarily upon the appearance and/or sequence of locomotion and the fine motor skills and factors affecting these areas of development. Attention has been focused on such factors as physical status, health, intelligence, environmental influences, and motivation.

While the physical educator also has investigated the areas of physical status and health, his research endeavors primarily have been in such areas as strength development and its relation to physical abilities, physical growth and developmental trends and accompanying motor skill development, construction of test batteries which would serve to evaluate motor abilities and motor skill achievement, studies of skeletal maturation, and effects of types and length of instruction upon motor skill achievement and motor fitness. Aware that research findings of both the physical educators and the developmental psychologists have yielded much valuable information, it must be acknowledged that these studies represent attempts to understand motor development qua motor development. Little consideration has been given to the other systems and the interaction of these systems in terms of their contributions or modes of operation in human movement behavior.
Since learning cannot be measured directly, it must be inferred from performance, and performance simply does not occur as an isolated phenomenon. Witkin expressed his concern most succinctly when he stated, "As with all psychological functioning, we are concerned with an active, integrated, purposeful person equipped with characteristic ways of coping in all situations to which he must adjust . . . "\(^1\) Closely aligned with Witkin's statement is Thompson's contention that "motor skills are complex in that they involve almost every aspect of the child's physical and psychological status . . . related to perception and intelligence, previous learning and present motivation, emotional stability, social relationships, and personality characteristics."\(^2\)

Thompson's statement places the study of human movement behavior in a total-systems context--a total system that displays a level of performance as it interacts in accordance with its perceptions of its environment. Within the context of a dynamic environment, one's perceptions are continually challenged and the meaningfulness of events must be sought constantly. Perhaps it is within this context that the significance of perception lies--its relationship to the manner in which the child achieves mastery of himself for greater manipulation of his environment. What and how one perceives seems to depend upon his distinctive coping mechanisms together with his current motivations and also the nature of the real world with which he must deal at the moment.

---


When a child moves, he is dealing with the real physical world. His body is a mass, a physical object, which is governed by the same laws of motion that explain the movement of objects on this planet. To remain standing, the child must resist the constant downward pull of the force of gravity. To move, the child must overcome the inertia of his own mass. His movement occurs in time-space relationships. It is the intricacies of these factors that the child must somehow appreciate and master if he is to move in an articulate manner.

To move in an articulate manner assumes the child's movement efforts to be the result of his perception of the environmental situation in which he finds himself and a self-initiated appropriate neuromuscular response. In the language of psychology, this is the nature of the relationships involved in an input-output mechanism which is sensitive to physical energy impinging upon it. In all cases of human behavior, it seems logical to contend that some aspect of the output, the behavior of the organism, is related to some aspect of the input or stimulation impinging on the organism. This phenomenon is conceptually organized through the use of the word perception. Perception seems to imply the possibility of misperception. The mechanisms by which one is able to perceive correctly are not understood but the important aspect of the phenomenon of perception is that to function successfully our correct perceptions must far outweigh our misperceptions. But where does it all begin?
The philosopher Immanuel Kant introduced the idea of the body schema as a mediating device most significant in the process of integrating human behavior. Kant implied that characteristic features of oneself projected in particular features of the object world could be the manner by which one establishes a linkage between self and world. In his work, *Phenomenology of Perception*, Merleau-Ponty makes clear the significance of the body percept, or schema, for the forming of the human world when he speaks of the percept as a dynamically defined entity. He points out that the spatiality of the body is not a spatiality of mere position but a spatiality of situations: "If I stand in front of my desk and lean on it with both hands, only my hands are stressed and the whole of my body trails behind them like the tail of a comet."³

Since the early 1900's, an impressive number of studies have been reported which purport to investigate the phenomenon of body image or body schema. Such variables as body anxiety, preferred body proportions, body dissatisfaction, concept of body size, position of body in space, and differentiation of values assigned to right and left body sides have been posited as important dimensions of the body image. More recently, there has been a trend to conceptualize the individual's perception of his own body as a special event of perception in general. In these studies, the subjects have had to make perceptual judgments about their own bodies in much the same manner as they would any non-self object.

Another exciting trend in research strategies has resulted from the realization that body attitudes are often the result and reflection of interpersonal relationships. There exist clear-cut demonstrations that body evaluations are differentially affected by previous success or failure experiences.

Currently in the literature there is a mounting number of references to the concept of the body image boundary. Basically, the idea of the concept is that the individual must learn to demarcate his body from his environment and that the clearness of this demarcation might have significant behavioral implications. \(^4\) It is upon this latter trend, the body image boundary-concept, that the writer has focused. More specifically, this investigation has been concerned with exploring the relationships that exist between one's body image boundary concept, one's estimates of dimensions of body space, and one's performance of selected gross motor tasks. A second aspect of the research has been to ascertain whether or not developmental trends are indicated across the age groups of eight-, ten-, and twelve-year-old boys and girls with respect to each of the three areas of investigation.

Developmental psychology postulates one regulative principle of development--an established trend in which an organism proceeds through his course of development. It states that "wherever development occurs

\(^4\) J. M. Popper, "Motivational and Social Factors in Children's Perception of Height" (Ph. D. dissertation, Department of Psychology, Stanford University, 1957).

it proceeds from a state of relative globality and lack of differentiation to a state of increasing differentiation, articulation, and hierarchic integration.\textsuperscript{6} According to this principle, there is a state involving a relative lack of differentiation.\textsuperscript{7} While the process might begin before birth, the ontogenetic point of view has generated the assumption that from the moment of birth psychological differentiation begins and continues to be refined, developed, and reorganized on the basis of the individual's continuing experience of himself in relation to his environment. It is thought that the infant's earliest perceptual, proprioceptive, and kinesthetic experiences have played roles in the individual's gradual differentiation of what is himself from his non-self. Thus, in the human child's years through childhood, he should have followed a trend of development from one of a level of non-differentiation of self from environment and the other objects within it to one of increasing subject-object differentiation.

In view of the developmental principle, the awareness and appreciation of self from non-self has been considered to be basic to adequate integration and personality functioning. This line of thinking has evolved because psychological differentiation appears to result not only


\textsuperscript{7}The lack of differentiation focused upon in this study was that which concerned the task of differentiating oneself from one's environment. It is to be understood that the writer was aware of many dimensions of psychological differentiation but these were not the subject of focus intended here.
from the individual's reactions of others to him but also from his perceptions and experiences of the world of objects. Since the consequence of psychological differentiation is one of a greater capability in the manipulation of one's environment, the highly differentiated person would be able to function at a higher level than the individual possessing a lesser degree of psychological differentiation.

As was stated earlier, the particular aspect of psychological differentiation focused upon in this study was the body image boundary concept. The work of Paul Schilder brought the concept of the body image boundary into its present state of usefulness. Elaborating upon Schilder's work, Fisher and Cleveland have focused their research upon this dimension of body image. Since 1951, their studies have established that there are distinct individual differences in the definiteness or articulation which one ascribes to the boundary regions of one's body—the skin and the musculature.

This concept had its inception, most likely, in the works of Pick, the German neurologist, and Head, a British neurologist. In the early 1900's Pick, as cited by Fisher and Cleveland, conjectured: "... the individual in the course of development evolves a spatial image of the body. This image is an inner representation of one's own

---


body as it appears to him consciously from information supplied from the
senses." Then in 1920, Sir Henry Head constructed a fairly elaborate
theory concerning the function of the body image in which he postulated
the following:

... each individual gradually constructs
a picture or model of himself which becomes
a standard against which all body movements
and postures are judged.\(^\text{11}\)

The inference is that each new movement one makes must be evaluated
relative to a continuous standard of some sort which will permit inte­
gration of what is now occurring with what had occurred previously. In
essence, Head cast the role of the body image as that of a mediator of
human movement. This function of the body image became known as the
postural model—a perception of self which must be accurately and highly
organized. Without such a model, Head considered coherent movement an
impossible task.

While the mechanisms by which the body image is established are
not understood, Schilder's work has stressed the role of motility as an
outstanding factor in the development of the body image by contending
that changes in the motility will be a determining influence on the
structure of the body image.\(^\text{12}\) He further asserted that motor control
over our own limbs apparently plays a special part in the creation of the

\(^{10}\text{Ibid., p. 3.}\)


\(^{12}\text{Schilder, pp. 15-16.}\)
body image. By positing that the development of the body image most likely parallels sensory motor development and by pointing out that the primitive postural model of a body shows a lack of differentiation of the separate parts, Schilder was applying the developmental principle of differentiation. Schilder seems to be suggesting that continued activity is at the basis of one's bodily self.

If Schilder's work is understood and if Head's fundamental assumption is correct, then the reciprocity of body image development and human motor performance becomes apparent—movement is necessary for the development of the body image, and a well-defined body image is necessary for coherent movement. It is generally accepted that establishing a highly functional body image and increasing the degree of motor control are developmental tasks for the child. The level of articulateness in both, theoretically, can be considered as indicator areas of psychological differentiation.

When one discusses the body image in such terms as well defined, clarity, and degree of differentiation, there is an implication of finiteness, limits, or boundaries. Throughout life, it is dubious as to whether or not most people experience any special concern about their body boundaries. As a consequence, this body image dimension is difficult for most people to grasp. Generally speaking, people seem to know well enough where they end and the outer environment begins. However, in various pathological states, individuals do lose the ability to identify

13 Ibid., pp. 104-106 and 296.
their body boundaries. There is also evidence that indicates the normal population exhibits variation in the ability to demarcate themselves clearly from the external environment.¹⁴

To ascertain the definiteness or articulation which one ascribes to the boundary regions of one's body, Fisher and Cleveland devised an index which is known as the Barrier Score. Based on content analysis of the protocols of either the Rorschach or Holtzman inkblot plates, the Barrier Score equals the number of responses that are characterized by an emphasis upon the containing, protective, decorative, or covering functions of the periphery. Common examples of highlighting the periphery are as follows: cave with rocky walls, animal with striped skin, person covered with a blanket, and woman in fancy costume. In all examples, the existence of the boundary is assigned special attributes.

Recent work by Fisher and Fisher has demonstrated rather dramatically that the individual's Barrier Score is linked with one's perception of the relative prominence one assigns to the boundary regions of one's body.¹⁵ Essentially, the Barrier Score reflects the degree to which the body boundaries are perceived as providing an effective barrier separating one's bodily self from the external environment. Overall, a picture has emerged depicting the individual with definite boundaries

¹⁴ Fisher and Cleveland, Body Image . . .

as more active, independent, autonomous, and communicative than the individual with indefinite boundaries. One must exercise caution here because this description of the high barrier individual has emerged from research findings with adult subjects. At the present time, because of a lack of reported research, no such picture has emerged with children.

In their book, *Body Image and Personality*, Fisher and Cleveland offer the following conjecture pertaining to the developmental aspects of boundary development in children:

\[\ldots\] there may be large shifts in the site of the body image boundary in the individual during his life span. It is doubtful that the first hazy boundaries developing in the young child would be associated with the body wall. Most of the meaningful body experiences at that time center on the mouth, stomach, and gut. Therefore, the boundary would tend to be experienced as encompassing an area somewhat interior to the actual body wall. It is conceivable that as the child grows older there is a differential rate at which the boundary approaches the body surface in various areas. At points of intensive contact with the world, (e.g., mouth, anus, eyes) the boundary might early be set at the surface; but in other areas the boundary might be conceived as lying more within the interior. This presents a picture of a boundary which might have highly irregular contours. It is in the adult that the boundary probably reaches its maximum of regular contour at a locus identified with the body wall.\[17\]

\[16\] Hereafter known as high barrier individual.

The above discourse of the development of children's body image boundaries is reasonable from a psychoanalytic frame of reference; however, it remains the task of future research to either confirm or refute Fisher and Cleveland's opinion.

While developmental aspects of body boundaries remain somewhat nebulous, Piaget has maintained the evolution of self-boundaries parallels the development of intelligence. According to Piaget, self-boundaries and intelligence are respectively the inward and outward expressions of immediate interaction with the environment at a behavioral level. The implication of Piaget's position is that while all consciously directed behavior is psychic in nature it is manifested through purposeful motor behavior. In essence, voluntary human motor behavior is the overt expression of human thought. Hebb has added support to this suggestion through his belief that man's thoughts and voluntary actions are mediated by the same neural structures. In any case, the development of the body image boundaries grows in significance as one peruses the literature.

It is obvious that the body boundaries, specifically the skin and the musculature, are literally one's closest physical contact with the external environment. The boundary is that part of oneself that one shows most openly to the world—the most obvious representation of oneself. It is the first line of physical involvement in any situation. In view


of these ideas, one must entertain the question: If the boundary is ill perceived or ill defined for a given child, can that child actively and successfully cope with the external environment, or will his intercourse with the environment be limited and in some instances prohibited?

The recent work of Witkin, Fisher and Cleveland, Wapner, and others would tend to support the possibility of the occurrence of a lower level of functioning. At this point, one is tempted to raise questions concerning the meaning of children’s motor performance relevant to the level of differentiation of the body image boundary. Does each reflect the status of the other? If a child were to be observed as exhibiting poor motor performance, might one suspect a poorly differentiated body boundary? On the other hand, might there be periods in a child’s developmental pattern when a poorly differentiated boundary would be advantageous to his motor performance? Is the perception of one’s boundaries one result of the struggle of individualization, and if so, does the clarity of the percept suggest or reflect the level of psychological differentiation? Is the skill with which a child executes purposeful gross motor tasks a reflection of his level of psychological differentiation? If each is necessary to the other, as Head and Schilder have both suggested, will their assessed levels parallel each other developmentally? To date, the writer knows of no research which purports to investigate these areas in question.

Since it is conceivable that the body image might be a mediating variable in children’s gross motor performance, if Head and Schilder are
fundamentally correct; if the degree of boundary definiteness reflects the level of differentiation of bodily self from the environment, it is imperative that research be conducted to ascertain what relationships exist between children's body image boundaries and their performance of selected gross motor tasks. Further, if we are to begin to understand the phenomenon of individual differences, we must acknowledge as plausible that in dealing with individual differences we might be dealing with differences in articulation of the body image.

For the child who is moving toward psychological differentiation, the relationship of the body image boundary and purposefully organized human movement must be thoroughly investigated. While age and maturation levels are undoubtedly important considerations in regard to the establishing of the body image, the ability to use the muscles of the body effectively is certainly basic to the expression of personality generally. It must be remembered that the younger the child the fewer are the personality resources available to him along the lines of dealing with abstractions. Because of these lack of resources, the child tends to function primarily on the basis of large muscle activity. The implication is that his ability to cope with his environment in a satisfying manner is dependent to a great extent upon his ability to move with control and assurance. In addition, his evaluation of himself in the absence of other well-developed personality resources might depend upon the effectiveness with which he can control and use his body. Perhaps herein lies a major portion of the significance of human movement.
CHAPTER II

STATEMENT OF THE PROBLEM

The purpose of this study was to discover whether or not relationships exist between the following dimensions of human personality functioning:

1. the body image boundary concept as reflected through the Barrier Score
2. estimates of the dimensions of body space
3. performance of selected gross motor tasks.

A second aspect of the research was focused upon ascertaining whether or not developmental trends could be suggested across the age groups of eight-, ten-, and twelve-year-old boys and girls in each of the three areas that were investigated. The expectation of relationships and developmental trends across these diverse areas was viewed as being possible, theoretically, as a manifestation of the children's general progress toward psychological differentiation. Since it was accepted by the writer that in the process of growing up children move toward greater psychological complexity, one might expect to find individual differences in degree of articulateness in each of the three areas. The
questions considered pertinent to these individual differences were as follows:

1. Would the Barrier Score be significantly related to the symbolic representation of one's estimates of the dimensions of body space?

2. Would the Barrier Score be significantly related to children's performance on each of the gross motor tasks?

3. Would each or all of the estimates of the dimensions of body space be significantly related to children's performance on each of the gross motor tasks?

4. Would there be significant differences between the means of Barrier Scores for each age group within a sex category?

5. Would there be significant sex differences in the Barrier Scores between the three age groups?

6. Would there be significant sex differences regardless of age group?

7. Would the following predictions be accurate?
   a. an increase of Barrier Score with age
   b. with age a decrease in the discrepancy scores of children's estimates of the dimensions of body space
   c. an increase, with age, in children's performance of the selected gross motor tasks

8. Would a perceived configuration of body shape be evidenced through the estimates of the dimensions of body space?

9. If a perceived configuration were to be evidenced, would there be sex and/or age differences that would be statistically significant?
10. Would there be statistically significant differences between the performance means for each of the gross motor tasks between the high and low barrier groups?

11. Would there be statistically significant differences in the estimations of the dimensions of body space between the high and low barrier groups?

12. Would patterns of symbolic representation of the estimates of the dimensions of body space emerge as either of the following?

   a. pattern of consistency—estimates tend to be either over the actual dimensions of body space or under the actual sizes.

   b. pattern of inconsistency—no definite manner of estimating.

To make apparent the relationships and differences that might exist, task situations were presented to the children to determine the following:

1. the degree of body image boundary articulateness—the extent to which one's boundaries are perceived as being firm, thereby causing the conceptualization of oneself as being clearly demarcated from the external environment.

2. the accuracy of symbolic representation of the estimates of the amount of space one's body and selected body parts consume in the horizontal and vertical planes.

3. the level of performance in selected gross motor tasks which represent an appreciation for and an understanding of the necessary manipulation of the elements of space, force, and time.

In addition to age and sex, actual measurements of standing height, extended height, arm span, shoulder width, and hip width were recorded for each child.
Since one focus of this study was upon the boundary dimension of body image and children's performance of selected gross motor tasks, representing an initial attempt to study relationships between these phenomena, the writer decided to keep the approach exploratory, descriptive, and comparative in design.

Cognizant of the fact that developmental trends could not be identified through a cross-sectional approach, the writer was willing to assume the risk of criticism and determine whether or not developmental trends could at least be suggested. Furthermore, it was the contention of this writer that treatment of the data would yield information which would allow a discussion of the following in terms of the differentiation principle of development:

1. the differences in body image boundary differentiation that exist between the three age groups.

2. the differences in performance of the gross motor tasks that exist between the three age groups.

3. differences in accuracy of symbolic representation of the estimates of the dimensions of body space that exist between the three age groups.

4. the implication of statistically significant sex differences that appear in any of the age groups between the independent and dependent variables.

5. implications for better understanding the nature of individual differences in human movement behavior exhibited in children's performance in the gross motor task situations.
Specifically, then, this study focused upon the developmental relationships that might be found to exist between children's body image boundaries, their estimates of the dimensions of body space through symbolic representation, and their performance of selected gross motor tasks.

Basic premise

According to developmental principle, the conceptualization of the boundary between the body and outside space is more or less a continuous body-field matrix experience for the young child. This relatively global conception of the body later becomes more articulate—that is, the child gains an impression of his body as having definite limits or boundaries. An articulated body concept, then, may be considered as an indication of developed differentiation. Since a well-articulated body image has been posited as being necessary to coherent movement and movement as necessary to building the image, it is conceivable these two dimensions of the total personality might be either separate indicators of differentiation or one might influence and be reflected by the other.

Assumptions basic to the study

1. Everyone has a body image.

2. There are varying degrees of body articulateness.

3. A quality of boundedness, or boundaries, develops in terms of understanding what is self and what is non-self.
4. The degree of conceptualized boundary definiteness can be ascertained.

5. The Barrier Score reflects the degree of perceived body image definiteness.

6. There is a relationship between differentiation of self from non-self, perceptual tasks, and gross motor performance.

7. When performing gross motor tasks, the human organism is involved in the manipulation and control of his own body parts as well as the manipulation of the movement factors of space, force, and time.

8. Successful manipulation of the space, force, and time factors in human movement is an indication of a level of self-mastery and can be posited as another indicator area of psychological differentiation.

**Definition of terms**

**Barrier Score:** an index of the degree of firmness with which the body boundary is perceived as being an effective barrier separating body from environment.

**Body Image or Concept:** an organized impression of the body in its experiential and symbolic as well as physical aspects—the picture of our own body which we form in our mind.

**Body Image Boundary:** the outer layers of the human body which are most intimately in contact with the environment—the skin and musculature. The boundary is perceived as either ill defined and
relatively permeable or has having an enclosing, protective, strong, and definite quality.

Developmental: a process of differentiation.

Differentiation Hypothesis: the expectation that at any age level children will differ in the extent of differentiation and that greater or more limited differentiation will be manifested in a given child in each of the indicator areas although in varying degrees.

Dimensions of Body Space: the amount of space one's body and selected body parts consume in the horizontal and vertical planes.

Gross Motor Tasks: selected structured movement tasks that involve control and articulation of the whole body while in motion and implies either an unconscious or conscious manipulation of the movement factors of space, force, and time.

High Barrier Scorer: one whose responses to an inkblot series are characterized by an emphasis upon the protective, containing, decorative, or covering functions of the periphery. Assignment of these special attributes to the periphery highlights the existence of the boundary. Examples are cave

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with rocky walls, woman in fancy costume, and a vase. Scores above the mean are considered high.

Low Barrier Scorer: one whose responses to an inkblot series are below the mean.

Performance: reality testing at a behavioral level as to the precision or skill with which a subject can carry out an assigned task in which he has had previous experience and is beyond the learning stage.

Psychological Differentiation: the increased complexity of a system's organization and structure together with the capability of greater specificity of function and a higher degree of segregation from the environment.

Limitations of the study

1. Findings may be generalized only to the population sampled.

2. Relationships between two responses from an organism cannot be interpreted in terms of cause and effect.

3. Cross-sectional data cannot yield or identify developmental trends or stages but findings may suggest trends or stages which can be either confirmed or refuted through longitudinal research.

4. As with all normative data, the individual is lost and a group picture emerges. Whether or not a given individual will exhibit the behaviors suggested by the data is not known.

5. Since this was an assessment of children at a given time in their history, one may speculate only that the sampled behavior was typical of each child.
CHAPTER III

REVIEW OF LITERATURE

It is generally accepted that developmental psychology holds as its goal the measurement and description of psychological growth from the moment of conception to the end of life. The child psychologists have restricted these same concerns and endeavors to the period ensuing after the moment of conception and ending with the advent of adolescence. Physical educators, on the other hand, have been currently viewing as one of their goals the deepening and/or enriching of man's experience of himself and others through the medium of human movement. Cassidy has stated, "... physical education is the sum of the changes in the individual caused by experiences centering in the basic movement patterns."

To contend that man has learned and continues to learn through his repertoire of movement certainly seems plausible. Consider the infant dependent upon adults for turning him in his crib and bringing the world to him whether this be in the form of nourishment or his play toys. The moment the child breaks free of his infant bondage--learns to move about on his own in his crib--he is able to continue his lifelong exploration of and adventure with the outside world; that same outside world which at one time lay just beyond his finger tips. Through his self-initiated

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1 Thompson, p. 3.

movement, he comes into contact with the world of objects and other persons such as himself. Through this contact, he learns that something is soft or hard, solid or liquid, up or down, in front of or behind him. In essence, through these experiences, the child comes to understand the realities of the physical world and his relation to his environment. These experiences help from the basis of his ability to interact with the external environment in a progressively complex and satisfying manner.

The thinking and writings of Kant, Rousseau, Froebel, Montessori, Schilder, Piaget, Linn, and to a certain degree, Kephart have emphasized the role of human movement as necessary to the development of perceptual skills as well as being in itself a necessary mode of operation throughout one's lifetime. Whether or not there is a causal or dependency relationship between human movement and the development of perceptual skills remains inconclusive. The elucidation of this relationship remains the task of future research. However, within the framework of total personality functioning, one can find agreement among various research scholars as to the relationships that exist between body image and motor performance.

A recent area of research interest to the physical educator, reported studies relevant to the dimension of body image and human movement behavior, first began appearing about 1962. Since 1962, fewer than a dozen studies investigating simultaneously these two

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dimensions of human personality functioning have appeared. Presently, this writer has seen only one contribution in these two areas in the physical education research literature in which children were subjects.

Belzer conducted a study investigating the differences in body image perception among elementary school boys. Three groups were used and identified as physically active, relatively inactive, and boys enrolled in clinic sessions of physical development. Findings indicated that when viewing themselves through aniseikonic lenses the frequency of perceived body distortion was not significant between the physically active and physically inactive boys. Furthermore, the boys enrolled in the physical development clinic showed no significant changes in frequency of perceived image distortion after the seven weekly sessions. These data seem to suggest that physical activity had no influence on the perceptual organization of these subjects relative to body image.

Several studies conducted with adult college women have yielded findings as to the relationship between attitudes toward the body image at a conceptual level and motor performance. Doudlah, in a study conducted with 40 college women, found at the .05 percent level of confidence a significant relationship between motor ability and movement concept. According to Doudlah, this finding suggested that actual motor performance was influenced by how the subjects perceived themselves as moving beings. Since Doudlah also found that the subjects with average motor

ability perceived themselves as coming closest to their ideal self in movement, and that subjects with average motor ability more characteristically than the subjects having low motor ability perceived themselves as moving beings, one may question the causal relationship that Doudlah suggested. Doudlah at one point suggested that the significance of the average motor ability subjects perceiving themselves as moving beings, more so than the low motor ability subjects, might be because of their being competent in movement and relatively more secure in a moving situation. This writer would agree with the latter interpretation of Doudlah's findings—that one's motor performance might influence one's concept of self in movement. Furthermore, the relationship might not be causal as Doudlah suggested. It is conceivable that the relationship was a manifestation of integration between two different dimensions of personality functioning. Weber's study indirectly would give support to both interpretations. At the .02 percent level of confidence, a positive relationship was found between body image security and figure-ground perception.  

In physical education activities, the participant is constantly coping with figure-ground perception and very often confronted with quickly changing spatial situations. Children engaged in a game of dodgeball are met with as challenging a situation as are adults involved in a

tennis match, a basketball game, or a driver maneuvering in and out of eight lanes of high-speed traffic. Success in any of these situations, theoretically, would provide positive reinforcement.

Using Doualah's study as a point of departure, Nation investigated the effects of fencing and swimming instruction upon the movement concept of college women. Her findings were as follows:

1. Subjects receiving instruction in fencing were more like their ideal self in movement than were those taking swimming.

2. Both groups showed a statistically significant difference in movement-concept and a closer ideal-self to real-self relationship.

3. Subjects enrolled in swimming made the greatest change in movement-concept after instruction.\(^8\)

Nation's latter finding seems to give support to this writer's suggestions of alternative interpretations to Doualah's findings— that one's motor performance might influence one's movement-concept, and/or integrated behavior between two personality dimensions are being evidenced. While positing no causal relationships, a major finding of the McBee study was that a secure body image was significantly related to secure feelings about the movement patterns of ball throwing and broad jumping.\(^9\) Again, this finding would seem to support either of the two alternative interpretations posed by this writer. However, one may only speculate as to

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the meaning of or the dynamics involved in this relationship. Regardless of the interpretations, the findings of these studies are in agreement as to their being a relationship between the psychological picture one has of oneself and one's motor performance.

It is debatable as to whether or not the findings of these studies may be discussed in the same terms of the earlier-cited Belzer study. Debatable because Belzer's subjects were elementary school boys and Doudlah, Weber, Nation, and McBee's subjects were college women. Contrasting or comparing findings might not be logical because Belzer was investigating effects of physical activity on visual distortions of body image at a visual perceptual level, whereas Doudlah, Weber, Nation, and McBee were investigating the intricacies of body image within a conceptual framework. The relationship remains unclarified. Does gross motor performance influence body image? Does the currently held image influence the gross motor performance? Is the relation between body image and gross motor performance a manifestation of different aspects of psychological functioning or is the relationship at best spurious? And, why is the educator now concerned with the dimension of body image?

Historically, the investigations concerning the relationship between body image and human behavior were conducted by neurologists who had observed aberrant behavior in personal reactions and deficiencies in the function of spatial perception and symbolization among patients having certain types of cortical lesions. Schilder\(^{10}\) discussed the

\(^{10}\)Schilder, p. 31.
case of a female with a severe right-side hemiplegia whose frequent behavior consisted of looking at her hand and leg and denying that these body parts were her own. Accompanying these denials, there frequently was a distorted perception of size of body parts indicated through emphatic statements that her hand and face were swollen. Describing the behavior of another patient, Schilder related that when asked to use the left limbs of the body the patient would use the right side in spite of the fact that no paresis was present on the left side. According to Schilder, Pick earlier had observed patients having a disturbed postural model. The inability to show body parts was the most characteristic feature. One patient, unable to find her own ear, began hunting for it on the table. When asked to locate her left eye, she was equally unsuccessful. Finally, the patient decided she had lost her eye. Pick's cases also showed evidence of the disturbance spreading into the motor behavior of the patients. Patients had difficulty in grasping objects and would direct their reaching/grasping efforts either behind, to the right, or to the left of the object.\textsuperscript{11}

Delving deeper into the behavior observed by the early neurologists, a group of psychologists headed by Wapner and Werner undertook research which resulted in findings relative to other distortions in body image. Since the commencing of these studies in about 1940, a significant finding has been concerned with the perceived size of selected body parts. These investigations revealed that children, schizophrenics, and normal

\textsuperscript{11} Ibid., p. 40.
adults under LSD perceived their head width as relatively larger than did adults under normal conditions. Since normal children's perceptions were in line with the perceptions of adults who were operating under abnormal conditions, the Wapner and Werner group hypothesized these findings as being indicative of a lower developmental status among the adult subjects. In essence, these researchers were suggesting that the subjects operating under abnormal conditions had reverted to the child's manner of perceiving this particular body part. The research endeavors of Herman Witkin et al. have placed the development of the body concept within a developmental context. Their overall contention has been that since the body concept is a systematic impression formed in the course of growing up its study makes possible greater understanding of individual development and functioning.

The investigations of the neurologists and psychologists are rich in meaning for the physical educator who is concerned with human functioning directed toward the mastering and controlling of one's own body. Mastery and control are desirable attributes since we live by moving—moving to execute everyday tasks; to engage in sport, dance, and recreational activities; moving quickly to avoid being hit by another person in a crowded area, or moving safely from the path of an oncoming automobile.

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13 Witkin et al., Personality . . . .
In his remarks on human action, Schilder maintained that the greatest progress made in the understanding of human action stemmed directly from Liepmann's investigations. According to Schilder, Liepmann has shown that every action is based on an anticipatory plan. Schilder further clarified this finding by explaining in the following manner:

In this plan the knowledge of one's own body is an absolute necessity. There must always be the knowledge that I am acting with my body, that I have to start the movement with my body, that I have to use a particular part of my body. ... there is always an object towards which the action is directed. ... may be one's own body or it may be an object in the outside world. ... we must also know in what way we want to approach the object. The formula contains therefore the image of the limb or of the part of the body which is performing the movement. It may remain undecided whether this image will be a clear one.

Schilder completed this explanation by pointing out that pathology of the apractics proved that intellectual knowledge was not sufficient. He committed the image to the German "Bewusstheit"--a living thought--which might never reach a fully conscious level. The important concept here is the function of the anticipatory plan. Essentially, controlled or highly articulate movement is necessary for preservation and enhancement of the human organism. This need for preservation and enhancement prevails throughout life.

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14 Schilder, p. 50.
15 Ibid., pp. 51-52.
Consider again the child who, because of a lack of other well-developed personality resources, must depend primarily upon his human movement skills for coping and interacting with his environment. While many studies have been conducted on the motor development of preschool-age children, considerably fewer investigations have been carried out with the elementary school boys and girls. The studies which have been conducted at the elementary school age level have been primarily in areas of physical maturity, physical fitness, and the relationship of the independent factors of age, height, weight, strength, flexibility, balance, endurance, and agility to each other as well as to motor ability or to selected motor activities.

While it is true that performance of the gross motor type is dependent upon the degree of fitness of the physical attributes of strength, balance, agility, flexibility, and endurance, these factors do not supply all the information necessary for understanding the differences in the gross motor performance of the elementary school child. Espenshade spoke most succinctly in saying the following:

When a child moves easily and the sequence and timing of his acts are well controlled, he is said to have good coordination. Quite probably, coordination in complex motor performance is more than neuromuscular control. It may actually be this plus optimum combinations of strength, physique, speed,

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balance, and possibly other factors not clearly identified.\textsuperscript{17}

In an attempt to identify the other factors to which Espenschade referred, Ross conducted a study in 1961 designed to investigate the relationships between eye-hand coordination skills and visual perception skills in children. The results of this study tended to support the following theses:

1. Visual skills and motor skills of the children tested were still in the process of development.

2. Visual space is developed through the sense of touch and the use of muscular activity.

3. Children who have more opportunities to explore their respective environments, free to move and manipulate objects, have a greater chance of developing better visual skills than the children who are restricted in movement and exploration of the environment.

4. The development of visual skills and motor skills are highly complex processes which are closely associated in the development of the sensorimotor functions of the child.\textsuperscript{18}

The research investigations cited thus far seem to allude to the interaction of perceptual and motor development and function. There seems to be some mode of operation implied. Perhaps Piaget clearly defined the relationship by contending the following:

\ldots there can be no movement occurring in any conceivable type of behavior which


does not rest on perception. Neither can there be a perception taking place without activity which involves motor elements. It is the total 'sensorimotor schema' which must constitute the starting point for the analysis of behavior, and not perception or movement considered in isolation.¹⁹

On this point, one finds Piaget and Merleau-Ponty to be in agreement that a reciprocity exists between movement and perception—that movement is the transformation of the perceptual field and the perceptual field is altered and/or determined by movement or the positioning of oneself within a spatial context.²⁰

If this reciprocity does in fact exist, it becomes imperative that those persons concerned with the movement education of elementary school children develop understanding of and conduct research investigating the manifestations of and developmental trends of these alleged dimensions of human personality functioning. Furthermore, if young children are to learn to move in a highly articulate manner—with control and assurance—those responsible for providing the learning experiences must be cognizant of and employ intelligently the findings of research related to the area of gross motor performance. Presently, no one is certain which dimensions of total personality functioning are most influential; neither are there any claims as to which research tools are most powerful. There are many fruitful theories and much work to be done.


²⁰ Merleau-Ponty, p. 100.
The concept and implications of the body image boundary model

Research conducted by Fisher and Cleveland investigating the body image boundary has generated research in several areas of human personality and functioning. Investigating the relationship of boundary definiteness as reflected through the Barrier Score and one's outlook on life, Cleveland and Fisher found the high barrier individual to be more dedicated to the feeling that it is through one's own efforts that one's fate is determined. In contrast, the individuals scoring low on the barrier index were found to adopt a more passive and fatalistic outlook on life.21 In a follow-up study reported in 1960, Cleveland and Morton found that group status of children was related to the Barrier Score. Data revealed that children most preferred by their contemporaries were the children possessing high Barrier Scores, while those with low Barrier Scores fell into the isolate category.22

An earlier study, conducted by Fisher and Cleveland, was focused on whether or not the body image boundary concept could be used with normal subjects in clarifying their behavior relative to psychosomatic symptom choice. The investigators had predicted that high Barrier Scores would be associated with exterior body complaints, whereas low Barrier Scores would be associated with interior body complaints. Results of


choices indicated by the 87 undergraduate men and women supported the prediction. The importance of this particular study lay in contrasting the psychological significance of the emphasis on the body exterior with the body interior. Fisher and Cleveland's position has been that the outer layers, particularly the striate musculature, are more subject to voluntary control. As a point of contrast, the body interior is an area of involuntary control and rarely can a response to a stimulus be controlled. Thus, the voluntary striate musculature and the skin which covers it are literally one's closest physical contact with the external environment. Since the high barrier individual highlighted the boundary regions of the unstructured Rorschach stimuli and since the individuals with psychosomatic symptoms occurring in the skin and musculature had high Barrier Scores, one may hypothesize a definite preoccupation with one's own periphery. Carried one step further, one could contend that the high Barrier Scorer is more aware of his body boundary and assigns it a protective and encasing function.

A subsequent study testing the hypothesis that if a high Barrier Scorer assigned a protective and encasing function to his body boundary he would engage in a style of life that exhibited the following characteristics:

1. high level of aspiration

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2. greater drive for self expression
3. greater motivation for competitive advancement of self.

Two interesting findings resulted. First, the hypothesis was supported in the sense that the barrier aspect of the body image boundary was a "reflection of a style of life based upon an unusually strong definition of self-identity and objective self-expression aimed at a stable controlling relationship to the environment." The second finding was that the high Barrier Scorer was more active and tended to engage in sport activities.25

In their original publication, Body Image and Personality, Fisher and Cleveland had noted that persons with definite boundaries; that is, high Barrier Scorers, had been found to be more open and less defensive in dealing with the environment than were persons with indefinite boundaries.26 A more recent contention of Fisher, relative to the above finding, was the interpretation that the degree of boundary articulation reflects one's consistency and definiteness of goals and values that have been interiorized.27

Investigators other than Fisher and Cleveland have appealed to the boundary model as an explanation and/or factor in human behavior.

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26 Fisher and Cleveland, Body Image and Personality, p. 205.
In an endeavor to better understand the dynamics of adjustment to physical crippling, results of a study conducted in 1957 revealed a relationship between body image boundaries and adjustment to poliomyelitis. This finding led to the generalization that "the extent to which the individual conceives of his body exterior as having a defensive, shielding, barrier-like quality plays some part in the total constellation of forces affecting the adequacy of the individual's adaptation to physical crippling." To gain further insight into body image organization, the psychoanalytic group has considered body boundary formation basic to adequate ego functioning and a sense of identity. Kaufman and Heims, in an effort to identify factors in juvenile delinquency, postulated the factor of boundary disturbance. The Werner-Wapner group employed the model to explain changes in perceived head size that occurred when external stimuli were applied to the temporal area.

In the early 1960's, results from two independently conducted studies led the investigators to the same interpretation of the relationship of perceived size and body boundaries. Weckowicz and Sommer and

31 Wapner and Werner, pp. 19-20.
Cleveland et al.\textsuperscript{33} suggested that consistently overestimating body size among schizophrenics might be interpreted as dissolution of body image boundaries and, therefore, associated with body image pathology. It will be recalled that the Wapner-Werner group had placed the overestimation of size into a developmental context. Their hypothesis was that overestimation of the size of the body part was indicative of lower developmental status. One must acknowledge, however, that the fine line between pathological behavior and behavior at the lower developmental stages probably is more subtle than discrete.

Since the body image boundary seems to be related to the way in which the human organism functions and since the boundary has been placed in a developmental framework, the concept of psychological differentiation should be applicable. Witkin has stated that, "the description of a system as more differentiated or less differentiated carries definite implications about how the system functions. . . . that a major characteristic of a highly differentiated system would be specialization."\textsuperscript{34} Theoretically, the highly differentiated human organism would have the capability of greater specificity of function and a higher degree of segregation from the environment. While not synonymous with psychological differentiation, the body image boundary construct may be accorded a descriptive function as the manner in which the human organism organizes his perceptions and

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\item\textsuperscript{34} Witkin, \textit{Psychological Differentiation}, pp. 9-10.
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interacts with his environment. In a theoretical context, the development of the body image is an aspect of differentiation, and the manner in which that image is articulated may be considered in terms of the boundary dimension. Halpern seemed to allude to a boundary dimension in the following comments relative to the implications of the term self-concept:

The term self-concept implies . . . that the individual regards himself as . . . a figure or object apart from the rest of the world. . . . at first only dimly and intermittently perceived and recognized as such, but with increasing experience in living it becomes clearer and stronger and its aspects more definite.

The suggestion, then, is that the self-concept is a product of the experiences the individual has with the world about him. The boundary model, according to Fisher and Cleveland, would posit differences in the manner in which the individual experiences himself as an object apart from the external environment. Specifically, the focus would be upon the quality being ascribed to the periphery or exterior of one's own body, and this would be a product of experience. Thus, for Fisher and Cleveland, the body image boundary is that dimension of the body image as it is experienced rather than how it is known. The construct, then, emphasizes the interdependence of cognitive and affective activities in the organization of perception and cognition of the body. While it is to be understood that the boundary concept is considered a major dimension

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35 Personal communication with Dr. Seymour Fisher, Upstate Medical Center, Syracuse, New York, March, 1966.

of the body concept, research investigations have not shown clearly whether the boundary is simply a fruitful construct, an indicator area of psychological differentiation, or an entity. Nonetheless, the Witkin group for some time has considered an articulate body concept to be indicative of developed differentiation, and the differentiation distinctly refers to the impression one has relative to one's body having definite limits or boundaries.\(^{37}\)

Studies by Witkin et al. have centered on the body as it is perceived or known. This focus is in contrast with Fisher and Cleveland's investigations of the body as it is experienced. It has appeared to this writer that both viewpoints are necessary for an intelligent understanding and investigation of human personality functioning, that both are necessary for reality functioning. It would be unfortunate for one to ascribe the qualities of impenetrable, protective, and hard-shelled to one's boundaries and not have come to know that the physical body can be punctured or penetrated— that the skin and musculature are not of a hard-shell quality. If this were to be one's reality orientation of bodily self in an external environment, the consequences of such orientation are obvious. Granted, then, the concept formed of one's own body must be considered from an experiential point of view— our conceptions of our body arise out of our experiencing it as both self and object. As a result, the body concept

is based on the knowledge about the body but it does not correspond fully to a physical entity. It would seem that relative to any discussion of a relationship between body image boundary and psychological differentiation a highly articulate concept would be a product of knowledge about the body as a physical entity operating in a physical universe and attitudes about the body based upon one's experience within the structure and context of a dynamic environment.

Relative to developed differentiation, research conducted by Fisher and Cleveland between the years 1951-1958 had led the authors to the contention that there should be a significant positive correlation between maturity and stability of the individual's overall style of body image organization and the definiteness of his body image boundaries. Data had revealed that, in general, the more definite the body image boundaries the greater the ability to deal effectively with stressful demands. At an inferential level, one could generalize that the higher the Barrier Score the greater the degree of body image maturity. To this writer, it seems that Fisher and Cleveland's contention has placed the body image maturity into a differentiation context if the definition as set forth in this study has been accepted. Maturity connotes an organism's organizational complexity and increased capacity for function. Assuming this to be valid, it follows that a significant correlation found to exist between body image maturity and definiteness of boundaries suggests

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38 Fisher and Cleveland, Body Image ..., p. 207.
body image boundary definiteness as an area of psychological differentiation. Fisher, however, has continued to maintain that boundary definiteness and psychological differentiation are not synonymous. This position has been puzzling because a well-articulated body image is conceived as having definite boundaries, and in this context, a well-articulated image would be synonymous with mature image organization.

Regardless of Fisher's position, one must ask whether or not the cognitive model of one's body is the result of the struggle for individualization. If so, does the clarity of the percept suggest or reflect the level of differentiation? As a result of recent studies conducted with ten-year-old boys, the Witkin group would respond to the question in terms of the following ideas:

... in individual differences ... we are dealing with differences in articulation of the body concept, and moreover ... a tendency to experience the body as more articulated or less articulated is associated with a tendency to experience the self and the surrounding world in a similar fashion.40

The Witkin group has suggested, then, that the manner in which a child organizes perceptions and experiences the world around is a reflection of the way the child experiences himself. The Fisher-Cleveland boundary model would not preclude the hypothesis set forth by the Witkin group.

39Letter from Dr. Seymour Fisher, Upstate Medical Center, Syracuse, New York, April 20, 1966.

40Witkin, "Development of the Body Concept . . . .", p. 34.
Although the Witkin group and Fisher and Cleveland have approached the dimension of body boundary in a different manner, similar and compatible findings have resulted. For example, Witkin and others found that children who had difficulty perceiving their bodies as a separate field had difficulty picking out a simple figure embedded in a complex design. If the hypothesis is correct, that one experiences the world as one experiences oneself, the significance of the above finding lies in the manner of perceiving and organizing external events. Since the subjects were unable to separate the simple figure from the complex field, one may contend that the subjects experienced the stimulus situation as a continuous figure-ground matrix. If observable behavior is a reflection of internal organization, one could hypothesize that the subjects were experiencing themselves as a continuous body-field matrix. Theoretically, experiencing oneself as a continuous body-field matrix is characteristic of a lower developmental status; consequently, a lower developmental status—a less differentiated or poorly articulated body image organization of the organism—could be postulated. At the behavioral level, one could contend the development of and/or experiencing of self boundaries is necessary for a more articulate interaction with the environment. This discussion has been pertinent to the Witkin hypothesis of a self-consistency model—a similarity exists in the way a child experiences himself and the way he experiences the world around—and the Fisher-Cleveland model which posits a well-articulated body image in terms of

\[41\] Witkin et al., Psychological Differentiation, p. 115.
the boundary being qualitatively experienced as definite, firm, and clearly demarcated from the external environment.

As one considers the boundary model and the self-consistency hypothesis, questions arise relevant to the integrative activity that apparently exists between a psychic and a physical experience of self. In other words, if one works operationally with the Fisher-Cleveland model of the boundaries "as they are experienced," which is essentially a psychic phenomenon, can one demonstrate a corresponding physical involvement? How do a psychic experience, which is non-material, and a physical response become integrated at the behavioral level? Further, can one influence or reflect the other? Schilder sought to resolve the potential conflict by asserting that activities of the human organism are primarily psychic activities. Schilder contended that although the physiological or motor function is derived from the psychic function this is not to say that the psychic function is complex and the physiological function simple. Rather, Schilder's assertion implied a level of integration wherein each influences and penetrates the other. Thus, Schilder has posited a "psycho-physiological sphere" composed of a multiplicity of factors. Appealing to the postural model of the body as the explanation of the integration of the psychic and physiological events, Schilder stated the following:

Perceptions ... only have a meaning as the basis for actions. The postural model of the

\[42\]
Schilder, p. 296.

\[43\] Ibid., p. 292.
body, the knowledge of the limbs and their relation to each other is necessary for the start of every movement. In all actions directed against one's own body, the knowledge of one's own body is also necessary. When the knowledge of the limbs is not sufficient for the start of a movement, the individual will increase his knowledge by testing movements. Knowledge without movement is always incomplete.\textsuperscript{44}

Fisher and Cleveland's investigations have endeavored to show a relationship between boundary definiteness, as reflected by the Barrier Score, and physiological events. Using skin resistance as the physiological variable, subjects were directed to estimate the respective sizes of front-back, head-body, right-left, and upper-lower aspects of the body. In addition to estimating size of the respective body parts, the subjects were instructed to compare simultaneously the amount of space occupied by the body parts under consideration. The estimates of size differences served as the body image variable. Fisher then correlated skin resistance with each body-part area. Analysis of data revealed that if the subject perceived one body-part combination (i.e., head-body) to be larger than the other the skin resistance was lower in the part judged as larger.\textsuperscript{45} These data were then correlated with the Barrier Scores. Testing an hypothesis stated in an earlier study, "that the more definite or firm an individual's concept of his boundary, the

\textsuperscript{44} Ibid., p. 293.

more likely he is to build up organized tonus sets . . . and systems involving readiness in the exterior body layers." Fisher apparently demonstrated at an operational level a relationship between boundary definiteness and physiological reactivity.

In a subsequent study, Fisher and Fisher demonstrated at the .01 percent level of confidence a positive relationship between Barrier Score and a tendency for exterior body sensations to predominate over interior sensations. Data revealed that the higher the Barrier Score the greater was the likelihood that sensations would be acknowledged as arising from the boundary regions—the skin and striate musculature. Conceivably, the experiencing of body boundaries as being either more or less firm plays some role in proprioceptive functioning which, in turn, plays a role in level of kinesthetic awareness.

Since proprioceptive and kinesthetic functioning are apparently necessary to coherent movement behavior, one may hypothesize tentatively a relationship between body image boundary firmness and human gross motor performance. For the physical educator, the boundary model with its implications for gross motor performance potentially opens a whole new sphere to understanding this aspect of human functioning. Apparently afferent stimulation plays a paramount role in eliciting a sense of body integrity and identity. When the human organism moves, the movement is


the observable result of efferent activity which, in turn, elicits
afferent stimulation. One may only speculate at this point the role
the boundary dimension plays in human gross motor performance. Whether
or not the boundary dimension is an entity or purely a construct perhaps
is not important. The fact that the model has generated much research
in increasing the understanding of human behavior is in and of itself
justified.

Personal correspondence between the writer and Dr. and Mrs. Hubert
Armstrong of Stockton, California, revealed additional data on the rela-
tionship of the Barrier Score to performance on selected physical fitness
measures. Engaging 100 normal female and 70 normal male high school
students between the ages of 14 to 18, there existed a significant correla-
tion of .42 for the female group between Barrier Score and physical fitness
score; an insignificant correlation of -.077 between Barrier Score and
physical fitness score was reported for the male group. Interpretation of
the data by the investigators, at the time of correspondence (in terms of
interest patterns which assumed a developmental basis), suggested that
the lack of a significant correlation in the male group was attributable
to an indiscriminate encouragement to participate in physical activity of
the sort being tested. Thus, a test of "physical fitness" or skill would
be less discriminating— at least in this stage of their development. The
female group, on the other hand, appeared to be more free to pursue physical
activities if they so desired; thus, a test of skill in the area of
"physical fitness" seemed to be more discriminating between persons of high and low barrier characteristics.

The above interpretations have puzzled this writer because it seems the Armstrongs have introduced two factors. One is motivation and the other is indiscriminate encouragement. It appears that the Armstrongs have presented a rather unstable picture of the Barrier Score. Unstable because, without any evidence, the suggestion made was that the Barrier Score as a discriminating index was a function of the criterion battery somehow being viewed by the female subjects as aligned with activities they were free to pursue on an interest or self-motivated basis. The investigators seem to have implied an assumption of questionable validity—that the female subjects were interested and/or self motived. Further, this writer has failed to understand how Armstrong can posit a causal relationship since the factors of indiscriminate encouragement and motivation in physical activity neither were controlled nor manipulated experimentally.

The relevance of the above research to children's gross motor performance would be conjecture at best. Since these subjects already had entered the adolescent stage, the effects of the advent of puberty upon the boundary dimension is unknown. It is questionable as to whether or not pre-pubescent and post-pubescent subjects may share the same generalizations.

Research with preschool, adolescent, and adult subjects greatly exceeds the research being conducted with the elementary school child.
This time of the child's life has many hallmarks as he seeks to become at home with himself and his environment. The importance of the development of boundaries and the child's reliance upon gross motor activity have already been established. With respect to these two areas of human personality, vital information is still missing.

In a personal conference with Dr. Seymour Fisher in October, 1965, the intended area of investigation and research design for this study were discussed. At that time, Dr. Fisher confided that he knew of no other studies purporting to investigate developmental trends in Barrier Score, the relationship between Barrier Scores and children's performance of gross motor tasks, and the ability to represent symbolically the horizontal and vertical dimensions of body space. It was conceivable that findings would yield more information pertinent to the dimensions of body boundary and children's gross motor performance.

Assessment of the body image boundary

Assessment of the body image boundary through psychological testing is in somewhat of a precarious position because of the dependency upon inference. As a result, any measure and/or interpretation of this dimension of human personality organization is limited by the appraisal techniques. However, Thompson has asserted that, "almost every conceivable recording of an individual's behavior has potential value for personality measurement. . . . because man reflects his needs and purposes in almost everything he does."

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48 Thompson, Child Psychology, p. 575.
Best defined a psychological test as, "an instrument designed to describe and measure a sample of certain aspects of human behavior." The use of psychological testing in descriptive research primarily has been to describe prevailing conditions at a particular time. Basically, questions and concerns revolve around the use of objective or projective techniques.

In defining a projective technique, Best has described it as, "... a data-gathering instrument which conceals its purpose in such a way that the subject cannot guess how he should respond. ... thus his real characteristics are revealed." Implied here is the notion that the subject unconsciously projects his innermost thoughts and organization.

The use of inkblots as a means of psychological testing began with the work of Alfred Binet in 1895. According to Holtzman, Binet interpreted the ability to see a great number and variety of figures in an inkblot as an indication of one being highly imaginative. The use of the inkblot attracted others; among them, Hermann Rorschach. In 1911, Rorschach began a period of experimentation with the inkblot that eventually led to the development of the Rorschach technique. This system of analysis, in its broad principles, is used today. Basically, Rorschach's endeavors were committed to analyzing a person's mode of perception.

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50 Ibid., p. 156.
52 Ibid.
There is basic to all projective techniques the explicit assumption that one's concepts reveal one's consistent way of organizing experiences.

Theoretically, the ambiguous stimulus situation makes possible a non-stereotyped response which reveals the dynamics of one's inner life. It is generally accepted that an individual will regard and confront an amorphous and ambiguous situation in a manner that is consistent and characteristic of his personality organization. According to Klopfer, it is the ego structure of the individual that is revealed. This is a fundamental point because in psychological theory the ego structure is the reality contact.

Hirt, discussing the nature of projective tests, pointed out they do not begin with a well-defined universe of behavior. Rather, it is the meaning for the individual that is sought and evaluated in any stimulus situation. Thus, the technique does allow for the description of the individual as an individual. In contrasting projective and objective tests, Hirt acknowledged that objective tests do not describe the individual as an individual "but rather in terms of his approximation to the typical performance of culturally determined tasks for which an arbitrary, but internally consistent, empirical rating scheme has been devised." Objective tests have a real limitation because they are based on the reductionist's approach to behavior— that of ordering behavior on a

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55 Ibid.
continuum that has been predetermined by the selection and description of a particular universe. The implicit assumption underlying objective tests is that the subject, the experimenter, and the test constructor all have the same meaning for each item. While the testing situation is structured during the time of projective testing, the responses of the subject are encouraged to be spontaneous rather than selective.

Because of the encouragement of spontaneity, one must acknowledge a problem inherent in the administration of the test. The problem: the effect of the examiner-subject interaction on the responses was not questioned or examined until 1950. Lord found that differences in Rorschach responses were produced by examiner differences more so than by the number of administrations or the prevailing atmosphere (positive, negative, or neutral) during the testing situation. Others interested in the effects of the examiner and the methods of inquiry have found personality variables and unconscious reinforcing acts to be influential in the responses obtained.

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56 Ibid.
57 Edith Lord, "Experimentally Induced Variations in Rorschach Performance," Psychological Monograph, 64, No. 10 (1950).
The validity of the Rorschach technique was challenged by Zubin in 1954 in a severe attack on the major failures of the technique. 61 Earlier, Ainsworth had defended the Rorschach technique by calling attention to the fact that it rests upon a phenomenological rationale. Reviewing the problems of validation, Ainsworth submitted the following argument:

The fact that interpretative hypotheses are modified by the context of the configuration in which they appear presents a difficult dilemma in planning validation research. On the one hand it may be argued that if the discrete hypotheses cannot be shown to have some valid basis, a judgment based on the integration of these hypotheses can scarcely be valid. On the other hand, it seems equally justifiable to insist that validation research is irrelevant unless it tests out the hypotheses as they are actually used in practice. There is probably no simple or single solution to this problem. 62

It seems the phenomenological "here and now" concept undergirds the problem in later validity studies by appearing as the "then and there." Personality is dynamic and it is open to question as to whether or not validity studies can be achieved with the hoped for results. The Rorschach technique is certainly open to construct validation and research has been conducted in this area. Results of such research have seemed to satisfy this criterion of a psychological test. 63

Another important area of concern is whether or not the Rorschach technique could be used with children. The disagreement among the Rorschach advocates has focused upon whether or not meaningful responses can be recorded before certain ages. Ames and colleagues have found that meaningful records can be obtained by age two. It is the contention of Klopfer et al. that any child who has attained a mental age of three can respond in a meaningful way to the inkblot stimulus. They further have maintained the principle in Rorschach administration does not differ from adults to children and that any problem encountered is in actuality one of verbal communication between the examiner and the subject. According to Klopfer, "... with very young children we come face to face with a stage in their development when the capacity for verbal communication is at its very beginning. ... the gradually developing ability of the young child to communicate, verbally or otherwise, is one of the most important aspects of the growth process which we want to study." The implication is that problems in Rorschach administration with young children can be solved through making the communication of instructions to young subjects more flexible. Klopfer and associates have contended that calling an inkblot a picture is more in keeping with the child's vocabulary. They have maintained that this deviation is not a violation of standard procedure but rather a clarifying term that has greater meaning for the child.

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65. Klopfer et al., Development in ..., p. 12.
While the Rorschach technique primarily has served as a psycho-diagnostic tool for predicting human behavior, Fisher and Cleveland used the original Rorschach plates to assess the boundary quality of the body image. Through content analysis of the responses, they devised an index known as the Barrier Score. The rationale for the scoring system was based upon the assumption that percepts which were characterized as having well-defined relatively impermeable boundaries corresponded to relatively well-defined and differentiated body image boundaries.  

One readily acknowledges the sizable leap that has been taken when one posits that a response to an amorphous inkblot corresponds to concepts about one's own body. However, investigations previously cited have built a strong case for projecting one's own psychological organization onto an unstructured situation. Several efforts have been directed toward demonstrating that responses to inkblot plates may be utilized to measure the parameter of boundary definiteness. Perhaps the most dramatic finding has been a significant correlation of the Barrier Score with the literal sensory prominence of the boundary regions of the body. Apparently, content analysis of Rorschach records gives evidence of unconscious acknowledgement by the individual of qualities of firmness or softness of his own body boundaries.

Assuming that the unstructured and ambiguous stimulus taps the personality organization at a deeper or unconscious level, the Rorschach record can be used to identify the perception of the boundary organization. Fisher has stated that the Rorschach is one of the richest sources for obtaining information about the body image organization. He further believes the technique reliable since interscorer agreement in evaluating the protocols for Barrier Score has averaged about a .90 correlation.\textsuperscript{70} Earlier, Daston and McConnell had reported high reliability coefficients of the Barrier Scores over a period of time.\textsuperscript{71}

In classifying and enumerating a characteristic of a subject's response to the Rorschach, Fisher and Cleveland shifted from a purely projective point of view to a psychometric frame of reference. This strategy has been evidently a compromise position in psychological testing for boundary definiteness. The unstructured situation has been preserved in order that the subject might project but a definite meaning has been assigned a certain classification of responses.

Realizing that placing the Rorschach technique into a psychometric framework demanded a revision before adequate scores on most of the original blots could be obtained, Holtzman and colleagues undertook the monumental task of constructing a new projective technique. Their intent was to utilize the same principles as the original Rorschach. Their objective

\textsuperscript{70} Personal conference with Dr. Fisher, October 16, 1965.

was to construct a test that would be void of the seven major failures
cited by Zubin.\(^{72}\) The result of these efforts became the technique known
as the **Holtzman Inkblot Test**. Basically, Holtzman's test differs from the
Rorschach in its standardized administration procedure, an increase in
the number of inkblots presented the subject, an alternate form (Form B),
and a consistent scoring technique.\(^{73}\)

Relative to Fisher and Cleveland's work, Holtzman found the
barrier variable to load highly on Factor I as a result of a factor
analysis of the correlates of inkblot scores. Holtzman has interpreted
Factor I as dealing mainly with integrated ideational activity, awareness
of conventional percepts, and perceptual maturity.\(^{74}\)

In research reported by Fisher, one is aware that he has used
both the Rorschach and Holtzman techniques. According to Fisher, the
Holtzman Inkblot Test yields results consistent with the original
Rorschach.\(^{75}\) In a personal conference with Dr. Fisher in October, 1965,
he advised this writer to use the first 25 inkblots from the Holtzman test.

Efforts to develop techniques that would assess the boundary
dimension in a clear-cut objective manner have been attempted. Fisher
and Cleveland worked with 40 of the Holtzman inkblots in an effort to
construct a multiple-choice instrument. Sixty college students were given

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\(^{72}\) J. Zubin, "Failures of the Rorschach Technique," *Journal of

\(^{73}\) Wayne Holtzman, *Inkblot Perception and Personality* (Austin,
Texas: University of Texas Press, published for the Hogg Foundation
for Mental Health, 1961), p. 3.

\(^{74}\) Ibid., p. 151.

\(^{75}\) Personal conference with Dr. Fisher, October 16, 1965.
the group Rorschach and the multiple-choice test. A correlation coefficient of .64 was found between the Barrier Scores of each test. Although the correlation was fairly high, Fisher and Cleveland were not convinced of the multiple-choice test's validity. The reservation concerning the use of the multiple-choice instrument seemed to be in the idea that this method could distort the meaning of the inkblot variable. Distortion would be possible because the response alternatives were limited to a well-defined range of responses; therefore, the projecting function could be lost. Conceivably, the chosen responses could confound the data regarding that which was being assessed.

Prior to 1959, no attempt had been made to relate the Barrier Score to conscious report measures indicative of the quality ascribed to the boundary region. Cognizant of this omission, Bart undertook a study with the purpose of developing a technique that would effect a conscious assessment of the boundary dimension. Having categorized the subjects by their Barrier Scores, Bart then administered the Body-Cathexis scale and the Semantic Differential test. She then administered an adjective check list, which she had designed, and a modified version of the Draw-a-Person test. Both the adjective check list and the picture test, designed by Bart, were conceived as capable of tapping the boundary organization at a conscious level. Bart's findings led her to concur with Fisher that the Barrier Score does not reflect the individual's usual

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Fisher and Cleveland, *Body Image and Personality*. 
consciously verbalized feelings but rather taps the more basic concepts and feelings which are found at a deeper level of psychological organization. 77

Another study conducted by Fish had the secondary purpose of constructing a multiple-choice test to assess the parameters of body boundaries. Fish evaluated the attempt as being unsuccessful. 78

A more recent attempt to construct an inkblot test scale to assess the individual's concept of his body boundaries was approached differently by Casswell. This investigator focused on the assessment of the individual's concept of the depth layers of his body image. Scoring was based on the number of percepts whose content directly represented the body interior or openings into the body. Test data obtained from the 115 college men and the 70 college women revealed the following:

1. When compared with Fisher and Cleveland's Barrier Score as a reflection of boundary quality, the high barrier people had few interior percepts.

2. Men had more interior responses than did the women. 79

This instrument appears to have more promise as a technique than do the others previously reviewed.


78 Jeanne Fish, "An Exploration of Developmental Aspects of Body Scheme and of Ideas About Adulthood in Grade School Children" (Ph. D. dissertation, University of Kansas, 1960).

One other means of assessing the perception of the body image is reviewed here because of the possibilities it offers in exploring the boundary dimension of the body image. In 1957, Popper devised an objective measure which became known as the Popper Height Estimation Test. The underlying rationale for such a measure was discerned as being the tendency to overestimate one's height reflects some inaccuracy in the perception of one's physical self. Popper, relating the tendency of children to underestimate their heights as a reflection of their attitudes toward their bodies, found distortions of these perceived heights to be related to feelings of adequacy and inadequacy.  

What relationships lie among the perception of size of one's own body, the Barrier Score, and gross motor performance would be conjecture at this point. However, Fisher has expressed the point that size is one of the simplest of perceptual parameters and has contended that it has proven to have exciting possibilities as a means of measuring body image attitudes. Evidently, there seems to be a basic tendency to translate body feelings into terms of body size.

In view of the literature reviewed relative to the assessment of the body boundary, this writer concurs with Fisher that the Rorschach or the Holtzman tests probably yield the richest source of information tapping the boundary dimension of the body image. Cognizant that most of the research pertaining to body boundaries has been conducted with

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80 Popper, "Motivational and Social Factors . . . ."
adult subjects, the writer further takes heed of Thompson's conclusion regarding the Rorschach that children's responses cannot be interpreted validly against adult norms. 82

**The parameter of body size**

The subject's awareness and perception of self-size has been reviewed as a potential dimension for better understanding of perceptual organization and human psychological functioning. Schilder has viewed the dynamics of space perception from a psychoanalytic framework by stating, "Space perception is a function which depends upon the libidinous structure of the individual. Id functions modify it continually." 83 The implication seems to be one of reverting back to self as the basic reference point. Relative to and supportive of Schilder's viewpoint was a study conducted by Katcher and Levin investigating children's conceptions of body size. Recorded were the children's perceptions of size of self, opposite sex, mother, and father. Although their technique did not permit comparisons between actual and perceived sizes, the findings indicated the following:

1. Children correctly perceived themselves as smallest.

2. Children perceived the mother as the intermediate size.

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82 Thompson, *Child Psychology*, p. 584.

3. Children perceived the father as the largest.  

Consistent with Schilder's remarks, it seems these children were reflecting a commonly held percept which usually is consistent with reality. The id function is not clear but it would have been informative to have had comparisons between actual and perceived sizes. Perhaps this treatment would have suggested id functions.

Studies conducted by Wapner and Werner, cited elsewhere in the literature, have tended to reaffirm that perception of body space and perception of external space are not independent but interact intimately. These investigators have approached their research in terms of the visual field context. As a result, they have found that perception of self-size differs with respect to judgments being made in an open spatial or closed-confined spatial context. Other studies conducted by the same authors have shown that overestimation of size of body parts seems to be associated more with a disturbed body image or, at least, an ill-defined one.

Throughout the research literature, findings have emerged which allude to space perception and perception of body size being intimately related to each other and related to personality characteristics and functioning. However, one is tempted to ponder whether or not a confounding of data has occurred. For example, in the Popper Height Estimation Test, the subjects symbolically recorded their perceived heights. In so doing, it is not really clear just what determined the
results. On one hand, it is possible that misperception did occur and it was accurately represented. On the other hand, it is possible that misperception did not occur but inaccuracy occurred during the symbolic treatment of the percept. Perhaps a spurious relationship is all that exists. This would be a tenable hypothesis if it were not for the findings of the Wapner-Werner group. Using more direct measures, their findings have been consistent with the less direct measures of perceived size. 86

Because of relationships that are found to exist, there is suggested a significance of the perception of our own bodily states relative to establishing functional spatial relationships. Armstrong has suggested that our body is for each of us the paradigm of a physical object. He elucidates upon the relationship by pointing out that in bodily perception the following are perceived:

1. awareness of motion and position of limbs
2. position relative to the earth of the whole body
3. pressure of one part of the body on another
4. the stretching of tissue. 87

The above all seem to resolve themselves into spatial determinations of the body. In essence, all that immediately have been perceived are the spatial properties of a particular physical object--our body. Armstrong

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86 Ibid., pp. 11-23.
would be in agreement with Schilder, Fisher and Cleveland, Wapner and Werner, and Witkin that each individual builds a spatial image of his body. The spatial image may or may not correspond to reality. The significance of the space perception/body size relationship might not be in its correspondence to reality measures but rather how the perceived relationship makes possible the individual's functioning at a reality level.

Relative to the developmental aspects of spatial concepts, Meyer postulated three stages with the third stage being particularly relevant to self-size perception. In the third stage of Meyer's hypothesis, after four years of age children begin considering themselves as one object among many and attempt to adjust their behavior to the relative position of all other objects. At this stage, the child is responding to objective space. The factor analytical work of Michael, Zimmerman, and Guilford has suggested that even into the elementary school years spatial relations are derived from a relationship to the human body. Their work further indicated that with respect to the factor of spatial relations ability boys tended to be more accurate than girls. Evidently, spatial perception does not remain at the body-reference level but moves toward greater differentiation by entering the symbolic level. The inference

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is that while spatial perception is deeply rooted in the body framework greater functioning becomes possible through symbolically dealing with the spatial context.

In discussing the mental development of children, Inhelder stated that Piaget's work has indicated that during the eighth year the child achieves the space-time operations, those being the Euclidean coordinates, projective concepts, and the event of simultaneity. The relevance of these data to children's estimations of their own sizes through symbolic representation has not been established.

Fish's data indicated that between the ages of nine and eleven, the accuracy with which boys estimated their own height increased significantly. Relative to direction of errors at the different age levels, there was a strong tendency among the seven-year olds to underestimate their heights. Fish related these data to feelings of adequacy and inadequacy. Consistent with Fish's findings was a finding that resulted from the Kennedy-Lasswell study. These investigators found that with 300 children, grades four through eight, there was a tendency to underestimate their own heights and weights relative to those of all adults.

These studies have served to point out a predictable behavior of children's estimates of self-size. Still one must question whether


91 Fish, "An Exploration . . . ."

or not this predictable behavior is a function of the instruments used and, if not, then of what significance is self-size perception.

Measurement of perceived self-size has been achieved most frequently through the use of the following techniques. First, the aniseikonic technique as used in the Belzer study.\(^\text{93}\) Basically, the aniseikonic lenses cause a visual distortion of the physical appearance. It is conceivable that those subjects who were well aware of their actual physical image would react differently than those subjects who were less aware. It could be hypothesized that those subjects having greater awareness of actual physical dimensions of self-size would perceive greater distortion than those less aware. Although the aniseikonic technique was not used for the primary purpose of perception of self-size, the instrument certainly could be used for size assessment.

Wapner, Werner, and associates have used more direct measures of perceived size.\(^\text{94}\) The most common method has been that of indicating with the hands against a horizontal meter stick the perceived size of the body part. Another technique used by these investigators has been the moving of two rods into position to indicate the perceived space consumed by the body part under consideration.

The third technique which has been used is the technique devised by Popper.\(^\text{95}\) This technique consists of the subject assessing his own

\(^{93}\) Belzer, "The Effect of Physical Activities . . . ."

\(^{94}\) Wapner and Werner, pp. 16-18.

\(^{95}\) Popper, "Motivational and Social Factors . . . ."
height by imagining himself standing alongside a standard. The subject then makes an estimate of his height on a scaled model of the standard, which is drawn on paper. Since children at about eight years of age are able to deal with space at a symbolic level, the assumption is that accompanying this increased capacity for functioning is the ability to translate and represent perceptual judgment in symbolic terms.

The best technique for recording size estimates has not been discerned. Actually, all three techniques reviewed here have possibilities as well as drawbacks. When one is working at an inferential level, there is present at all times the danger of making spurious relationships. When assessing at a conscious and direct level, such as that used by the Wapner-Werner group, there is always the question of whether or not the subject is performing in a field-dependent or field-independent manner.

Whether or not a more intact and articulate body image is reflected through size estimates is still inconclusive. It remains to be demonstrated whether or not accurate perception of self-size plays any role in gross motor performance such as that typical of physical education activities.

There are implications resulting from the work previously conducted. From an organismic point of view, it has been assumed that the boundary between body space and outside space is lessened with a lower developmental status. Within this egocentric framework, young children conceive of their body space as being a continuous field with the external environment.
According to Wapner and Werner, the "factor which makes for change in articulation of body and objective space is developmental in nature." Therefore, changes in differentiation of body space from objective space can be anticipated. To support the developmental hypothesis, children have been observed to be more accurate in their judgment of distance between ten and twelve years of age. While it is true that during these years certain visual maturity is achieved, this does not preclude a function of the knowledge of own body space.

Studies from the Innsbruck Laboratory have shown that first an individual learns to master space on a sensorimotor level; that is, he is able to move about without error. If one considers these findings in terms of gross motor performance, one could contend that the effectiveness with which an individual moves in and through space is indicative of one's level of spatial mastery. Theoretically, the mastery of space as indicated through gross motor performance could be indicative of greater psychological differentiation.

Schilder has posited the relationship between the postural model and the knowledge of body space. To quote, "The space of our body has a special characterization, but in addition a spatial knowledge is necessary about the arrangement of the separate parts of our body, if we desire a

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successful movement towards the separate parts of our body." Schilder implies, then, that when spatial knowledge is incomplete so will be the movement.

In the book, Educational Gymnastics, one is introduced to the concept: body's sphere of movement. Basically, the concept presents the human body as the concrete reference point, when it is either stationary or moving through space, from which the location of all other non-self objects is perceived. Thus, the body's sphere of movement includes the horizontal and vertical aspects, plus all the points in between, of objective space. If an arm is extended into objective space, that particular space disappears and the body space is increased. Consequently, one can think of oneself in terms of bigness or smallness relative to the amount of space one is consuming at any given moment. For a child learning to catch a ball, the understanding of this concept could make the difference between his extending his arms into space to meet the oncoming ball, effecting a gradual dissipation of its force, or his waiting for it to come crashing in at close range. The ability to extend effectively into space could make the difference between the child's accurate judgment or misjudgment in making contact with the oncoming object.

99 Schilder, The Image and Appearance ..., p. 293.

According to Witkin, the visual environment has the character of a framework whose main outlines represent the true vertical and horizontal.\(^{101}\) At all times, the continuous postural adjustments made to the constant force and direction of gravity make possible the understanding of the true upright. It would seem that cooperation of the above would result in a unified impression of the upright. In the words of Witkin, "thus the perceptual process is of great and continuous importance to the individual since it involves his body directly and enters constantly into his adjustments to objects in the environment."\(^{102}\)

Throughout the literature, there has been suggested an interaction of body space and perception of external space. This writer has alluded to the function of perception of the vertical and horizontal aspects of body space in organizing objective space for accurate movement in and through space.

Is there a relationship between children's gross motor performance and the accuracy with which they estimate various dimensions of body space? With age, do children's estimates become more accurate? If a relationship exists, does the significance lie in the accuracy of the estimates or in a directional consistency to either underestimate or overestimate? After certain stages of development, does the knowledge of self-space become less important as a frame of reference? While answers will not be forthcoming from this investigation, it is hoped that information relevant to finding the answers will result.

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\(^{102}\) Ibid.
Motor performance

Motor performance is momentary, illusory, but a very real and complex human endeavor. Human movement occurs in terms of space, time, and force relationships. It is assumed that effective and efficient gross movement behavior results when these variables have been manipulated in a logical sequence or ordering of motor responses. The ordering of motor events may be done at either a conscious or subconscious level.

A youngster can throw a ball against a wall, catch it, and demonstrate this behavior repeatedly while working against time. As far as the child is concerned, he has involved himself in the task of throwing and catching. This is what he has experienced. However, in throwing and catching that ball, he also has demonstrated his awareness, appreciation, and level of coping with the space, time, and force factors which are inherent in and peculiar to that specific activity. Although the child may be unable to verbalize his understanding of these relationships, might not it be the understanding of these relationships—sensitivity to them—that makes it possible for the child to order these perceptual data and produce coherent movement? It seems reasonable to suggest that in order to be successful the child would also have to have an awareness and appreciation of the distance between himself and the wall; where his various body parts are in relation to each other and the wall; the angle of incidence to effect a rebound with an intensity, speed, and
height that he can manage; and an appreciation of the length of his own arm—its role as a lever. The point is that throwing and catching a ball as described above is more than catching and throwing a ball. It is a demonstration of the child's ability to manipulate the environment at a discernible level of functioning. This sorting out of the afferent impulses, the elicitation of the efferent impulses, and the resulting observable activity have been the subject of inquiry for the neurologist, psychologist, and physical educator.

Differences in the neonate, young child, and preschool child's motor performance and motor development have been an area of investigation for the child psychologists. These developmental psychologists have focused primarily upon the appearance and/or sequence of locomotion and the fine motor skills. The findings of early investigations conducted in human motor development are pertinent to this study.

The Gesell studies suggested that motor development of children progressed in an orderly sequence. Beginning with conception, it proceeded stage by stage and each stage represented a level of maturity. The implication here is that development is a function of maturation and/or age. This position made more tenable the hypothesis that motor development was inherent and that native ability through inherited genetic factors determined one's gross motor development.  

On the basis of extensive investigations, Shirley identified five sequential phases peculiar to postural and locomotor development of infants (N=25) during their first two years of life. As a result, she concluded each separate stage to be a prerequisite for the immediately succeeding stage and that every baby proceeded from stage to stage in the same order. However, she admitted that the sequence was not absolutely rigid since individual differences during the stages described as prerequisites did appear among the babies. These deviations from the supposed sequential phases could not be explained by Shirley.\textsuperscript{104}

Since children do seem to skip some of the phases identified by Shirley, the studies of Bayley\textsuperscript{105} and McGraw\textsuperscript{106} began the scrutiny of observable motor behavior in a broader context and in so doing cast doubt on the "function of maturation" hypothesis. Thus, Bayley in her studies acknowledged Shirley's conclusions as being unwarranted. According to Bayley, what appeared to be a sequence in postural and locomotor development did not depend on a regular order of an appearance of specific abilities but rather on a rapid increment in the whole level of ability. In this context, the general orderliness hypothesis was accepted but the notion of prerequisite phases was questioned.


In essence, the McGraw study of twins Johnny and Jimmy placed the general orderliness of motor development in an even less specific context. While she suggested phases for the development of motor skills, she introduced the variable of changing environmental conditions; thus, the function of the environment.

The opening remarks have been relevant to research conducted in motor development inclusive of the years infancy through early childhood. If one focuses on research in motor development of later childhood, a perusal of the literature yields a predominance of investigations in anthropometric, speed, and physical fitness performance areas.

Relative to significant findings, Carpenter found that strength and speed theoretically can be considered as functionally independent factors in motor development. Rarick gave further support to this finding by interpreting data of his investigations and concluding no single maturity measure is a valid indication of a child's status in motor skills; that skeletal maturity is of little consequence in explaining individual differences in strength and motor proficiency. Further, Rarick and Oyster stated that none of the maturity indicators accounted for more than 15 percent of variance in strength and motor performance of second-grade boys. On the basis of these data, chronological age was the most important variable explaining variance in strength.


Espenshade conducted a replication study investigating the relationships between physical performance and age of 7,600 children from ages ten through eighteen years. Analysis of the data revealed the following relationships:

1. Twenty-five percent of the variance in running, jumping, and throwing was accounted for by the combined factors of age, height, and weight for boys twelve - fifteen years.

2. There was with age a steady progression in all test items except sit-ups for the total school population sample of boys and high school athletes.

3. Girls' performance on the test items improved with age. Between ages ten - thirteen, improvement occurred in the broad-jump and 50-yard dash; between ages ten - fourteen, girls improved on the throw-for-distance item. Improvement was small but steady.

As a result of these findings, Espenshade recommended the use of the single factor, age, as a basis for the development of test norms.  

Again, performance as a function of age has been posited. Age as the common denominator has been hypothesized so often and, perhaps, so spuriously. Assign persons of a certain age to a given interval of time and it is obvious that age will increase. Since growth, by definition, is an increase in size, it is obvious that the child moving toward

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physical maturity will increase in height and weight as he grows older. Just as one's vocabulary and penmanship improve as one gets older, so might one's gross motor performance be expected to improve. Consequently, these improvements are developmental expectations. The prediction and classification functions which Espenschade has assigned to age are, in this writer's opinion, suspect.

Within the last fifteen years, results from investigations of the relationship of age to motor performance are inconclusive. Latchaw, in 1954, found a very low relationship between the motor tasks of throwing, jumping, running and the variables of age, height, and weight among children in grades four through six.\textsuperscript{111} On the other hand, Noble and associates having conducted a study with 600 subjects from ages eight to eighty-seven concluded age and sex are critical parameters in human psychomotor learning and performance.\textsuperscript{112}

In an earlier study involving 1,977 elementary school boys, Bookwalter found that body size and shape seemed to have an influence on physical performance.\textsuperscript{113} He also concluded that very obese boys were the poorest physical performers and that thin boys of average size performed better than medium-physique boys of average size. Findings of the


Wear study yielded a major conclusion supporting Bookwalter's findings. Wear concluded excess weight to be a definite handicap to performance on four items of the American Association for Health, Physical Education, and Recreation fitness tests.\footnote{114}

In an attempt to present new evidence relative to the age, anthropometric, and ponderal variables, Ismail and Kessler found the percent lean body weight to be the most important item related to selected items which purport to measure motor aptitude.\footnote{115}

The contribution of sex differences in children's gross motor performance is also inconclusive. The literature has revealed the following generalizations:

1. Where strength must play a major role, boys usually perform better than girls.

2. Performance in such activities as running, jumping, and throwing (which includes the factors of speed and distance) appears to improve with age. However, this improvement might be a function of practice, interest, instruction, or opportunity to move.

3. In activities which are not dependent upon strength, differences in boys' and girls' performances cannot be attributed to sex differences.\footnote{116}


Normative data from the Greensboro study of approximately 1,900 children would support the above generalizations in part. While the data were not analyzed for significant differences between age and sex groups, an inspection of the tabular material suggests a picture of parallel performance between boys and girls in grades three through six with improvement occurring across the age groups. 117

While age, sex, anthropometric, and ponderal variables have been investigated as sources of variation, one soon comes to realize they have not been fruitful in further understanding differences in children's motor performance. Since gross motor performance involves many aspects, there exists an expectation of some relationship between performance and certain aspects of personality functioning.

The early Bayley studies tended to suggest with advancing age during the first three years of life the correlation between intelligence and motor development gradually decreased. Generally speaking, low positive correlations tend to exist throughout childhood. Further, there is evidence to support the generalization that retarded children as a group are somewhat retarded in motor skills, whereas gifted children as a group are somewhat advanced. 118 Consequently, no significant relationship has been found to exist between intelligence and motor performance.


The relationship of the social factor to gross motor performance has been investigated more often with adults rather than with children. In a study conducted with 83 boys, aged ten to twelve, Cowell and Ismail found boys who scored high on the motor performance measures were likely to have leadership potential, to be personally accepted, and well adjusted socially. Another finding of the same study, which also used college athletes, was those engaged in team sports were more likely to be accepted than were those who engaged in individual sports. The latter finding may be considered as there being a possible relationship between this finding and the finding of Fisher and Cleveland cited earlier. It will be recalled that the high barrier individual tended to engage in sports. Related to the Cowell-Ismail findings were the results of a follow-up study conducted by Cleveland and Morton cited elsewhere in the text. It will be recalled, in that study, children who had high Barrier Scores were preferred more by their contemporaries. The nature of such a relationship and whether or not the Barrier Score plays a significant role is inconclusive.

Throughout this review of literature, the work of Head, Schilder, Fisher and Cleveland, Piaget, Witkin, Wapner, and Werner in some manner

121 Cleveland and Morton, "Group Behavior . . . ," p. 84.
have posited the demarcation of self from the non-self environment as being necessary for more articulate human functioning. Through the writings of these same men, a relationship of the awareness of body space, conceptualization of space, and motor performance has been suggested. Head's assumption of a postural model; Schilder's positing motility being the basis of our bodily self; and Fisher and Cleveland's operationally defined parameter of body image, the body image boundary, have suggested to this writer a function of reciprocity in man's psychomotor functions. The posing of a reciprocity function is tenable if one considers human functioning as likened to an input-output system. Also, there is no conflict between the proposed reciprocity function and the differentiation hypothesis.

Because elementary school age children are generally considered to be in the process of development toward greater differentiation, significant relationships may not be evident until a certain developmental level has been achieved. On the other hand, relationships might be apparent at early ages which tend to set the stage and/or remain for the individual as a style of coping with the environment throughout one's lifetime. In addition to the point that children are still in the developmental process, they are not expected to perform highly complex or sophisticated gross motor movement. For this reason, children's motor performance tasks usually consist of simple running, jumping, and throwing activities. Another factor supporting the use of these three diverse
activities is simply that children have had some type and amount of experience in these three categories. It is probable that, while a high level of proficiency has not been attained, by the time children are in the third grade they are well beyond the learning stage in the simple forms of running, jumping, and throwing.

Although beyond the learning stage, differences in performance are highly recognizable. No doubt many factors are contributing to these differences. The surface has not been scratched deeply enough to permit understanding of the functions of sociological and psychological factors. Many research endeavors have concentrated on the observable differences in children's gross motor performance. Essentially, the parameters investigated have been age, height, weight, and other anthropometric and ponderal factors.

On the basis of the studies reviewed and data available from studies similar to the ones reviewed, this writer contends that such variables as age, height, weight, and sex bear spurious relationships to motor performance. While these variables do relate, from time to time, to various measures of children's motor performance, they are categorizing variables and not ones possessing a contributory function.
CHAPTER IV

PROCEDURE

The twofold purpose of this exploratory investigation was to study data obtained from boys and girls aged eight, ten, and twelve relative to body image boundary definiteness, performance of selected gross motor tasks, and accuracy of symbolically representing various dimensions of body space. The writer deemed necessary the discussing of these data in terms of developmental theory, which posits a process of differentiation, in an effort to further the understanding of differences in human performance.

Selection of subjects

The subjects for this study were 143 boys and girls enrolled in two elementary schools and one junior high school from the Granite City, Illinois, school system. Following is a breakdown of the subjects retained for the study:

1. Eight-year olds: 22 boys; 20 girls
2. Ten-year olds: 22 boys; 20 girls
3. Twelve-year olds: 28 boys; 31 girls.
To qualify for the study, the following criteria had to be met by each subject:

1. Be within the normal intelligence range as indicated by the assessment tools used by each of the participating schools.

2. Have not evidenced or be known to have any serious personality disturbances.

3. Have not had recent serious illness.

4. Be free of uncorrected vision problems.¹

5. Be free of other forms of impairment such as hearing loss, known brain damage, and other known forms of psychomotor disturbance.

6. Be within a nine-month age range: 8.0-8.9, 10.0-10.9, 12.0-12.9.

7. Have not attained puberty.

8. Have been enrolled in the Granite City school system for the past two years.

9. Have participated regularly in the instructional physical education program.²

10. Have completed all tests administered in the study.

11. Be within the same socio-economic range.³

¹Subjects with vision problems of which the correction was questionable in terms of adequate visual functioning were dismissed from the study. These subjects were allowed to participate in the assessment program but their data were discarded.

²The Granite City school system was chosen because each school has a physical education specialist(s) conducting the program at all grade levels. The physical education program is conceived of and conducted as a program of planned progression. There is variation in the time allotted, that being either a daily program or classes which meet three times per week.

³This was easily accomplished. Light and heavy industries form the basis of Granite City's economic structure. Through assimilation, the city's population is made up of different Caucasian ethnic groups which have evolved into the prevailing socio-cultural structure.
Measurements recorded for each subject

1. Barrier Score

2. Estimates of Dimensions of Body Space
   a. Vertical Aspect
      (1) Standing Height
      (2) Extended Height
   b. Horizontal Aspect
      (1) Span
      (2) Shoulder Width
      (3) Hip Width

3. Actual Dimensions of Body Space
   a. Vertical Aspect
      (1) Standing Height
      (2) Extended Height
   b. Horizontal Aspect
      (1) Span
      (2) Shoulder Width
      (3) Hip Width

4. Performance of Selected Gross Motor Tasks
   a. Throwing-Catching
   b. Target Jump
   c. Shuttle Run
Assessment of body image boundary

Body image boundary was assessed according to the method suggested by Dr. Seymour Fisher. The first 25 Holtzman inkblot cards were projected by an overhead projector onto a Radiant screen. The subjects were seated so that all had a clear view of the inkblot being projected.

Following is an account of the group administration procedures:

1. Prior to administering the test, each subject was given a mechanical pencil filled with soft lead.

2. The subjects were told the following:

Today you are going to see some very different pictures. I think you will be very interested in them. I have some picture pages to pass out to you on which you will write me what you see in each picture. 4

After the protocol forms were distributed, the test administrator then said:

At the top of the first picture page is a place for your name. Please print your name very clearly. Now circle the word boy if you are a boy; circle girl if you are a girl.

Since exact age was to be recorded later by the test administrator and I.Q.'s and/or mental ages checked, the administrator proceeded:

Look at the first picture on the screen. This is Picture X. Find Picture X on your first picture page. Is there anyone who has not found Picture X? It is possible that you will see many things in each picture but I want you to write about just one thing that you see. Please write in the space alongside Picture X.

4See Appendix A for inkblot protocol record forms.
Subjects were allowed three minutes to respond to the inkblot. Three minutes had been suggested by Harrower and Steiner as adequate for the average adult.\(^5\) Holtzman has suggested group administration procedures for college students which differ from the Harrower and Steiner recommendation. Although data were incomplete relative to group administration, Holtzman stated that "a different time interval may be necessary for less articulate subjects."\(^6\) Since the maximum time allotted for viewing a single inkblot was 120 seconds for the college students, this writer decided to allow three minutes for each card on the assumption that children are less articulate in both verbal skills and writing mechanics. The same procedure was followed for Card Y and the first 25 of the Holtzman inkblots. The function of Inkblots X and Y was one of orientation to the type of stimulus, with which the children could expect to be confronted, and orientation to use of the protocol forms. After three minutes had elapsed, the tester said:

Please circle the part of the picture about which you have written. Now, let's look at the next picture.

The above procedures were used with all cards and all groups. The children had been told beforehand to avoid using words they did not know how to spell.


\(^{6}\)Holtzman, p. 257.
At the completion of showing Card 10, the children were given a stand-up break. Since the testing was conducted the week preceding the Christmas vacation, "Jingle Bells" was sung during this break. After the showing of Card 17, another break period was conducted. During this time, the children were asked to show how they would move if they were trying to imitate the movement of jingling bells. The children then proceeded to view and respond to the remaining eight cards. This procedure governing break periods was followed with all groups.

To control for examiner effects, the administration of the inkblots was conducted for all groups by the writer. The writer exerted caution and care in trying to create the same type of atmosphere for each group by addressing them in a friendly and sincere manner. Questions prior to test administration were encouraged, and brief exchanges of small talk ensued in an effort to build rapport.

When the testing period was terminated, the test administrator collected the protocol forms and pencils. The children were thanked for their cooperation and told that on the following day they would be taking part in some interesting activities in the gymnasium. Before leaving each group, the test administrator chatted briefly with the children, reacting in a positive manner to their questions and comments.

After all groups had been subjected to the Holtzman Inkblot Test, I.Q. and/or mental age factors checked, the forms then identified by code number only with all relevant subject identification data masked
were sent to Dr. Seymour Fisher and blind scored for barrier responses. The Barrier Score was ascertained by counting the number of protocols indicated as barrier responses.

Estimates of dimensions of body space

The Popper Height Estimation Test was the basic tool used. In addition, this writer was interested in determining whether or not children could deal on a symbolic level in representing an extension of their vertical heights as well as represent the horizontal aspects of their body space.

The writer assumed operational validity based on the following rationale. Children have some type of image as to how much space they consume. This image may or may not correspond to reality measurements. However, the degree and/or direction of correspondence might be important in dealing successfully with objective space. Whether or not the child appreciates the fact that the moment he extends his arm or leg into objective space he has extended his body space, this understanding might influence the way he moves into position in any of the game, sport, dance, aquatic, or gymnastic situations. It is conceivable this appreciation, or lack of it, would influence all the child's movement in his attempt to maneuver successfully in any situation.

According to the literature which has been reviewed, children should be able to deal with spatial relationships at a conceptual level
by age eight. Theoretically, this manner of functioning is indicative of a more differentiated level of behavior. One would posit, then, that children of this age could deal effectively with scaled models of spatial relationships. How accurately, or in what manner, would become apparent once the task had been completed.

To ascertain the accuracy and direction of the estimations, the children first performed the following tasks:

1. estimated their own standing height
2. estimated their own extended height
3. estimated their own span
4. estimated their own shoulder width
5. estimated their own hip width.

Following is a description of the procedure followed with each group:

1. The children were directed to sit on the gymnasium floor in a space no closer than 10 feet to the wall and no farther than 20 feet from the wall. This area was indicated by the test administrator.

2. Each child was given a 8-1/2- x 11-inch sheet of white paper on which appeared a blue vertical line 2 mm in length. At the bottom of the vertical line was an intersecting horizontal line 40 mm in length. The blue line on the side of the paper to the child's left was labeled Picture A. A second vertical line which appeared on the side of the paper to the child's right was labeled Picture B (see Appendix B).

3. Each child was then given a mechanical pencil with soft lead.
The group's attention was called to the wall which they were facing. On the wall, which was green in all three schools, was mounted an 8-foot vertical strip of 2-inch-wide cash register tape which intersected with the floor. Intersecting with the vertical strip on the horizontal plane was an 8-foot strip of 2-inch-wide cash register tape which was mounted to the wall four feet from the floor. Following is an explanation which was given to the children:

Look at the white tape that is placed up and down or vertically on the wall. Now, look at the paper which I have given you. Find Picture A. Picture A is a representation or a picture of our white tape that is placed up and down on the wall. The line across the bottom of the long blue line represents the floor. Our picture appears smaller than the tape actually is on the wall but we also look smaller when someone takes a picture of us.

After all children had located Picture A, the following directions were given:

1. Pretend you are standing tall against the tape that is on the wall and measuring yourself against it.

2. Now, look at Picture A. Draw a line across Picture A to show me where the top of your head would be.

3. Draw one line across; otherwise, I will be unable to use your pictures.

The children were directed to look at Picture B. The directions were as follows:

1. Again, pretend you are standing against the tape on the wall and stretching up with one
93.

2. Now look at Picture B. Draw a line across Picture B to show me how high the tips of your fingers would be.

3. Draw just one line across; otherwise, I will be unable to use your pictures.

The children were then directed to print their names at the top of the paper in the space provided. After the names had been printed, the vertical height estimates were collected.

The following procedure was maintained for each group as they engaged in estimating the horizontal aspects of body space:

1. Each child was given a 8-1/2- x 11-inch sheet of white paper on which appeared three blue horizontal lines each 200 mm in length. At the end of each line were perpendicular lines extending above and below the horizontal lines. The top line was labeled Picture 1; the second line, Picture 2; and the third line, Picture 3 (see Appendix C).

The children were directed to turn their papers in order to print their names in the space provided. They were told to keep the paper in this position because this was now the top of the paper. The group's attention was called to the wall which they were facing and were directed to look at the horizontal tape. The directions given were as follows:

2. Look at the white tape that goes across the wall. Now, look at Picture 1. It is at the top of your paper. The circle you see in the middle of Picture 1, we will pretend, is your head.

3. Look at the white tape going across the wall. Look at Picture 1 at the top of your page. This is a picture of our tape which goes across the wall.
4. Pretend you are standing with your back to the wall and your arms are stretched along the tape.

5. On Picture 1 show me how far on each side of your head you can reach. Show me how far you can reach by drawing a line across the picture line. Since you have two arms, you will have a line crossing your picture line on each side of the circle which we are pretending is your head.

The same procedure and directions were followed for Picture 2 with the following exceptions:

6. Picture 2 is still our tape which goes across the wall.

7. This time, think about where your shoulders are and where they end. Pretend your arms are stuck to your sides.

8. On each side of our circle, which is your head, draw a line showing me how far each shoulder would be from your head.

Picture 3 was used for estimating hip width. The directions were the same as those given for the shoulder width estimate with the word "hips" being substituted for shoulders. After the hip estimates had been made, the forms and pencils were collected. All children were then measured for actual dimensions of body space. Following the collection of the estimate forms, the children's actual measurements to the nearest centimeter were recorded.

The scoring of the size estimations of body space yielded an estimate of size and a discrepancy score. Symbolically represented
estimates of standing height, extended height, span, shoulder width, and hip width were converted by simple mathematical formula to obtain the actual estimates to the nearest centimeter. The vertical and horizontal lines on the 8-1/2- x 11-inch sheets of paper used by the children to record their estimates were scaled to 1/12 the size of the tape which appeared on the wall. Since both the tapes on the wall were each 240 centimeters in length (8 feet), the length of the horizontal and vertical lines on the paper each were 1/12 the size of the tapes on the wall, or 20 centimeters.

The method followed for converting all of the children's estimates can be explained best as illustrated in Figure 1.

![Figure 1. Computation of Span Estimate](image)

Let the distance between Lines A equal 20 centimeters. The circle represents the child's head. Lines B represent the child's symbolic representation of the distance he thinks he can span by stretching his arms wide to the side. Let the distance between Lines B measure 10.2
centimeters. Multiply 10.2 centimeters by 12, and the child's actual estimate is 122.4 centimeters.

The accuracy of the children's estimates of the dimensions of body space was ascertained by finding the difference between the actual measurement and the child's converted estimate. If, for example in Figure 1, the child's actual span measurement had been 131 centimeters, the discrepancy score would be expressed as -8.6 centimeters. In this case, 122.4 centimeters has been subtracted from 131 centimeters. The negative sign has been used to indicate the direction of the estimate. This example has illustrated an underestimation of the span by the child.

Performance of gross motor tasks

The third of the three types of observations recorded for each child was that of motor performance. In the early stages of the study, the writer had to make a decision as to whether the motor tasks sampled were to be from an atomistic or holistic point of view. The writer decided upon the latter for the following reasons:

1. These tasks would be representative of typical physical education activities.

2. Performance of these motor tasks would be in a total and functional context.

Since it has been pointed out in the literature that most evaluations of elementary school children's motor performance are made through
observations of running, throwing, and jumping activities, the writer decided to use these same categories of gross motor tasks. The three tasks were selected because the nature of each task represented a different organization and manipulation of space, force, and time factors. For these reasons, the following gross motor tasks were presented to the children:

1. Catching-Throwing Task
2. Target Jump

The catching-throwing task, described earlier in this section, was selected because it represented a manipulation of space, force, and time factors relative to object handling. Following is a description of the test and the procedures followed with each group:

1. The subject stood behind a restraining line 5 feet from the wall.

2. On the signal, "Go," the subject threw the ball against the wall and caught the rebound. The subjects continued throwing and catching for a period of 30 seconds.

3. The score recorded was the number of successful catches attained in the 30-second time period. A catch was successful if the subject had remained behind the restraining line and the ball had been caught without having hit the floor. If the signal to stop was called during the rebound from the wall and the subject made a successful catch, that catch was scored.

4. Each subject had two trials and the best score was retained.
The following conditions and procedure were maintained for each group:

1. Rubber soccer balls were used against smooth cement walls.

2. The same stop watches were used throughout and had been synchronized prior to testing.

3. The test was administered to each group by the same trained examiner and assisted by two physical education teachers in each of the schools.

4. Standardized directions were used for each group.

5. Each subject had a 30-second trial performance. At the end of this time, questions were answered and/or procedure clarified.

6. Two subjects performed at a time. The physical education teachers counted the successful catches and watched for foot faults (stepping on or over the restraining line).

7. The trained examiner gave the signals, operated the stop watch, and recorded the scores.

8. After all subjects at the catching-throwing station had completed the first trial, the subjects then repeated the task for the second trial.

The second motor task engaged in by the subjects was devised by the writer and has been named the Target Jump. Essentially, this task is based on the standing broad jump but offers a novel situation. The subject's task is to land on a predetermined line which is indicative of a given distance. The task was perceived of as posing a space-force
problem for the subject. Since the predetermined target-line distances could be achieved by all the subjects, it was assumed that the influencing factors of general explosive power and broad-jumping technique had been eliminated. Assuming this to be valid, the problem posed by the task was that of whether or not the subject could employ the amount of force necessary to project himself through space and land on the designated target line. Further, it was assumed that the subject would have to make spatial discriminations if he were to land exactly on each of the three target lines. A description of the target jump task follows:

1. A 1-1/2-inch width of white adhesive tape was premarked in centimeters. Centimeter markings began at a 45-centimeter distance from the take-off line and terminated at 150 centimeters (see Appendix D for diagram).

2. There were three target lines on which each subject was to land. The first target was at 60 centimeters; the second target at 150 centimeters; and the third target was at 100 centimeters.

3. Three take-off lines were available. In a pretrial, it was found that all eight-year-old subjects could jump a minimum distance of 110 centimeters. All ten-year-old subjects could jump at least 130 centimeters. All twelve-year olds could jump a minimum distance of 150 centimeters. Consequently, the eight-year olds' take-off line was at the 40-centimeter mark; ten-year olds took off from the 20-centimeter mark, and twelve-year olds' take-off line was at the zero mark or a total distance of 150 centimeters.

Since this investigator was interested in the subjects' level of performance at that moment, it was decided to allow only one trial per
target line. Knowledge of broad-jumping technique had been demonstrated by each subject during the pretrial in which the take-off lines were established. The task situation was administered by the same examiner to all groups who received standardized directions. The task description follows:

1. The subject stood with feet parallel and toes behind the take-off line which was appropriate for his age group.
2. The examiner pointed to the 60-centimeter target line and directed the subject to land with both toes exactly on the target line.
3. The subject then jumped and his score was recorded in plus or minus centimeters. A minus expression of centimeters was recorded if the subject landed short of the target line and a plus expression of centimeters if one jumped over the target line.
4. A mistrial was recorded if the subject fell or failed to land with feet parallel.
5. In all cases of mistrial, the subject was instructed to go to the end of the line. The subject was given an opportunity for another trial.

The same procedure was followed for the second target line, 150 centimeters, and the third target line, 100 centimeters.

6. A target jump discrepancy score was derived by disregarding the signs and adding the total amount of error recorded for each jump.

The third motor task in which the subjects engaged was the shuttle run as used by Latchaw. This task was viewed by the writer

\[7\text{Latchaw, pp. 441-442.}\]
as one in which the subject had to keep himself in motion and make quick
cchanges of direction in order to complete the task in a minimum amount
of time. Overcoming the inertia of one's own body can be posited as a
factor with which each subject had to cope. Another factor inherent in
the task was that of the subject's ability to keep his weight shifting
properly in relation to his base of support.

A description of the task is as follows:

1. Two 12-inch strips of masking tape were
   placed parallel on the floor 20 feet
   apart.

2. The same trained administrator gave
   standardized directions and administered
   the task situation to each group.

3. The subject stood with the toes of his
   forward foot on the starting line.

4. On the signal, "Go," the subject ran to
   the line opposite the starting line and
   back to the starting line. This consti-
   tuted one trip. The subject completed
   two more trips covering a total distance
   of 120 feet.

5. The time was recorded to the nearest 1/10
   second after the signal, "Go," to the
   crossing of the starting line after com-
   pleting three trips (120 feet).\(^8\)

6. If the subject failed to touch or go over
   a line at any time during the run, mistrial
   was recorded. If a mistrial occurred, the
   subject was given another opportunity to
   record a proper trial.

7. Two trials were given with the best of the
   two trials being retained as the subject's
   task score.

\(^8\) Ibid.
Because each motor task represented a different manner in which the space, force, and time factors had to be manipulated and organized, this investigator decided not to combine scores into a single criterion score. The writer's purpose in keeping these motor tasks as separate variables was to make possible the studying of relationships among each of the tasks and the other co-variables.

Design of the study

The nature of this investigation was exploratory. It was unknown whether or not relationships would be found to exist among children's body image boundary as reflected through the Barrier Score, their accuracy in symbolically representing selected dimensions of body space, and their performance of selected gross motor tasks. In essence, the focus of this investigation was upon discovery. Therefore, the independent variables were not manipulated for effect. The investigator was concerned with the boundary status and the children's performances in the conceptual and motor tasks at a particular time in the subjects' history.

The following summarizes the overall design of this investigation which must be understood and viewed as a status study.

All children were subjected first to the group administration of the Holtzman test during the first three days of the school week, followed by the size estimates and motor task performance on the last two days of the school week. Figure 2 illustrates the testing schedule.
To expedite the motor task performance and size estimates, the children were divided into four groups. Each group was identified through the use of a colored name tag worn by each subject belonging to each particular group. Before coming into the gymnasium, the homeroom teacher distributed the name tags; thus, the groups were pre-organized. Upon entering the gymnasium, the subjects sat in their groups and were administered the size estimate tasks. Following this task, the groups were directed to one of the four testing stations. Figure 3 illustrates the testing rotation followed by each group.

![Testing Schedule Table](image)

**FIGURE 2. TESTING SCHEDULE**

![Rotation Schedule Table](image)

**FIGURE 3. ROTATION SCHEDULE FOLLOWED FOR SIZE ASSESSMENT AND MOTOR TASK PERFORMANCE**
To have some estimate of reliability of the task items, reliability coefficients were obtained in a pilot study with volunteer college students. Since reliability coefficients were available for the catching-throwing task (.89)\(^9\) and the shuttle run (.89)\(^10\), the target jump and size estimates were of concern. Using 20 college students, the target jump yielded a .86 reliability coefficient on a test-retest basis of a two-week interval. On the same test-retest design, the following reliability coefficients were obtained for each of the size estimates:

1. Standing Height Estimate: .90
2. Extended Height Estimate: .89
3. Span Estimate: .89
4. Shoulder Width Estimate: .87
5. Hip Width Estimate: .85

These reliability coefficients were within acceptable limits for the purpose of this study. While reliability estimates were not obtained with children, it was assumed that if the instruments indicated an acceptable level of reliability with adults, the measures would still be reliable with children.

\(^10\)Latchaw, p. 444.
CHAPTER V

ANALYSIS AND INTERPRETATION OF DATA

The twofold purpose of this study was to determine the relationships among children's Barrier Scores, their accuracy in symbolically representing dimensions of body space, and their performance of selected diverse gross motor tasks. All pertinent data for these 143 elementary school boys and girls were studied for their developmental relationships.

The data for this study were programmed and processed by the statistics laboratory and the data processing center at The Ohio State University. Eleven variables comprised the data for this study. Age, sex, and Barrier Score were the independent variables, and five estimates of dimensions of body space comprised the co-variables; three selected and diverse gross motor tasks were the dependent variables.

Since a function of this study was to explore the developmental relationships among the variables, analysis of variance and co-variance were the statistical models employed. To clarify the source of variance for differences in group means, analysis of variance was employed to identify the source of variance with respect to age, sex, and Barrier...
Score. Through the analysis of variance and the co-variance technique, the hypothesis $B=0$ was tested.

The co-variance and analysis of variance technique permitted the studying of age and sex and age and Barrier Score by eliminating the effect of the co-variables.

Since one question of interest in this investigation was whether or not Barrier Score increased with age, the data of Table 1 suggested an increase in Barrier Score across the age groups.

Figure 4 illustrates the small but consistent increases that were indicated between the three age groups for the male subjects. It can be seen that, as a group, no increase was indicated between the eight- and ten-year-old females but a higher Barrier Score was evidenced with the twelve-year-old females.

The suggested directional accuracy trend of children to represent various estimates of the dimensions of their own body space are summarized in Table 2. As a general group picture, it can be seen that across the age groups and within the sex groups children tended to underestimate their heights. It is also apparent this trend existed for the estimates of extended height and span estimates, except in one group. The eight-year-old females in both estimates tended to overestimate the two dimensions of body space.

A further inspection of Table 2 indicates a noticeable shift in the estimation trend for the remaining two horizontal dimensions of body space. With the exception of the ten-year-old male and twelve-year-old
<table>
<thead>
<tr>
<th>Age</th>
<th>Male Mean</th>
<th>Male S.D.</th>
<th>Female Mean</th>
<th>Female S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>3.364</td>
<td>2.34</td>
<td>4.35</td>
<td>2.207</td>
</tr>
<tr>
<td>10</td>
<td>3.864</td>
<td>2.73</td>
<td>4.35</td>
<td>2.45</td>
</tr>
<tr>
<td>12</td>
<td>4.929</td>
<td>2.801</td>
<td>5.871</td>
<td>2.837</td>
</tr>
</tbody>
</table>
FIGURE 4. INCREASE IN BARRIER SCORE

Legend:

□ = Male
○ = Female
### TABLE 2. MEAN AND STANDARD DEVIATION OF DIRECTIONAL DISCREPANCY IN ESTIMATES OF BODY SPACE

<table>
<thead>
<tr>
<th>Age and Sex</th>
<th>Height Estimate</th>
<th>Extended Height Estimate</th>
<th>Span Estimate</th>
<th>Shoulder Width Estimate</th>
<th>Hip Width Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean, cm</td>
<td>S.D.</td>
<td>Mean, cm</td>
<td>S.D.</td>
<td>Mean, cm</td>
</tr>
<tr>
<td>Female</td>
<td>-2.841</td>
<td>30.7947</td>
<td>8.438</td>
<td>31.8677</td>
<td>3.0815</td>
</tr>
</tbody>
</table>
female groups, the subjects tended to overestimate the dimensions of space in estimating shoulder width. It can be seen that in estimating the hip width a definite tendency to overestimate occurred. Table 2 further indicates the following with respect to the pattern of the trend in which both the female and male subjects made the estimates. It can be seen that the male subjects tended to underestimate height more so than the female subjects. Figure 5 illustrates that a similar pattern existed for both male and female subjects. For both sex groups, there was a decided increase in the underestimation of height at age ten with a decrease in amount of underestimation occurring with the twelve-year-old group that almost corresponded to the amount of underestimation recorded for the eight-year-old group.

The representation of the extended height estimate presented the same general pattern for the male group which was consistent with their estimates of height. However, the female subjects' representation presented a different pattern. It can be seen in Figure 6 that the eight-year-old female subjects as a group overestimated, while an increase in underestimation occurred with the ten- and twelve-year-old female subjects.

Figure 7 revealed the same general pattern that tended to exist in Figure 6. Again, the male subjects tended to have a larger amount of underestimation than did the female subjects. As was shown in Figure 6, the eight-year-old female subjects tended to overestimate the span.

Figure 8 again points up the tendency toward a consistent pattern of representing the estimates of selected dimensions of body space for
Mean Discrepancy, cm

Legend:
- □ = Male
- ○ = Female

Age

FIGURE 5. ESTIMATE OF HEIGHT
FIGURE 6. ESTIMATE OF EXTENDED HEIGHT
FIGURE 7. ESTIMATE OF SPAN
FIGURE 8. SHOULDER WIDTH ESTIMATE
the male groups. For the male subjects, however, the shape of the graphed estimates was quite similar to Figure 5—the height estimates. It will be noted, however, there was a tendency toward overestimation and a tendency toward a smaller discrepancy in the shoulder width estimates.

While the female and male subjects' discrepancy patterns for the height estimation (Figure 5) were similar to each other's, the female subjects manifested quite a different pattern on the extended height estimate, span estimate, and shoulder estimate. It can be seen that the female subjects progressed toward and/or increased the underestimation of these dimensions of body space at each age level. Therefore, these data have tended to indicate that the male subjects consistently recorded the greatest amount of underestimation of the selected dimensions of body space at age ten. This was true for the female subjects on the height estimations only. As compared with the male groups, the female subjects tended toward increased underestimation at age twelve.

The representation of the hip estimates presented a pattern consistent with the female subjects' patterns previously indicated in Figures 6, 7, and 8. It can be seen in Figure 9, however, that the male subjects' pattern was parallel to that of the females'. The hip width estimates were unique in that this was the only dimension of body space estimates that deviated so markedly from the general trend of underestimation. The hip width estimates began with overestimation. It can be seen that at each discrete age group the tendency to move toward the zero discrepancy and/or toward underestimation was evidenced.
FIGURE 9. ESTIMATE OF HIP WIDTH
Overall, a different style of estimation has been suggested for the male and the female groups. There seemed to be a general pattern of consistency for each sex group with the exception of the female subjects on the height estimation and the male subjects on the hip width estimation. These data have suggested that in the vertical aspects of body space and in the span estimate the children tended to underestimate. In contrast, the estimates on the horizontal aspects revealed a tendency toward overestimation.

Relative to the children's performance of the selected diverse gross motor tasks, the means and standard deviations for each age within a sex group appear in Table 3. An inspection of Table 3 reveals an improvement in performance at each age level. It can be seen that the eight-year-old females' mean number of successful catches exceeded the group mean of the eight-year-old male subjects. Table 3 also reveals that the eight- and ten-year-old females were more accurate in the target jump than were the eight- and ten-year-old males.

Relative to performance on each of the three gross motor tasks, the group means of each age group indicated that male subjects had better times on the shuttle run than did the female subjects. It can be seen, however, that differences which did occur were relatively small. The mean differences in time between the sexes in each age group were .5 of a second for the eight-year-old male and female subjects; ten-year-old male and female subjects, .5 of a second; and for twelve-year-old male and female subjects, .8 of a second.
<table>
<thead>
<tr>
<th>Age</th>
<th>Catching-Throwing Task</th>
<th>Target Jump Discrepancy</th>
<th>Shuttle Run</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>8</td>
<td>13.773</td>
<td>5.163</td>
<td>14.1</td>
</tr>
<tr>
<td>10</td>
<td>28.455</td>
<td>3.90</td>
<td>23.95</td>
</tr>
<tr>
<td>12</td>
<td>33.107</td>
<td>5.108</td>
<td>31.935</td>
</tr>
</tbody>
</table>
For each of the gross motor tasks, data in Figures 10, 11, and 12 have suggested a tendency toward parallel performance with these eight-, ten-, and twelve-year-old children. There has seemed to be no indication of marked superiority between the sexes.

While Tables 1, 2, and 3 have presented the group means in the three areas being studied, the evidenced variability in the population samples was the next concern. Tables 4, 5, and 6 have presented the adjusted mean averages between columns and rows and the F-ratios for source of variance. (See Appendix E, Table 17, which summarizes the sum of squares, degrees of freedom, mean square, and F-ratios for all variables.) Through the co-variance technique, the null hypothesis, that the effects of the co-variables Barrier Score and the discrepancy estimates of body space would not be a contributing source to the population variance, was accepted. Because many factors are operating in human performance and since the design was exploratory and descriptive, the writer decided to accept as significant confidence levels between .10 and .01.

Utilizing age and sex as categorizing variables, the investigator was interested in the source of population variance for the Barrier Score. Both age and sex had a statistically significant F-ratio. As indicated in Table 4, age appeared to account for the total population variance with an F-ratio of 4.9933 which was significant at the .01 level of confidence. It further was evidenced that sex was also contributing to the total population variance but the F-ratio of 3.3818 held the confidence level to be .10. Since the interaction was only .1177, it was reasonable to consider age and sex contributing independently to the total population variance in the Barrier Score.
**FIGURE 10. CATCHING-THROWING TASK**
FIGURE 11. TARGET JUMP
FIGURE 12. SHUTTLE RUN
TABLE 4. AGE, SEX, INTERACTION, AND F-RATIOS FOR SOURCE OF VARIANCE FOR BARRIER SCORES

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Adjusted Mean Average</th>
<th>F-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>3.8566</td>
<td>4.9933	extsuperscript{a}</td>
</tr>
<tr>
<td>10</td>
<td>4.1068</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>5.3998</td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td></td>
<td>0.1177</td>
</tr>
<tr>
<td>Male</td>
<td>4.0519</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4.857</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a}Significant at the .01 level.
\textsuperscript{b}Significant at the .10 level.
TABLE 5. AGE, SEX, INTERACTION, AND F-RATIOS FOR SOURCE OF VARIANCE FOR DIRECTIONAL DISCREPANCY IN ESTIMATES OF DIMENSIONS OF BODY SPACE

<table>
<thead>
<tr>
<th>Height Estimation</th>
<th>Extended Shoulder Width Estimation</th>
<th>Extended Hip Width Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Adjusted Average, cm</td>
<td>F-Ratio</td>
<td>Mean Adjusted Average, cm</td>
</tr>
<tr>
<td>Height Estimation</td>
<td>Span Estimation</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Adjusted Mean Average, cm</td>
<td>F-Ratio</td>
<td>Adjusted Mean Average, cm</td>
</tr>
<tr>
<td>8</td>
<td>-10.1148</td>
<td>-4.8405</td>
</tr>
<tr>
<td>10</td>
<td>-28.8837</td>
<td>4.83a</td>
</tr>
</tbody>
</table>

Interaction

| Male | -12.3446       | 5.701b             | -19.062           | 8.0004a           | 4.333b           | 29.521a          | 10.3103a |
| Female | -12.6015     | -3.02              | -19.3413          | -8.7748           | 19.8276          |

Significant at the .01 level.
Significant at the .05 level.
TABLE 6. AGE, SEX, INTERACTION, AND F-RATIOS FOR SOURCE OF VARIANCE FOR PERFORMANCE ON GROSS MOTOR TASKS

<table>
<thead>
<tr>
<th>Age</th>
<th>Catching-Throwing Task</th>
<th>Target Jump Discrepancy</th>
<th>Shuttle Run</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adjusted Mean</td>
<td>Average</td>
<td>F-Ratio</td>
</tr>
<tr>
<td>8</td>
<td>14.106</td>
<td>100.31(^{a})</td>
<td>15.7701</td>
</tr>
<tr>
<td>10</td>
<td>26.1804</td>
<td>9.2001</td>
<td>6.803(^{a})</td>
</tr>
<tr>
<td>12</td>
<td>32.1636</td>
<td>8.4498</td>
<td>10.455</td>
</tr>
</tbody>
</table>

Interaction

- Male: 27.2506 | 11.6791 | 11.1317 | 12.91\(^{a}\)
- Female: 25.103 | 10.2679 | 11.7018

\(^{a}\)Significant at the .01 level.
To determine the source of population variability in the representation of the estimates of selected dimensions of body space, the data in Table 5 have been presented.

For the discrepancy in height estimation, an F-ratio of 4.83 was significant at the .01 level of confidence for age as a contributing source to the total population variance. The F-ratio of 5.701 for the variable of sex as contributing to the total population variance was significant at the .05 level of confidence. Because the F-ratio for interaction was only .1108, these data seem to suggest age and sex as being independently contributing to the total population variance.

The F-ratio of 1.242 for age as the source of population variance in the discrepancy of extended height estimation was not statistically significant. However, the F-ratio of 8.0004 for the sex variable was significant at the .01 level of confidence. Since the interaction F-ratio was 1.111, it was reasonable to assume that the sex variable was the contributing source of variation for the total population variance.

The source of variation in discrepancy in the estimation of span apparently was due to both age and sex. The F-ratio of 10.207 for age as a source of population variance was significant at the .01 level of confidence. The F-ratio of 4.333 for the sex variable being a source of population variation was significant at the .05 level. With the small interaction F-ratio, .903, it was reasonable to assume that both age and sex were contributing variables to the total population variance.

The source of variability in the discrepancy found in the shoulder width estimates revealed a different finding. It will be noted
that the F-ratios for age, 78.45; sex, 29.521; and interaction, 46.043, were statistically significant at the .01 level. An inspection of the cells revealed the source of population variance to be a result of a larger discrepancy in the estimate of shoulder width by the eight-year-old females and a small discrepancy in the estimate of shoulder width by the ten-year-old males. These data have suggested, then, that these two cells (eight-year-old females and ten-year-old males) were the source of variation.

The hip width estimation F-ratio of 27.077 for the variable of age was significant at the .01 level as was the 10.3103 F-ratio for the sex variable. Since the interaction F-ratio was 2.6108 and not statistically significant, it was assumed that both age and sex were contributing to the total estimate of the population variance.

With the influence of the co-variable Barrier Score eliminated, the source of variation for the population sampled with respect to performance on the gross motor tasks was studied. Table 6 has presented the age, sex, and interaction F-ratios. It can be seen that the F-ratio of 100.31 for age on the catching-throwing task is statistically significant at greater than the .01 level. For the age variable, the F-ratio was found to be 2.54 and not significant. Since sex differences were shown not to exist and the F-ratio of 2.677 for interaction was not statistically significant, it was reasonable to assume that age alone contributed to the total population variance.

With respect to the variability in the amount of discrepancy in performance on the target jump, the age F-ratio of 6.803 was significant
at the .01 level of confidence. The finding warranted the same assumption of age being the source of the total population variance since insignificant F-ratios were evidenced for sex and interaction.

The variability in shuttle run performance was attributed to both age and sex being the sources of variation for the total population. It can be seen in Table 6 that the F-ratio of 34.41 for age and the F-ratio of 12.91 for sex were both significant at the .01 level.

It was the function of the data in Tables 4 and 5 to show whether or not the sources of variation, age and sex, were contributing to the total variance of the sampled population. Table 7 was presented to illustrate data which were obtained with a stratified sampling drawn from the original 143 subjects. Subjects were recategorized in terms of the variables of age and Barrier Score. The two-by-three design was maintained but low barrier and high barrier replaced the male and female rows. The columns continued to be indicated by the ages eight, ten, and twelve. This sample was composed of 112 of the original subjects.

Table 7 presents the adjusted mean average between columns; between rows; the F-ratio for age, Barrier Score, and interaction for the variance estimate of directional discrepancy in estimates of body space.

Easily discerned was the significant F-ratios for the possible source of variation, age. There was one exception. Age and/or Barrier Score as a possible source of variation failed to exhibit F-ratios large enough to be significant at the .05 level. However, it was found that a
### TABLE 7. AGE, BARRIER SCORE, INTERACTION, AND F-RATIOS FOR SOURCE OF VARIANCE FOR DIRECTIONAL DISCREPANCY IN ESTIMATES OF BODY SPACE

<table>
<thead>
<tr>
<th></th>
<th>Height Estimation</th>
<th>Extended</th>
<th>Span Estimation</th>
<th>Shoulder</th>
<th>Hip</th>
</tr>
</thead>
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<tr>
<td></td>
<td>Adjusted Mean</td>
<td>Adjusted Mean</td>
<td>Adjusted Mean</td>
<td>Adjusted Mean</td>
<td>Adjusted Mean</td>
</tr>
<tr>
<td></td>
<td>Average, cm</td>
<td>F-Ratio</td>
<td>Average, cm</td>
<td>F-Ratio</td>
<td>Average, cm</td>
</tr>
<tr>
<td>Age 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-10.7069</td>
<td>-2.5273</td>
<td>-18.637</td>
<td>6.5537</td>
</tr>
<tr>
<td>Age 12</td>
<td></td>
<td>-15.7068</td>
<td>-15.5344</td>
<td>-33.3555</td>
<td>-1.0794</td>
</tr>
<tr>
<td>Interaction</td>
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<td>0.429</td>
<td>0.7787</td>
<td>0.24</td>
<td>0.607</td>
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<td>Barrier Score</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
<td>-18.475</td>
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<td>-29.9797</td>
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<td>0.384</td>
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<td>0.0128</td>
</tr>
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<td>-20.8233</td>
<td>-16.226</td>
<td>25.4092</td>
<td>0.9933</td>
</tr>
</tbody>
</table>

*a* Significant at the .01 level.

*b* Significant at the .10 level.
significant F-ratio (2.9563) did exist at the .10 level of confidence for Barrier Score. While it was recognized that a no interaction, no column, and no row significant F-ratio would suggest the operation of chance as the source of variance, it also was realized that a non-rejection of the null hypothesis does not prove the hypothesis. Going on this assumption, it was decided to determine whether or not the F-ratio was significant at the .10 level. The F-ratio of 2.9563 for Barrier Score was found to be significant at the .10 level of confidence. This finding suggested that Barrier Score was a possible source contributing to the total variance of the population. It has appeared to this writer that whether or not a subject had a high or low Barrier Score was not a significantly contributing source to the population variance in the discrepancy or accuracy with which these subjects represented the estimated dimensions of body space. The one exception was the F-ratio of 2.9563 for Barrier Score in the extended height estimate. This F-ratio was significant at the .10 level.

Generally speaking, the data in Table 7 are consistent with the data for the total group of 143. It will be recalled that when the hypothesis $B=0$ was tested for the effect of the co-variable Barrier Score the hypothesis was accepted. From the data presented in Table 7, the acceptance of the hypothesis is tenable. The one possible exception was the effect of Barrier Score at the .10 level of confidence as a contributing source for total variance in the estimate of extended height.
It can be stated that with these subjects age appeared to be the predominant source of variance, regardless of the population structure, contributing to the variability in discrepancy recorded for the dimensions of body space estimates.

Table 8 has presented the source of population variance when the possible source for variability, sex, has been removed and high or low Barrier Score tested for effect. The data in Table 8 have appeared, to this writer, to be consistent with the findings presented in Table 6. It was evident that age was the possible source of variation contributing to the total variance in the performance on the gross motor tasks. The F-ratios for age on each motor task (141.134, 8.7991, and 33.498, respectively) were all significant at the .01 level.

The data presented in Tables 5, 6, 7, and 8 have served to illustrate the contribution of age as a source of variation in the total variance of the discrepancy variability recorded in the estimates of dimensions of body space and performance on selected gross motor tasks. Further, these tables have illustrated that Barrier Score and the other co-variables of body space estimation have no significant influence on the gross motor tasks.

Another major focus of this study was to discover what relationships might exist between the various behavioral responses elicited from the elementary school children.

Since cause-and-effect relationships cannot be discerned from the correlation of 1, 2, 3, . . . or n responses, the investigator's
TABLE 8. AGE, BARRIER SCORE, INTERACTION AND F-RATIOS FOR SOURCE OF VARIANCE FOR GROSS MOTOR TASKS

<table>
<thead>
<tr>
<th></th>
<th>Catching-Throwing Task</th>
<th>Target Jump Discrepancy</th>
<th>Shuttle Run</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adjusted Mean Average</td>
<td>F-Ratio</td>
<td>Adjusted Mean Average</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>13.6553</td>
<td>11.9125</td>
<td>8.7991^</td>
</tr>
<tr>
<td>10</td>
<td>27.4102</td>
<td>141.134^</td>
<td>11.9125</td>
</tr>
<tr>
<td>12</td>
<td>32.2495</td>
<td>11.6297</td>
<td>10.7440</td>
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<tr>
<td><strong>Interaction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.3315</td>
<td>0.3997</td>
<td>0.9389</td>
</tr>
<tr>
<td><strong>Barrier Score</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>24.8523</td>
<td>14.3515</td>
<td>11.6760</td>
</tr>
<tr>
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<td>24.2144</td>
<td>0.5388</td>
<td>0.1871</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.6609</td>
</tr>
</tbody>
</table>

^Significant at the .01 level.
focus was upon studying relationships that existed within each classification of age and sex. Tables 9 through 14 have been designed to show the relationships of all the independent and dependent variables within discrete age and sex groups.

Table 9 has presented the correlation coefficients for all independent and dependent variables for eight-year-old males. Two significant correlations at the .01 level were found to exist between height estimate discrepancy and extended height estimate discrepancy (r = .8242) and between extended height estimate discrepancy and span estimate discrepancy (r = .6213). Since the significance of the correlations lie in a positive direction, several interpretations may be suggested.

1. The significant correlation between height estimate discrepancy and extended height estimate discrepancy might indicate that the two responses were measuring the same thing—the vertical dimension of oneself.

2. Another interpretation might suggest that the eight-year-old males as a group were self-consistent in their estimates of vertical body space. That is, if the subjects underestimated their standing height, they also underestimated their extended height. Thus, the direction and accuracy of the estimate is, perhaps, what is correlated.

The second correlation significant at the .01 level existed between extended height estimate discrepancy and span estimate discrepancy (r = .6213). The following interpretations are suggested:

1. Since both discriminations involved the use of the arms extending into space, a self-consistency may again be suggested. Again, perhaps the direction and accuracy are correlated at a discernible level.
TABLE 9. CORRELATION COEFFICIENTS FOR INDEPENDENT AND DEPENDENT VARIABLES FOR EIGHT-YEAR-OLD MALES

<table>
<thead>
<tr>
<th></th>
<th></th>
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<td>Height Estimate Discrepancy</td>
<td>0.8242&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.3701&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.1925</td>
<td>0.0265</td>
<td>-0.1025</td>
<td>-0.1114</td>
<td>0.2254</td>
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<tr>
<td>Extended Height Estimate Discrepancy</td>
<td>0.6213&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.1315</td>
<td>-0.3211</td>
<td>-0.2390</td>
<td>-0.0909</td>
<td>0.1375</td>
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<td>Span Estimate Discrepancy</td>
<td>0.3745&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-0.2336</td>
<td>-0.2936</td>
<td>0.0509</td>
<td>-0.2008</td>
<td>0.4812&lt;sup&gt;b&lt;/sup&gt;</td>
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</tr>
<tr>
<td>Shoulder Width Estimate Discrepancy</td>
<td>0.1620</td>
<td>0.2101</td>
<td>0.2922</td>
<td>-0.2748</td>
<td>0.2929</td>
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<td></td>
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<tr>
<td>Hip Width Estimate Discrepancy</td>
<td>-0.2354</td>
<td>-0.0558</td>
<td>0.0996</td>
<td>0.0991</td>
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<tr>
<td>Catching-Throwing</td>
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<td>-0.1543</td>
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<tr>
<td>Target Jump</td>
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<td>0.2648</td>
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</tr>
<tr>
<td>Shuttle Run</td>
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</tbody>
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<sup>a</sup> Significant at the .01 level.
<sup>b</sup> Significant at the .05 level.
<sup>c</sup> Significant at the .10 level.
TABLE 10. CORRELATION COEFFICIENTS FOR INDEPENDENT AND DEPENDENT VARIABLES FOR EIGHT-YEAR-OLD FEMALES

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<thead>
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<td>-.2192</td>
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<td>Span Estimate</td>
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<td>.0504</td>
<td>-.3879&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-.0979</td>
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<td></td>
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<tr>
<td>Shoulder Width</td>
<td>.4421&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-.1311</td>
<td>-.0704</td>
<td>-.2213</td>
<td>-.1379</td>
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<td>Hip Width Estimate</td>
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<td>.1002</td>
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<td>Catching-Throwing</td>
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<td>.1806</td>
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<tr>
<td>Target Jump</td>
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<tr>
<td>Shuttle Run</td>
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<td></td>
<td></td>
<td>.1850</td>
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</tbody>
</table>

<sup>a</sup>Significant at the .01 level.
<sup>b</sup>Significant at the .02 level.
<sup>c</sup>Significant at the .10 level.
### TABLE 11. CORRELATION COEFFICIENTS FOR INDEPENDENT AND DEPENDENT VARIABLES FOR TEN-YEAR-OLD MALES

<table>
<thead>
<tr>
<th>Variables</th>
<th>Ext. Ht.</th>
<th>Span</th>
<th>Sh. Width</th>
<th>Hip Width</th>
<th>Catching-Throwing</th>
<th>Target Jump</th>
<th>Shuttle Run</th>
<th>Barrier Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height Estimate Discrepancy</td>
<td>.8726&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.2480</td>
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<td>.1117</td>
<td>-.3522</td>
<td>.0753</td>
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<td>Extended Height Estimate Discrepancy</td>
<td>.3881&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.0296</td>
<td>-.0891</td>
<td>.0401</td>
<td>-.1728</td>
<td>.1118</td>
<td>.2342</td>
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<tr>
<td>Span Estimate Discrepancy</td>
<td>.3954&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.2600</td>
<td>-.0616</td>
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<td>.2342</td>
<td>.4099&lt;sup&gt;c&lt;/sup&gt;</td>
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</tr>
<tr>
<td>Shoulder Width Estimate Discrepancy</td>
<td>.3801&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-.0201</td>
<td>.0138</td>
<td>.0704</td>
<td>.3099</td>
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<tr>
<td>Hip Width Estimate Discrepancy</td>
<td>-.3821&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.3827&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.4936&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.0838</td>
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<tr>
<td>Catching-Throwing</td>
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<td>-.7186&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>Target Jump</td>
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<tr>
<td>Shuttle Run</td>
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<td></td>
<td></td>
<td>.3733&lt;sup&gt;c&lt;/sup&gt;</td>
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<sup>a</sup>Significant at the .01 level.
<sup>b</sup>Significant at the .02 level.
<sup>c</sup>Significant at the .10 level.
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<tbody>
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<td>Height Estimate Discrepancy</td>
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<td>.0281</td>
<td>-.5142\textsuperscript{c}</td>
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<tr>
<td>Extended Height Estimate Discrepancy</td>
<td>.5195\textsuperscript{b}</td>
<td>-.0339</td>
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<td>-.5740\textsuperscript{a}</td>
<td>-.2968</td>
<td>.1499</td>
<td>-.1869</td>
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<tr>
<td>Span Estimate Discrepancy</td>
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<td>.5154\textsuperscript{c}</td>
<td>-.1983</td>
<td>-.5321\textsuperscript{b}</td>
<td>-.2394</td>
<td>-.4255\textsuperscript{d}</td>
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<tr>
<td>Shoulder Width Estimate Discrepancy</td>
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<tr>
<td>Hip Width Estimate Discrepancy</td>
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<td>-.0497</td>
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<tr>
<td>Catching-Throwing</td>
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<td>-.4576\textsuperscript{c}</td>
<td>.3181</td>
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<td>Target Jump</td>
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<td>Shuttle Run</td>
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\textsuperscript{a} Significant at the .01 level.
\textsuperscript{b} Significant at the .02 level.
\textsuperscript{c} Significant at the .05 level.
\textsuperscript{d} Significant at the .10 level.
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</thead>
<tbody>
<tr>
<td>Height Estimate Discrepancy</td>
<td>.7412(^a)</td>
<td>.1313</td>
<td>.0500</td>
<td>-.2224</td>
<td>.3164</td>
<td>-.0354</td>
<td>.1306</td>
<td>.1162</td>
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<td>Extended Height Estimate Discrepancy</td>
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<td>-.2915</td>
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<tr>
<td>Span Estimate Discrepancy</td>
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<td>.1898</td>
<td>.0768</td>
<td>.1409</td>
<td>-.2019</td>
<td>-.3204(^b)</td>
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<tr>
<td>Shoulder Width Estimate Discrepancy</td>
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<td>.1164</td>
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<td>-.3173(^b)</td>
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<tr>
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<td>.2141</td>
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<td>-.3698(^b)</td>
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<tr>
<td>Catching-Throwing</td>
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<td></td>
<td>-.2993</td>
<td>-.5138(^a)</td>
<td>-.2504</td>
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<td>.1022</td>
<td>.1178</td>
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</tr>
<tr>
<td>Shuttle Run</td>
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<td></td>
<td>.1022</td>
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</tbody>
</table>

\(^a\)Significant at the .01 level.  
\(^b\)Significant at the .10 level.
<table>
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<tbody>
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<td>Height Estimate Discrepancy</td>
<td>.8741&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.1183</td>
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<td>.0239</td>
<td>-.0345</td>
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<td>.0847</td>
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<tr>
<td>Extended Height Estimate Discrepancy</td>
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<td>.1538</td>
<td>-.3212&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.0635</td>
<td>.0695</td>
<td>.0282</td>
<td>.2772</td>
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<tr>
<td>Span Estimate Discrepancy</td>
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<td>.3346&lt;sup&gt;c&lt;/sup&gt;</td>
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<td>.1402</td>
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<tr>
<td>Shoulder Width Estimate Discrepancy</td>
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<td>.2497</td>
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<td>Catching-Throwing</td>
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<td>.1750</td>
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</tr>
<tr>
<td>Target Jump</td>
<td>.3234&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.1750</td>
<td>.0203</td>
<td>.0072</td>
<td>.1154</td>
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</table>

<sup>a</sup> Significant at the .01 level.
<sup>b</sup> Significant at the .05 level.
<sup>c</sup> Significant at the .10 level.
2. It is possible that the significant correlation suggests that both measures are assessing the appreciation and awareness of the length of one's arms. The correlation might suggest that an understanding of how one may increase one's vertical space is related to one's understanding of how one can increase one's consumption of space in the horizontal plane.

The correlation .3701 between height estimate discrepancy and span estimate discrepancy (.10 level), while not as significant as a .05 level, tends to indirectly support interpretation (2) and reflect interpretation (1). In the height estimate, the arms were not used. This correlation supports a level of consistency but might support interpretation (2) above in that the two responses have lost a correspondence because cues are not taken from use of the arms in both estimates. It is also possible that the correlation reflects that the degree of accuracy in representing these dimensions symbolically is correlated.

A correlation of .3745 was found to exist between span estimate and shoulder width discrepancy. A review of Table 2 revealed that, as a group, the eight-year-old males tended to overestimate their shoulder widths. The underestimation of span correlated at the .10 level with the overestimate of the shoulder width. However, the overestimation was quite small, only 2.338 centimeters. This correlation has suggested that with the overestimation is the tendency to move farther from a significant relationship. This seems a valid interpretation since the findings of past investigations revealed a tendency for children to underestimate
body size. Consequently, a tendency to overestimate dimensions of body space would be indicative of a shift in the consistency pattern which the eight-year-old subjects had exhibited in the height and extended height estimates. This interpretation seems to be supported by the low and insignificant correlations occurring with shoulder width and hip width. A further review of Table 2 reveals a tendency of the eight-year-old males to overestimate hip width by 20 centimeters. Looking again at Table 9, one can see a consistent negative correlation between hip width and extended height estimate, hip width estimate and span discrepancy, and hip width and shoulder width discrepancy.

It appears that among the intercorrelation of the estimates of dimensions of body space the direction in which the estimates were made stand out as the most important and valid interpretations of the significant correlations as well as for those relationships which were not significantly correlated.

There were no significant correlations between the size estimates and performance on the gross motor tasks. Apparently, the manner in which the children represented the dimensions of body space had no relationship to the gross motor task performance. This interpretation would suggest that these two areas of behavior are independent dimensions of total personality functioning.

For the eight-year-old male group, the Barrier Score did correlate (.4812) at the .05 level with the estimate of span discrepancy. This correlation is consistent with studies cited in the literature which relate the tendency toward underestimation of body size to be related to a well-defined body image.
In Table 10, it is apparent that the eight-year-old female subjects displayed the same significant relationship between height estimate discrepancy and extended height estimate discrepancy as was found with the eight-year-old males. Tables 10, 11, 12, 13, and 14 revealed this relationship to exist for the three age groups and both sex groups. These correlations were all significant at the .01 level of confidence.

It can be seen in Table 10 that the overestimation of span correlated at the .02 level with the overestimation of shoulder width (.5413). The overestimation of shoulder width correlated (.4421) at the .10 level with the overestimation of hip width. It is apparent that the eight-year-old females as a group shifted from a mode of underestimation to one of overestimation as did the eight-year-old males. However, a review of Table 2 reveals that the eight-year-old females as a group experienced this shift with the estimate of extended height and continued with an overestimation style of representation of dimensions of body size.

The literature has implied a relationship between an ill-defined body image and the tendency to overestimate body size. It is possible that the eight-year-old male and female subjects were reflecting an inaccurate image with respect to the shoulder and hip sizes. Any number of factors could be responsible for the inaccurate image if this is being reflected.

The eight-year-old females exhibited the following significant correlations with respect to the gross motor tasks:

1. between span estimate discrepancy and shuttle run (−.3879) at the .10 level
2. between catching and throwing and shuttle run (-.3792) at the .10 level.

It appears that the tendency to overestimate span was related to the time on the shuttle run. The meaning is not immediately clear but the data suggest that a larger overestimate was being correlated with a poorer time. The correlation significant at the .10 level between the catching-throwing task and the shuttle run revealed a negative relationship. Essentially, a greater number of catches was related to a lower time on the shuttle run.

An examination of Tables 11 and 12 reveals that the ten-year-old males and ten-year-old females exhibited significant correlations between extended height estimate and span estimate. The correlation for the male group (.3881) was significant at the .10 level, while the female group's correlation (.5195) was significant at the .02 level. These correlations indicate a consistent tendency to underestimate the size of these variables. The ten-year-old males also had significant correlations at the .10 level between span estimates and shoulder width estimates (.3954) and shoulder width estimates and hip width estimates (.3801). The ten-year-old males' span estimate discrepancy also correlated with the Barrier Score (.4099) at the .10 level. This same relationship existed for the ten-year-old females (Table 12), for the twelve-year-old male group (Table 13), and for the eight-year-old male group at the .05 level (Table 9). It will be remembered from Table 2 that at ten years of age the males recorded a greater underestimate than the ten-year-old females, the twelve-year-old males, and the eight-year-old males.
Nevertheless, if the tendency to underestimate body size is related to a well-defined body image, these correlations give support to the posited relationship between a well-defined body image and the tendency to underestimate body size.

Other relationships of interest in Table 11 seemed to be the negative correlation between shuttle run and the catching-throwing task. Rather than measuring a general factor of speed, these correlations would tend to indicate the children have well-developed ball-handling skills and running and/or agility skills. The shuttle run did relate significantly to the Barrier Score (.3733) at the .10 level with the ten-year-old male subjects. Thus, one might hypothesize that at age ten a higher Barrier Score was related to a lower time on the shuttle run. It will be noted this correlation appeared for the ten-year-old male group only.

Referring again to Table 11, it can be seen that hip width estimate discrepancy related significantly to performance on the three motor tasks. At the .02 level, the negative correlation between hip width discrepancy and shuttle run (.4936) tends to indicate that an overestimation is related to a higher time on the shuttle run. The positive correlation (.3827) at the .10 level between hip width estimate discrepancy and target jump seems to suggest an overestimation of hip width is related to a greater amount of error in the target jump. The negative correlation of -.3821 (.10 level) between hip width estimate discrepancy and the catching-throwing task suggests a relationship between overestimation of hip width and a fewer number of catches recorded for the catching-throwing
task. These correlations seem to suggest that overestimation of hip width is significantly associated with poorer performance on the gross motor tasks.

In Table 12, a negative correlation of \(-.5740\), significant at the .01 level, appeared between extended height estimate discrepancy and performance on the catching-throwing task. Significant at the .05 level was the correlation coefficient \(-.5142\) between height estimate discrepancy and catching-throwing task. This correlation did not appear for any other group. It may be interpreted that for these ten-year-old female subjects an underestimate of height and extended height was related to a greater number of catches. Three body space estimates, not mentioned earlier, were significantly related to each other. An underestimation of span discrepancy (-20 centimeters) correlated at the .05 level in a positive direction with the hip width discrepancy \(.5154\). The theoretical significance of this is that as a group the ten-year-old female subjects have reflected a consistent style of perception. Span was underestimated and hip width was overestimated. This correlation reflected the information shown in Table 2. Sociological, role awareness, and other factors of self-awareness could be suggested for this correlation. Basically, the correlation suggests a tendency for a style of response for the ten-year-old female subjects which might reflect the perceived size relationship held by these subjects. The significant correlation at the .02 level between span estimate discrepancy and extended height estimate discrepancy \(.5195\) might be interpreted in the same manner as was the previous correlation. The third significant relationship which existed in the dimensions
of body space estimates was found between the discrepancy of shoulder width and the discrepancy of hip width (.6111). Significant at the .01 level, this relationship suggested a consistency in the manner of estimating horizontal space. This correlation revealed that an overestimate of shoulder width was positively related to an overestimate of hip size.

Relationship of performance on the gross motor tasks was evidenced between the catching-throwing task and the shuttle run. This negative correlation of -.4576, significant at the .05 level, suggested that a greater number of catches was related to a lower time on the shuttle run. This significant finding with the ten-year-old females was also evidenced with the ten-year-old males (Table 11).

Table 13 points out four significant correlations. In addition to the correlation between height estimate discrepancy and extended height estimate discrepancy which has been discussed earlier, the following correlations existed:

1. between span estimate discrepancy and shoulder width discrepancy (.6196) at the .01 level

2. between the small (.8643 centimeter) shoulder width discrepancy and small (1.8496 centimeters) hip width estimate discrepancy (.3591) at the .10 level

3. between the catching-throwing task and the time on the shuttle run (-.5138) at the .01 level.

The meaning of the first correlation referred to in Number 1 is not clear; therefore, no interpretation will be attempted. Relative
to the correlation referred to in Number 2, the relationship does suggest a characteristic style with which these two body parts are estimated. The theoretical significance of this correlation lies in the suggestion that this relationship suggests the perceived size relationship between the two body parts.

The negative correlation in Number 3, between catching-throwing and time of the shuttle run, is better understood. The correlation suggested that a greater number of catches was related to a lower performance time on the shuttle run. An inspection of Tables 9, 10, and 11 will reveal that this same correlation did not exist for the eight-year-old male group but existed for the ten-year-old male and female groups and the twelve-year-old male and female groups.

Table 14 summarizes the correlated responses of the twelve-year-old female group. The following significant correlations were evidenced between

1. height estimate discrepancy and extended height estimate discrepancy (.8741) at the .01 level
2. extended height estimate discrepancy and hip estimate discrepancy (-.3212) at the .10 level
3. span estimate discrepancy and shoulder width estimate discrepancy (.5861) at the .01 level
4. span estimate discrepancy and hip estimate discrepancy (.3346) at the .10 level
5. shoulder width estimate discrepancy and target jump (.3544) at the .05 level
6. catching-throwing performance and shuttle run time (-.4639) at the .01 level
7. target jump and shuttle run (.3234) at the .10 level.
The first correlation has been discussed previously and will not be repeated at this time. Relative to correlation Number 2, this relationship seems to reflect the characteristic style of the female population; that is, height was underestimated and the hips were overestimated. If one refers to Table 2, it can be seen that these subjects underestimated height and overestimated the hip width. It seems that correlation Number 3 suggests that the tendency of these twelve-year-old females to underestimate span was related to an underestimate of shoulder width. Relative to correlation Number 4, it is not immediately apparent why the relationship is significant and positive. Since the level of confidence was at .10 percent, one might suggest a chance relationship; or since the overestimate of hip width was just a matter of 4 centimeters, the smaller or more accurate hip estimate discrepancy plus a smaller underestimate of span discrepancy for some reason bears a meaningful relationship.

Since correlation Number 5 was significant at the .05 level, one may posit a meaningful relationship between shoulder width estimate and target jump. The shoulder width was underestimated by 2.8268 centimeters. Since the target jump was based on a distance discrepancy, the relationship suggests that a more accurate estimate of shoulder width is related to more accuracy on the target jump. This interpretation is somewhat supported by the information revealed in Figure 11. Here, one can see that the twelve-year-old females' mean discrepancy in the target jump was 11.903 centimeters. Correlation Number 6 has been previously discussed. Correlation Number 7 suggested that a lower discrepancy in
the target jump was related to a lower performance time for the shuttle run. Or, the reverse would be equally true that a larger discrepancy for target jump was associated with a higher performance time on the shuttle run.

To facilitate the suggestions for major findings, Table 15 brings together the significant correlations for the male group within their discrete age groups. Table 16 accomplishes the same task for the female subjects.

**Summary of major findings**

1. The children in this study tended to underestimate their heights, their extended heights, and span through symbolic representation. Two exceptions prevented this pattern being completely consistent. First, the eight-year-old females overestimated the extended height and they also overestimated the span. Thus, a reasonable generalization would be that these children underestimated the vertical aspect of body space and one of the horizontal aspects, span.

2. The children in this study tended to overestimate the two remaining aspects of horizontal space with two exceptions. The ten-year-old males and twelve-year-old females underestimated shoulder width. A reasonable generalization would be that these children tend to overestimate two horizontal aspects of body space, shoulder width and hip width.

3. Pertaining to accuracy of the estimates, theoretically, the dealing with spatial concepts, boys and girls were more
TABLE 15. SUMMARY OF SIGNIFICANT CORRELATIONS FOR MALES AGED EIGHT, TEN, AND TWELVE

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\(^{a}\) Significant at the .01 level.
\(^{b}\) Significant at the .02 level.
\(^{c}\) Significant at the .05 level.
\(^{d}\) Significant at the .10 level.
TABLE 16. SUMMARY OF SIGNIFICANT CORRELATIONS FOR FEMALES AGED EIGHT, TEN, AND TWELVE

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<sup>a</sup>Significant at the .01 level.
<sup>b</sup>Significant at the .02 level.
<sup>c</sup>Significant at the .05 level.
<sup>d</sup>Significant at the .10 level.
accurate at ages eight and twelve. Regarding the hypothesis that the tendency to underestimate body size is related to a well-defined and intact body image, these data have suggested this firm image reflected through underestimation occurred with the ten-year-old boys and girls.

4. Pertaining to accuracy of dealing symbolically with spatial concepts, a review of Figures 6 through 9 reveals two differently shaped trend lines for the boys and girls. The exception has already been discussed in Number 3 above and may be reviewed in Figure 5.

For the girls: For the extended height, span, and shoulder estimates, they progress from overestimation toward no or very little discrepancy to underestimation. For the hip estimate, they progress from great overestimation toward very little overestimation (+41 centimeters at age eight to +4 centimeters at age twelve). The trend line resembled an inverse regression line (⁻)

For the boys: For extended height, span, and shoulder width, their trend line resembles a V shape. The one exception is noticed for the hip estimate. For this estimate, their trend line resembles that of the female subjects. The male group's estimates were predominantly that of underestimation. The greatest amount of underestimation occurred with the ten-year-old group for all estimates of body space except for hip width estimate. Age-eight males consistently had the smallest
amount of underestimation, and age-twelve males underestimated at points in between the age-eight and -ten groups. Two exceptions to this general trend occurred. First, the twelve-year-old male group presented a picture of great accuracy by exhibiting a $0.8643$-centimeter overestimate of the shoulder width. Second, the twelve-year-old boys approached the zero discrepancy level for the hip width estimate with an overestimate of $1.8496$ centimeters.

5. The children in this study exhibited a small but consistent increase in Barrier Score across the age groups. Girls at all three ages exhibited higher Barrier Scores. The eight-year-old girls and ten-year-old girls as a group reflected the same Barrier Score.

6. The children in this study tended to exhibit parallel performance on the gross motor tasks. At age eight, the female group performed better than did the eight-year-old males on the catching-throwing task. Thereafter, the boys' scores were higher but the actual differences were small. Each succeeding age group achieved a greater number of catches than the preceding age group(s). On the target jump, the eight- and ten-year-old female groups recorded a lower mean discrepancy than did the two male groups. The twelve-year-old males exhibited less discrepancy than did the twelve-year-old females. The shape of the trend line for the males resembled the same V shape that was exhibited in the height,
extended height, and span, and shoulder width estimates. Across the three age groups, the males had a lower mean time for the shuttle run than did the female groups. The trend line was in the shape of an inverse regression line.

7. The source of variation for the population sampled for the dimensions of body space estimates were age and sex. Age at the .01 level; sex at the .05 level for height and span and the .01 level for hip width estimate were evidenced. Two exceptions occurred. For shoulder width estimate, the interaction (.01 level) of the overestimates recorded by the eight-year-old females and the underestimates for the ten-year-old males was the contributing factor for variance. For the extended height estimate, the sex variable contributed to the total population variance (see Table 5).

8. Age at the .01 level and sex at the .05 level contributed to the total population variance for Barrier Score. Each variable operated independently.

9. The source of variation for each of the three gross motor tasks were as follows:

Catching-Throwing Task: age, at the .01 level. Sex was not a contributing variable.

Target Jump: age, at the .01 level. Sex was not a contributing variable.
Shuttle Run: age, at the .01 level, and sex at the .01 level. Each contributed to the total variance for the sample (see Table 6).

10. Sources of variation were not completely different for the stratified sample of high and low Barrier Scorers. The variations in the estimates of dimensions of body space were still attributed to age at the .01 level with one exception. The F-ratio of 2.9563, significant at the .10 level of confidence, suggested the Barrier Score as contributing to the total variance in what otherwise would have been accepted the factor of chance as being the source of variation (see Table 7).

The correlations which appeared between the responses appear to this investigator to exhibit some ambiguity in the data. While this is not altogether true, it must be acknowledged. Anytime responses of an organism are correlated against other responses, the meaning of the resulting correlations will not be clear. However, the following have been included in this summary of major findings because their meanings tend to be clearer.

1. Significant positive correlations at the .01 level occurred between the height estimate discrepancy and the extended height estimate discrepancy for all age levels and for both sexes.

2. Span estimates correlated at the .05 level with Barrier Score for the eight-year-old male group and at the .10 level for
the ten- and twelve-year-old male groups. This correlation also occurred at the .10 level for the eight-year-old female group.

3. Hip width estimate discrepancy correlated at the .10 level with target jump, at the .02 level with shuttle run, inversely at the .10 level with catching-throwing task, and negatively at the .10 level with Barrier Score for the ten-year-old male group.

4. Span estimate correlated negatively at the .02 level with target jump for the ten-year-old female group.

5. Catching-throwing task correlated negatively at the .01 level with shuttle run for the ten- and twelve-year-old male groups, negatively at the .01 level with the twelve-year-old female group, at the .05 level with the ten-year-old female group, and at the .10 level with the eight-year-old female group.

6. Shuttle run and target jump correlated at the .10 level for the twelve-year-old female group.

7. Barrier Score correlated at the .10 level with shuttle run for the twelve-year-old male group.
CHAPTER VI

SUMMARY AND CONCLUSIONS

The purpose of this study was to explore the relationships between body image boundary, estimates of dimensions of body space, and performance of selected gross motor tasks with children ages eight, ten, and twelve. A second aspect of the research was to ascertain whether or not developmental trends could be suggested across the age groups in each of the three areas that were investigated.

One-hundred and forty-three boys and girls from the Granite City, Illinois, public school system were subjects for the study. The number of subjects in each discrete age and sex group were as follows:

- eight-year-old males: 22
- eight-year-old females: 20
- ten-year-old males: 22
- ten-year-old females: 20
- twelve-year-old males: 28
- twelve-year-old females: 31

The measures recorded for each individual were as follows:

1. Barrier Score
2. estimates of dimensions of body space
3. actual dimensions of body space
4. performance on selected gross motor tasks.

159.
The Holtzman Inkblot Test was used to assess the body image boundary. The protocols were blind scored by Dr. Seymour Fisher. The Barrier Score equalled the number of responses scored as a barrier-type response. A barrier-type response was one which highlighted the periphery of an inkblot stimulus by ascribing a quality of firmness and/or a protective or decorative function.

The estimates of the dimensions of body space were obtained through use of the modified Popper Height Estimation Test and a series of additional similar task situations devised by this writer. Five areas of body space were used to represent the vertical and horizontal aspects of body space. In addition to the estimates, actual measurements in each of the areas were recorded for each subject. The difference between the actual measurement and the estimate was referred to as the estimate discrepancy.

The motor tasks selected were catching and throwing, target jump, and shuttle run. Theoretically, each task presented a focus for using the human body which was different from each of the others. Each task also represented different manipulations of the space, force, and time factors common to all human movement.

Analysis of variance and co-variance techniques were used to ascertain the source of variation for each of the independent variables and the dependent variables. A two-by-three design was used in which age and sex were the categorizing variables. Through the co-variance technique, it was discerned that the co-variables of Barrier Score and the various estimates of the dimensions of body space would not influence or contribute to the total population variance indicated in the gross motor
task performance. Correlation coefficients were obtained between the independent and dependent variables for each age-sex group. A stratified sample of the original population was obtained by placing subjects into either the high or the low barrier group. To be placed in the high barrier group, a subject had to score above the mean range for his age-sex group. If the Barrier Score mean for a particular age-sex group was 4.35, a Barrier Score of 5 or above would place the subject in the high barrier group. To be placed in the low barrier group, the subject would have to have had a Barrier Score below the mean range for his age-sex group. Using the example above, a Barrier Score of 3 or below would have placed the subject in the low barrier group. The basic two-by-three design was maintained. The purpose in examining this sample was to determine whether or not the source of variation for the independent co-variables and dependent variables would be different with the removal of the sex factor and a change in the group composition.

The analysis of variance and co-variance techniques revealed that the co-variables of Barrier Score and the discrepancy estimates of the dimensions of body space made no significant contribution to the source of variation in performance of the gross motor tasks. This finding led to the conclusion that questions regarding significant differences in performance between high and low barrier groups and between high accuracy and low accuracy groups, relative to the estimates of body space, would have to remain unanswered for the present.

The following questions asked in Chapter II may be answered in terms of the findings and within the limitations of this study.
1. Would the Barrier Score be significantly related to the symbolic representation of one's estimates of the dimensions of body space?

Discussion: It was found that for the eight-year-old male group Barrier Score and span estimate discrepancy were correlated (.4812) significantly at the .05 level. For the ten-year-old male group, the Barrier Score was correlated negatively at the .10 level with the span estimate discrepancy (.4099). Within the twelve-year-old male group, the Barrier Score correlated at the .10 level with span estimate discrepancy (-.3204), shoulder width estimate discrepancy (-.3173), and hip width estimate discrepancy (-.3698). There was only one correlation between Barrier Score and the body space discrepancy estimates for the female subjects. A negative relationship between Barrier Score and span estimate discrepancy correlated (-.4255) at the .10 level for the eight-year-old female group.

2. Would the Barrier Score be related significantly to children's performance on each of the gross motor tasks?

Discussion: The ten-year-old male group evidenced the only significant correlation between Barrier Score and a motor task. Significant at the .10 level was the relationship between Barrier Score and the shuttle run.

3. Would each or all of the estimates of the dimensions of body space be related significantly to children's performance on each of the gross motor tasks?
Discussion: Within the ten-year-old male group, a negative relationship significant at the .10 level existed between hip width estimate discrepancy and the catching-throwing task (-.3821); a positive correlation with target jump (.3827) at the .10 level; and a positive correlation at the .02 level with the shuttle run (.4936). The female subjects evidenced more correlations. Within the eight-year-old female group, span estimate discrepancy and shuttle run were correlated (-.3879) at the .05 level. The ten-year-old female group revealed a significant negative correlation between extended height estimate discrepancy and the catching-throwing task (-.5740) at the .01 level of confidence. Significant at the .02 level was the negative correlation between span estimate discrepancy and target jump (-.5321). The twelve-year-old female group evidenced a correlation between shoulder width estimate discrepancy and target jump (.3544) at the .05 level.

4. Would the following predictions be accurate?

a. increase in Barrier Score with age

b. with age, a decrease in discrepancy scores of children's estimates of body space

c. increase with age in children's performance of the selected gross motor tasks.

Discussion: A higher mean Barrier Score was evidenced for each succeeding age group with the male subjects. The differences were small between the eight- and ten-year olds--still within the 3 range. The twelve-year-old
male group had a mean Barrier Score of 4.9. The eight- and ten-year-old female subjects as a group evidenced no difference in Barrier Score. However, the twelve-year-old female subjects as a group had a mean Barrier Score of 5.8. Generally speaking, the Barrier Score tendency was in the predicted direction.

With regard to the second prediction, the picture was not clear. Two trends seemed apparent. First, there was a tendency toward underestimation for the vertical aspects of body space and for the span estimates for both boys and girls. There was a tendency for overestimation for both shoulder width estimate discrepancy and for the hip width discrepancy. However, the hip width estimate discrepancy appeared to proceed toward a more accurate mean estimate. For each age-sex group, there was evidenced a smaller discrepancy. Rather than accuracy, the tendency toward underestimation appeared to be the consistent style of dealing with the representation of the estimates. However, with regard to the height estimate discrepancy, the boys and girls were more accurate at ages eight and twelve. Age eight represented the age of greater accuracy. On extended height, the girls were more accurate at age ten, and the boys were more accurate at ages eight and twelve. On the span estimate, the eight-year-old male and female
groups were more accurate than the ten- and twelve-year-old groups. On shoulder width estimate, the twelve-year-old males and twelve-year-old females were more accurate than the other groups. There seemed to be a tendency toward overestimation for the twelve-year-old male group, whereas for the twelve-year-old female group, the trend line appeared to progress toward underestimation.

The third prediction may be answered in the affirmative. Each age-sex group evidenced performance better than that of the younger age group(s). Through analysis of variance, it was found that age was the variable that contributed to the total population variance on the catching-throwing task (.01 level). On the target jump, age was the variable contributing to the total variation. The trend line for both boys and girls was of interest. The combined shapes of the trend line for the target jump greatly resembled the shape of the compared trend lines for the shoulder width estimate discrepancy (Figures 8 and 11). For the shuttle run, the mean time recorded for each age-sex group was lower than the record of the younger group(s). When the male and female subjects were considered as discrete groupings, the male groups consistently had lower times than the female groups.

5. Would a perceived configuration of body shape be evidenced through the estimates of the dimensions of body space?
Discussion: An inspection of Table 2 has revealed that within each discrete age-sex group the tendency to overestimate hip size was greater than the estimated shoulder size. It can be seen that the greatest amount of distortion occurred at age eight, and the greatest accuracy of the size relationship of these two body parts occurred at age twelve. (See Appendix F for suggested configuration.

In terms of the differentiation hypothesis, it can be stated that these children manifested a greater capacity for functioning at each age level. If the Barrier Score reflects the degree of perceived boundary firmness or definiteness of the individual, the data suggested that these children at each age level had moved toward a firmer, more definite boundary organization. Since the ability to conceptualize space has been posited by other investigators as an indicator of greater psychological functioning, the children as a group at age eight reflected greater accuracy in representing the vertical aspects of body space and one horizontal aspect, span. For the horizontal aspect, shoulder width, the boys were more accurate at age twelve while the girls were more accurate at age ten. However, both of these estimates were overestimations. For the other horizontal aspect, hip width, the boys and girls were more accurate at age twelve.

A tenable generalization would be that greater accuracy is indicated at different ages for the vertical and horizontal dimensions of body space. The significance lies, perhaps, in the fact that these children demonstrated at different ages that they could deal symbolically with
space. If, however, the hypothesis that underestimation of body size is associated with a more intact and well-defined image, it may be suggested that different areas of the body space are experienced and conceptualized at different ages. Perhaps this was why height and arm span were underestimated and the hip width overestimated. It could be suggested that children are more conscious of the height factor and, through experience with the more articulate body parts such as the arms, have a firmer image than they do with the less articulate part—the hips. The hip estimates at each age level became more accurate. Perhaps an incorporation of this body part into the total image was being evidenced. If so, one could posit a manifestation of the cephalo-caudal developmental principle.

The body space estimates indicated support of the self-consistency hypothesis cited in Chapter III. This, in turn, is further evidence of developed differentiation. Through experience, we come to develop a style of being in the world. Characteristic styles were suggested through the body space estimations for the male and female groups.

It is the contention of this writer that developmental trends have been suggested across the age groups relative to the development of body image boundaries through the Barrier Score and the tendency toward underestimation of body size; the accuracy and characteristic consistency in dealing with spatial concepts; and the improvement in the gross motor tasks which suggested different organization of space, force, time factors which required different organization of the gross human movement for dealing effectively and efficiently with the task situations.
With these children, there seemed to be evidenced at each age level a general increment in the capacity for total human personality functioning. Whether or not this observation is correct only longitudinal research can support or refute.

Whether or not cause and effect is the question of importance cannot be ascertained from this study. Because the co-variables Barrier Score and the estimates of body space did not contribute to the total population variance evidenced for the motor tasks, and since there was evidence of developed differentiation in each of the three areas, this writer has considered these findings to suggest a reciprocity function. Thus, a state of mutual interdependency is suggested to exist. If coherent movement cannot occur without an accurate and firm image and if, according to Schilder, movement is at the basis of our bodily self, there is a psycho-physiological basis for the input-output model of human functioning.

The value and meaning of the data presented in this study lie in future research endeavors. The following are indicated:

1. longitudinal studies of the development of body image boundary concept

2. the meaning of significant relationships as well as non-significant relationships between Barrier Score and gross motor tasks at discrete age groups

3. the significance of being able to represent body space accurately

4. the significance of the direction of the estimate of the dimensions of body space

5. longitudinal studies of the developmental relationships between body image boundary, symbolic representation of body space, and performance of gross motor tasks
6. the meaning or implications of correlated variables, which were removed significantly from the zero order, for greater understanding of individual differences in total personality functioning

7. the role of body image boundary organization in gross motor learning and performance.

It is contended that future research in the areas indicated above will give greater insight into the phenomenon of individual differences. Age and sex have long been posited as the sources of variation in performance. Data from this study have not refuted that position. However, the findings from these data have suggested that sex was not a predominant source of variation in these children's performance.

While the variable of age dominated as the source of variation, it must be remembered that age and sex are categorizing variables only. It is this writer's contention that age and sex, qua age and sex, do not have a contributory function of any significance in individual differences of human personality functioning. The questions which need to be asked are those relative to the significance of particular behaviors or combination of observable behaviors which are occurring at any given time in the human organism's history.
HOLTZMAN INKBLOT TECHNIQUE RECORD FORM

Form A

Name __________________________ Age ________ Sex ________ Date ____________

Address ________________________ Phone ________ Educational Level __________

Examiner _______________________ Previous Administration (Form and Date) __________

Symbols: Qt. — question regarding location; QC — question regarding characteristics; Qe — question regarding elaboration; X< — change in card position; R.T. — reaction time in seconds.

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APPENDIX B
ESTIMATE OF HEIGHT AND EXTENDED HEIGHT

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<tr>
<th>Picture A</th>
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<tr>
<td>Actual Height</td>
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<tr>
<td>Estimated Height</td>
<td>Estimated Extended Height</td>
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<tr>
<td>Discrepancy</td>
<td>Discrepancy</td>
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ESTIMATE OF SPAN, SHOULDER WIDTH, AND HIP WIDTH

Name ___________________ Grade ____ School ____________________

Actual Span _______ Estimated Span ________ Discrepancy ______

1

Actual Shoulder Width _______ Estimated Shoulder Width _______ Discrepancy ______

2

Actual Hip Width _______ Estimated Hip Width _______ Discrepancy ______

3
TARGET JUMP

Take-off line for 12-year olds.
Take-off line for 10-year olds.
Take-off line for 8-year olds.
TABLE 17. SUM OF SQUARES, DEGREES OF FREEDOM, MEAN SQUARE, AND F-RATIOS FOR INDEPENDENT AND DEPENDENT VARIABLES WITH BOYS AND GIRLS AGED EIGHT, TEN, AND TWELVE

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<tr>
<th>Variables</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
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<tr>
<td>Height Estimate Discrepancy</td>
<td>7006.92</td>
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<td>3503.46</td>
<td>4.83^a</td>
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<td>Extended Height Estimate Discrepancy</td>
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<td>8890.30</td>
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<td>Shoulder Width Estimate Discrepancy</td>
<td>2157.40</td>
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<td>1078.70</td>
<td>78.45^a</td>
<td>405.88</td>
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<td>Hip Width Estimate Discrepancy</td>
<td>19461.04</td>
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<td>9730.52</td>
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<td>Catching-Throwing</td>
<td>5416.55</td>
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<td>Target Jump</td>
<td>1174.57</td>
<td>2</td>
<td>587.28</td>
<td>6.803^a</td>
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<td>Shuttle Run</td>
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<td>29.46</td>
<td>34.41^a</td>
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<td>Barrier Score</td>
<td>71.06</td>
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<td>35.53</td>
<td>4.9933^a</td>
<td>24.06</td>
<td>1</td>
<td>24.06</td>
<td>3.3818^c</td>
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^aSignificant at the .01 level.

^bSignificant at the .05 level.

^cSignificant at the .10 level.
FIGURE 13. PERCEIVED CONFIGURATIONS OF BODY PROPORTION EVIDENCED THROUGH SYMBOLICALLY REPRESENTED ESTIMATES OF SHOULDER AND HIP WIDTHS
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