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THE RELATIONSHIPS BETWEEN BODY IMAGE
BOUNDARIES, ESTIMATES OF DIMENSIONS OF BODY
SPACE, AND PERFORMANCE OF SELECTED GROSS
MOTOR TASKS IN LATE ADOLESCENT SUBJECTS.

The Ohio State University, Ph.D., 1968
Education, physical

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1968
THE RELATIONSHIPS BETWEEN BODY IMAGE BOUNDARIES,
ESTIMATES OF DIMENSIONS OF BODY SPACE, AND
PERFORMANCE OF SELECTED GROSS MOTOR
TASKS IN LATE ADOLESCENT SUBJECTS

DISSERTATION

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

By

Wilhelmina Desda McFee, B.S., M.S.

** ** ** **

The Ohio State University
1968

Approved by

[Signature]

Adviser
Department of Physical Education
DEDICATION

This study is dedicated to my parents: William D. McFee, M.D., and Madeliene M. McFee. They gave me life and showed me the way. Dear Mom and Dad, my deepest thanks and love to you.
ACKNOWLEDGMENTS

The writer wishes to express gratitude to the adviser of this study, Dr. Margaret Mordy, who has my respect and admiration. Her influence and sustaining help have been a constant source of inspiration. In addition, the writer has been very fortunate to have had the support and suggestions of Professors Naomi Allenbaugh and Seymour Kleinman of the Physical Education Department, and Professor John Horrocks of the Psychology Department. To all of the above Professors of The Ohio State University, who served as the examining committee for this candidate, my sincere thanks.

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Further, thanks are acknowledged to all of those who made this study possible. In particular, my thanks to Dr. Marcella Woods whose design of a previous study served as the basis for this study; my thanks to those who helped with the test administration for their generosity in giving
time and for their excellent assistance; and, finally, my thanks to the subjects who volunteered to participate.

It is not possible to thank all who have in some way directly or indirectly influenced this writer. Humbly, acknowledgment and thanks is given to the teachers, friends, and students who have shared their thoughts and ideas.
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## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEDICATION</td>
<td>ii</td>
</tr>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>VITA</td>
<td>v</td>
</tr>
<tr>
<td>TABLES</td>
<td>ix</td>
</tr>
<tr>
<td>FIGURES</td>
<td>x</td>
</tr>
<tr>
<td>CHAPTERS</td>
<td></td>
</tr>
<tr>
<td>I Introduction</td>
<td>1</td>
</tr>
<tr>
<td>II Theoretical Rationale</td>
<td>12</td>
</tr>
<tr>
<td>III Procedure</td>
<td>32</td>
</tr>
<tr>
<td>IV Analysis and Interpretation of Data</td>
<td>52</td>
</tr>
<tr>
<td>V Summary and Conclusions</td>
<td>98</td>
</tr>
<tr>
<td>APPENDIXES</td>
<td></td>
</tr>
<tr>
<td>A Score Sheet for Motor Tasks</td>
<td>115</td>
</tr>
<tr>
<td>B Score Sheet for Modified Popper Estimate of Vertical Dimensions</td>
<td>116</td>
</tr>
<tr>
<td>C Score Sheet for Modified Popper Estimate of Horizontal Dimensions</td>
<td>117</td>
</tr>
<tr>
<td>D Score Sheet for Grid Body Estimates, and Actual Body Dimensions</td>
<td>118</td>
</tr>
<tr>
<td>E Grid for Vertical Estimates of Body Size</td>
<td>119</td>
</tr>
<tr>
<td>F Grid for Horizontal Estimates of Body Size</td>
<td>121</td>
</tr>
<tr>
<td>G Summary of All Correlation Coefficients for Independent and Dependent Variables for all Subjects</td>
<td>123</td>
</tr>
</tbody>
</table>
CONTENTS (Con'd)

Page

BIBLIOGRAPHY 125
# TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mean and Standard Deviation for Barrier Score</td>
<td>54</td>
</tr>
<tr>
<td>2</td>
<td>Mean and Standard Deviation of Directional Discrepancy in Modified Pepper Estimates of Body Space</td>
<td>56</td>
</tr>
<tr>
<td>3</td>
<td>Mean and Standard Deviation of Directional Discrepancy in Grid Body Estimates</td>
<td>58</td>
</tr>
<tr>
<td>4</td>
<td>Mean and Standard Deviation for Weeds Motor Tasks</td>
<td>68</td>
</tr>
<tr>
<td>5</td>
<td>Mean and Standard Deviation for Scott-French Motor Ability Tests</td>
<td>73</td>
</tr>
<tr>
<td>6</td>
<td>Summary of the Correlation Coefficients for Independent and Dependent Variables for Subjects Aged Eighteen</td>
<td>75</td>
</tr>
<tr>
<td>7</td>
<td>Summary of the Correlation Coefficients for Independent and Dependent Variables for Subjects Aged Twenty</td>
<td>80</td>
</tr>
<tr>
<td>8</td>
<td>Summary of the Correlation Coefficients for Independent and Dependent Variables for All Females</td>
<td>85</td>
</tr>
<tr>
<td>9</td>
<td>Summary of the Correlation Coefficients for Independent and Dependent Variables for All Males</td>
<td>93</td>
</tr>
<tr>
<td>10</td>
<td>Summary of the Correlation Coefficients for Independent and Dependent Variables for All Subjects</td>
<td>123</td>
</tr>
</tbody>
</table>
## FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rotation of Testing Schedule</td>
<td>51</td>
</tr>
<tr>
<td>2</td>
<td>Barrier Score</td>
<td>55</td>
</tr>
<tr>
<td>3</td>
<td>Height Estimates</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>Extended Height Estimates</td>
<td>62</td>
</tr>
<tr>
<td>5</td>
<td>Span Estimates</td>
<td>63</td>
</tr>
<tr>
<td>6</td>
<td>Shoulder Width Estimates</td>
<td>65</td>
</tr>
<tr>
<td>7</td>
<td>Hip Width Estimates</td>
<td>67</td>
</tr>
<tr>
<td>8</td>
<td>Catching-Throwing</td>
<td>69</td>
</tr>
<tr>
<td>9</td>
<td>Target Jump</td>
<td>70</td>
</tr>
<tr>
<td>10</td>
<td>Shuttle Run</td>
<td>71</td>
</tr>
<tr>
<td>11</td>
<td>Inferred Interrelations of Variables</td>
<td>109</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

The fields of psychology and physical education long have shown considerable interest in the so-called mind-body problem. In general, psychology has emphasized the importance of mental behavior in human functioning, while physical education has stressed the importance of physical development for optimal human functioning.

Though physical educators have emphasized physical development, leaders in the field such as Nash, Williams, and Oberteuffer, among others, have stressed the importance of considering the whole person in physical education. Yet, one of the accepted definitions of physical education is that it is education by and through the physical. Moreover, members of the physical education profession frequently encounter difficulty in explaining to non-professionals exactly what their work is. Certainly, in part, this difficulty relates to the fact that physical education means different things to different people. This is not surprising, since it represents a conglomeration of many past influences. Each of these past influences is still in evidence in certain physical education programs.
Many claims have been made to try to justify the place of physical education in the school. These claims stress the relationships between physical education experiences and psychological, physiological, and sociological values. The field of physical education has been most flexible in changing its focus of emphasis to meet the needs and challenges of the times, while continuing to hold to traditional aspects that are an outgrowth of past influences. So it is, that physical education has undergone periods of emphasis upon: physical culture, physical welfare, skills through drills, fitness to fight, physical survival, sports for recreation -- and -- social growth through sports, gymnasium psychiatry for those with problems of adjustment, carry-over activities for leisure, and fitness for living.

A list of physical education objectives would relate to all of the above emphases. Voltmer and Esslinger refer to a study by Stoodley that listed 493 different items as physical education objectives. These were summarized under the headings of:

1. health, physical and organic development
2. mental-emotional development
3. neuro-muscular development
4. social development
5. intellectual development. (1, p. 21)
In essence these objectives imply that physical education in its education through the physical does contribute to the development of the totally integrated person.

It may well be that physical education can and does achieve all these objectives which are claimed as its goals. In any case, there is a wealth of tradition in its heritage. As with all forms of tradition, it is necessary to examine and evaluate traditional beliefs and practices in order to know what validly may be claimed.

In an effort to substantiate the beliefs of the physical education profession, there has been considerable research examining the relationship between motor skill and some laboratory controlled variable. It may be that studies which have dealt with an artificial dichotomizing of the individual, both in the fields of psychology and physical education, have obscured meaningful relationships in human behavior. The results of such studies are derived out of context from the whole interacting self of the person, and therefore the significance of these studies may be questionable in understanding the whole man. Thus it is, that though a great deal of research has been done in an attempt to clarify and identify the role of the mind, and research has been extensive on the physical aspects of human functioning, there has been nothing conclusive in resolving the mind-body question.
It is not to be supposed that this study in itself has resolved the mind-body dichotomy. Nevertheless, the rationale for the study has pointed to the need for considering the self as a total person in any research that hopes to make a contribution toward the understanding of an integrated Being* operating in a world environment. It was the contention of this writer that the age-old mind-body conflict will not be resolved until research substantiates a clearer and more definitive construct of self. According to English and English, self is defined as "two distinct concepts: (1) the self as subject, the agent; and, (2) the self as the individual that is somehow revealed or known to himself." (2, p. 485) It would appear that there must be some resolution of these two distinct concepts, if a unified construct of the total self is to be achieved.

The nature of this study was associated with an area of self psychology. This is the view that psychology must be defined by reference to the self or person. (2, p. 488) In the study of self psychology there is a central role accorded to perceptions, cognitions, and feelings. The

*The word Being is capitalized in this study when it is used in the noun form so as not to confuse it with the same word in the verb form. The intention has been to use an existential position of the word.
phenomenal self is identified as a Being who is consciously aware of self. Attitudes, knowledges, motivations, and perceptions which are hypothesized as being unconscious are called nonphenomenal. (3, p. 6)

The design for this study included both phenomenal and nonphenomenal self concepts. It was assumed that in the movement of the body there is both conscious and unconscious behavior. Thus, the tests of gross motor ability were presumed to consist of phenomenal and nonphenomenal aspects.

In the assessment of body image two dimensions were studied. One dimension sought to determine the level at which the individual demarcated his body boundary from his environs. This dimension has been thought to deal primarily with the nonphenomenal self. Its importance as an operational dimension of personality is based on Fisher's and Cleveland's premise that the unconscious self concept will be more potent in a real sense than the conscious self in understanding body experience as well as important personality phenomena. (4)

The second dimension of body image assessment concerned the experimental task of having the subject make perceptual judgments about his own body by estimating his own self size. This task was approached by two methods, namely, the modified Popper estimation test and a grid
method devised by this writer. It was speculated that
the modified Pepper test may enable the subject to operate at the conscious level, and that the results may be a
conscious representation of the ideal self. The grid, in
its open-ended approach to estimating self-size, was an
attempt to place the subject in an operational situation
in which he would make judgments about his own body in a
manner analogous to the way he would evaluate non-self
objects. It was assumed, however, that these judgments
of the test tasks would involve both subject and object
positional concepts of self. The estimates of self size
were posited as being representative of both phenomenal
and nonphenomenal self concepts. The role of the uncon-
scious and/or the conscious is still open to question,
and more research is needed to clearly differentiate the
aspects of the phenomenal and nonphenomenal self.

Although there is extensive literature involving
studies on self concept, the research has been directed
primarily toward the conscious functioning of the self.
There is comparatively little research on the unconscious
self concept. Wylie remarks that "the state of measure-
ment in this field is undeveloped and confused." (3,
p. 251) Wylie also points out that the use of different
research designs presents a problem in making comparisons
of data on the self concept. She states,
At present there are no longitudinal data on which to base a description of the development of self-concept. In lieu of such data one might think that results from cross-sectional studies of various age groups could be pieced together to attain a tentative developmental picture. This is impossible, however due to the wide differences in instruments, relevant characteristics of subjects, and testing conditions in the studies. (3, p. 119)

She surely has pointed to the need for studies that follow up, replicate and/or extend exploratory research. In answer to a question of the value of reusing a design of a previous study, this writer maintained that, in the particular area of research, repetition of the basic design was not only important but essential if we are to make progress in formulating constructs concerning the self as a basis for predicting behavior. In an extended study of this type it was considered important to recognize the weak points in the original design in order to make feasible additions which strengthen hypotheses, instruments, and procedures that had been employed. In this way it was intended that this writer’s own creativeness would contribute to the results obtained in the study.

Statement of the Problem

The purpose of this study was to explore the relationships between levels of differentiation of body image boundary, discrepancy of estimating dimensions of body space, and performance on diverse gross motor tasks in
subjects of late adolescence. The study was intended to be an extension of the previous study by Marcella Woods, titled, *An Exploration of Developmental Relationships Between Children's Body Image Boundaries, Estimates of Dimensions of Body Space, and Performance of Selected Gross Motor Tasks*.

Basically, this study was designed to follow that of the previous study by repeating all of the tests used in exploring the three dimensions. These were as follows: (1) the Holtzman Inkblot Test scored for barrier score as a measure of body image boundary, (2) the Popper Height Estimation Test as modified by the previous writer to include body size estimations of: standing height, arm extended standing height, shoulder width, arm extended shoulder span, and hip width, and, (3) the three motor tasks consisting of shuttle run, catch and throw, and target jump tests. These motor tasks were selected as fundamental movement skills that were representative of physical education activities performed by elementary school children. (5, p. 96)

This study has extended the test items of the previous study by including, in addition to the above, the three items from the Scott-French Motor Ability Test of: the obstacle race, the basketball throw for distance, and the broad jump; and, a grid designed for estimating the five
body size estimates as listed above for the Popper Test. These tests were judged to be more appropriate for the age group of this study.

It was the purpose of this study to explore the relationships of all the variables. The possible relationships suggested the following questions:

1. What would be the relation between each of the motor tasks and the body image boundary?

2. How would each of the two methods used to measure estimation of body dimensions compare in relating to body image boundary, and in relating to each of the motor tasks?

3. Would any sex differences occur in the relation between any variables?

4. What developmental pattern would be indicated, in terms of the tests which were employed in both studies, when the data of this study was added to that of the previous study?

Underlying the ideas of the rationale of this study was the assumption that, since man's behavior and biological functioning are represented by an organic whole, all aspects of the individual's development will in some way contribute to the self as a Being. A basic premise was that assessment of the body image is indicative of the way the individual functions as a dynamic body entity. This writer has hypothesized that if structured movement experiences contribute to the development of a well-differentiated body concept, then gross motor performance will show a relationship to personality measures of body image.
Limitations of Study

There are necessary limitations to any study. The following were the limitations of this study:

1. Any inferences obtained from the results of this study may be applied only to the population sampled.

2. Since the results of this study compared responses, and not the relationship of stimulus to response, no inferences can be made regarding cause and effect of variables.

3. Only longitudinal research can show developmental trends. This study was an extension of cross-sectional research and is limited to the suggestion only of any trends.

4. While this study intended to extend knowledge in an area of the development of human behavior, the complete developmental picture would need to include the years of early adolescence which regrettably were not possible to include with this study.

5. This study did not attempt to discover fundamental categories of human behavior. No attempt was made to control the many interacting variables, and relative to the study of self, too many measures have been omitted. The study represents only a beginning in the description of the variables considered for eighteen, nineteen, and twenty-year-olds.

Summary

The succeeding chapters have discussed the theoretical framework deemed relevant to this study, have discussed the procedures utilized in collecting the data, and have reported the results and inferred conclusions. Finally the needs for further research implied by this study have been suggested.
This study examined the relationship of selected gross movement experiences to certain purported personality measures. The rationale for any study should align with one or more theories. Selection of a recognized theory was made with cognizance that no one personality theory is accepted by all authorities as accounting for all known facts of the nature of human behavior in general, or, of the development of human personality in particular. Each theorist works within the framework of the theoretical concepts that appear to be in keeping with his own philosophical foundations. Furthermore, most research on human behavior is designed to substantiate or eliminate one or more aspects of the theoretical model that is in question. The next chapter established the rationale that is basic to the interpretations of this study.
CHAPTER II

THEORETICAL RATIONALE

An explanation of the theoretical support of the research is basic to an understanding and appreciation of the nature of this study. As mentioned in the introductory chapter, this investigation was a replicated design of a previous study. This chapter has presented the theory, underlying philosophy, and rationale pertinent to an interpretation of the results of the study, since the previous study included a review of the pertinent literature. Too frequently the researcher fails to establish his own philosophical ideas and the logic of the relationship of these ideas to his choice of a theoretical basis for undertaking a particular study.

In examining the various psychological theories that attempt to explain human behavior it is apparent that not all theories cope with all the relevant research data in the same manner. A brief summary and critique of the principal theoretical approaches has served to illustrate some of the problems inherent in present theories. The discussion has been limited to theories of personality,
since the nature of the study has dealt with purported aspects of human personality. Further, it is possible that any general theory of behavior may be accepted as a theory of personality. The writer has elected to consider certain theories of personality as they appear to relate to and differ in embracing holistic principles. That is, does a theory accept the premise that man's behavior may be best understood by segmenting behavior atomistically by rigid experimental controls, or must the integrity of the whole individual be maintained in studying the nature of man's behavior? Theories vary in the extent to which they regard holistic principles.

**Theoretical Considerations**

It might be said that all research on man in some way touches on the problem of the nature of man. As one peruses research literature on human behavior there appears to be two broad categories of research patterns. One attempts to extract pieces of man and combine these pieces into a meaningful whole. The other examines man's totality and attempts to explain the role of man's many-faceted nature from the perspective of the whole organism.

The term "body" for centuries has been used for various implicit and explicit meanings. The word itself has ten major usages according to Webster's Unabridged Dictionary.
This writer has not wished to enter the semantic web, but it is important to note that there are many meanings. Even when one specifies "body" as "human body", the term has different connotations. There is an extensive history of philosophical discourse on body concepts that deals with the mind-body question. This mind-body controversy is one with which physical educators and psychologists long have been concerned.

The early roots of psychology stemming from the philosophical considerations of behavior focused strongly on the mind as a separate entity from the body. Attributed to the mind were the important functions of human ability to master existence. This is especially noticeable in the early empirical studies by Wundt and the British Associationists who supported the theory that the mind was the base of operation for learning. They atomized the mind by reducing it to small particles of feelings, sensations, and images. (6)

Psychologists in support of mentalist theories have attempted many methods of research aimed at understanding and identifying human mental behavior. Throughout the years of research on human behavior the scientific method has been stressed in an effort to place psychology on a firm scientific base and to lend credance to its experimental findings. The methods and techniques of research have been refined considerably in terms of procedure, mechanical tools, design,
and statistical interpretation. Nevertheless, the so-called mind has yet to be defined empirically, and the exact location of thought processes remains unidentified. Learning itself must still be inferred by observing performance. (7)

A theory that philosophically differs from that of the mentalist is held by the behaviorist psychologist. Today's leading champion of behaviorism is B. F. Skinner, whose book *Walden II* has served to popularize his views. According to Skinner, "the behavioristic principle is that ideas, motives, and feelings have no part in determining conduct and therefore no part in explaining it." (8, p. 7) Skinner admits that "a special problem arises from the inescapable fact that a small part of the universe is enclosed within the skin of each of us." (8, p. 7) He claims that though this "small part" is no different than the rest of the universe, we grant it special consideration because of our intimate and somewhat exclusive contact with it. He states, "it is said to be known in a special way, to contain the immediately given, to be the first thing a man knows and according to some the only thing he can really know. Almost everyone seems to begin with it in explaining his own behavior." (8, p. 7) Skinner discards this "special problem" largely by ignoring it or by turning away from it. He says, "as
scientific analysis grows more effective, we no longer explain behavior in terms of inner events." (8, p. 7) Yet the behaviorist is concerned with the process of the individual’s mediation between his responses and the tremendous variety of stimulation (internal and external) to which he is exposed. (9, p. 420) Behaviorist theory is only a partial theory in that it is interested primarily in the learning process rather than the more stable aspects of personality. This writer felt compelled to consider the behavioristic approach to research, if for no other reason than the fact that the sheer bulk of research conducted by this methodology has contributed information that is utilized by other branches of psychology, such as developmental psychology.

Much of the research of the behaviorist has been conducted on lower animals. The results have been applied freely to human behavior. This application is made under the assumption that the higher organism, namely the human, follows the pattern of lower animals with progressively greater complexity. This assumption may overlook the very nature of human beings. Investigation of this sort reduces the behavior artificially, and the result may be consistent only with the simplification. Possibly the nature of lower animal forms is so remote from human nature that such simplification makes impossible a real understanding of them.
Goldstein has stated,

In order to decide whether performance of a given organism is simple or complex, it is necessary to know what demands that performance makes upon the capacity of that organism. Thus the problem of simplicity and complexity leads us to the problem of unequivocal description of the very essence, the intrinsic nature of the particular organism. (10, p. 3, 4)

In the analysis of human behavior, attempting to reduce the more complex performance to simpler performances has met with problems. Gestalt psychology is an effort to resolve these problems. Beginning with the whole perceptual field, the Gestaltists have studied different aspects of figure-ground and their mutually dependent relationships. The basic contention of the Gestaltist is that mental processes and behavior cannot be analyzed into elementary units without remainder, since wholeness and organization are features of such processes from the start. Originating mainly as a psychology of perception, it has been extended to cover learning and other aspects of human behavior, such that, Gestalt psychologists have injected their primarily phenomenological methodologies into the stream of general psychology. But the Gestalt theorist has tended to limit his study of behavior to perception and learning, that is, phenomena of which the person is consciously aware, and thus neglects the total personality of the person. (9) A unitary image of man necessitates an acknowledgment of the importance of unconscious factors and symbols. (4)
More recently, cognition and motivation have become major interests in almost all areas of psychology to the extent that Wylie implies the possibility of a fusing of interest of the behaviorist and Gestaltist within general psychology, especially in the area of self studies. This interest has generated a proliferation of self theories. (3, p. 6) According to Wylie, "all personality theories which have been put forth in the last two decades assign importance to a phenomenal and/or nonphenomenal self concept with cognition and motivational attributes." (3, p. 6) Self-theorists such as Rogers and Maslow utilize organismic concepts as do Lecky, Allport, Murray, Murphy, and Werner, to mention some prominent psychologists. (9) It would appear that self-theorists frequently are also organismic theorists, and vice versa.

It would seem that organismic theory has many advocates, but there is no one theory. It is more a set of directives and a perspective or point of view dependent on the attitude of the theorist. Hall and Lindzey state, "there is little to find fault with in the organismic approach because it is universally accepted." (9, p. 330) The present study recognized the organismic theory as the most promising rationale for research on human behavior, and as such, has accepted this theory as the theoretical framework for this study.
One of the main exponents of organismic theory is Kurt Goldstein. He has given a treatise of his organismic perspective in his book The Organism. A major assumption in the organismic position is that self-actualization is the motivation for an individual's behavior. Further, in the process of self-actualizing, there is an ongoing attempt of the organism to organize itself in resolving the polar influences that act upon it and within it. There is a unifying principle in the human self. (10) In this writer's opinion, the body is the self, and used in this sense is a dynamically defined entity. This holistic view attempts polar interrelation of all human antinomies of human existence.

Implied in the resolving of human polarities is a concept of balance constituted by man's state of becoming. This balance has an apparent analogy in physiological homeostasis. The relationship of biological and social homeostasis was suggested by Walter Cannon in his Wisdom of the Body. (11) The idea of analogous inference of physiological homeostasis relating to a kind of psychological homeostasis has been supported by Maslow. (12, p. 120)

Maslow describes self-actualization in terms of the tendency of the organ system to express itself, or to function. Function implies that the person is in a process of becoming balanced in his efforts to resolve the ongoing
inner conflicts. The person himself is a self-actualized Being when there is unity of the antinomic tendencies. (12) Goldstein, using an ontological approach, is concerned with analyzing man as a Being and of the role of human existence in the Being itself. The ongoing striving for self-actualization is a striving for the realization of essence. The concepts of self-actualization and essence share holistic, integrative qualities. (13) Becoming... Balanced... Being... these three, characterize arriving at the intrinsic nature of human essence and the culmination of self-actualization. The organismic view, in this sense, asserts that what is becoming actualized is the essence of man.

Any split between body and mind is nothing more than a product of our own thought and does not correspond to the reality of man as he operates in his world. Further, well-being is not an assumption of the mind — it is expressed in man's whole body, in the way he walks, talks, and in the very tonus of his muscles. For Goldstein, the feeling of unity is the deepest foundation of well-being and for self-realization. (13, p. 185) Goldstein states, "It /unity/ touches on a central phenomenon of man, the experience of being, or realizing our nature, which is possible only in a genuine unity with the other and with the world." (10, p. x)

Merleau-Ponty is also concerned with the unity of man.
He makes clear the importance of a holistic concept of the body as he states, "I am in undivided possession of it [my body] and I know where each of my limbs is through a body image in which all are included." (14, p. 98)

Merleau-Ponty has conceived of the body as a system moving in space, and he has implied that the coordination of the body is its orientation toward the world and the origin of objective space. (14)

The attitude of the organismic theorist, as presented by this writer, seems to be sympathetic to some of the views of the existential philosopher. This may be more than coincidental. Maslow states, "It is extremely important for psychologists that the existentialists may supply psychology with the underlying philosophy that it now lacks." (15, p. 89) Nevertheless, it is important to temper the philosophical contemplations that parallel organismic theory by testing the theory with research methodology and design that can extend knowledge gained from ordinary experience. In the foreword of *The Organism*, Lashley points out that the organismic view "avoids many of the difficulties of both those whose scientific aims are satisfied neither by extreme oversimplification of facts nor by postulation of forces which cannot be investigated." (10, p. xiii)
Maslow indicates that in the study of self-development, research is needed to clarify the role of genetic factors in comparison to the continual choices of the person himself, and that the dynamic role of the future in the now existing personality may stimulate meaningful understanding of human behavior. (16, p. 92) Heinz Werner stipulates that while one of the major concerns of developmental psychology is the study of genetic changes, "the conviction has been growing in recent years that developmental conceptualization, in order to reaffirm its truly organismic character, has to expand its orbit of interest to include as a central problem the study of individuality." (17, p. 146)

Apropos of developmental psychology, an orthogenetic principle states that "wherever development occurs it proceeds from a state of relative globality and lack of differentiation to a state of increasing differentiation, articulation, and hierarchic integration." (17, p. 126) From the ontogenetic view, the process of development proceeds from a level of non-differentiation of subject-world to an integrated yet differentiated polarity of self-world. The well-differentiated individual can better manipulate his environment, is better able to exercise
choice, reflects an articulated body concept and in general has an articulated manner of experiencing the world. (18, p. 39)

The relation of structured movement experience to the development of the self in the total connotation of personality appears obvious, if one accepts the assumptions of the previously developed theoretical rationale. In other words, a person moves in the process of experiencing life, and his experiences have been assumed to be influential in the development of his personality. The particular aspects utilized in this study are considered to be important operations of man's behavior as he acts in and interacts with his environment. This writer has considered it important to point out more specifically the relevancy of the theoretical rationale to the nature of the aspects dealt with in this particular study.

George Thompson indicates that "motor skills are complex in that they involve almost every aspect of the child's physical and psychological status. They are related to perception and intelligence, previous learning and present motivation, emotional stability, social relationships, and personality characteristics." (19, p. 252) This places human movement in the context of a total system. John E. Anderson has discussed the characteristics of development from the perspective of a system in process. He has pointed
out that the individual is "an open system with a very high rate of interchange within the system and with the environment in which he exists." (20, p. 44) This system is "a going and active concern upon which events and stimulation are superimposed. This implies that the system is in itself in some degree a determiner of its own experience." (20, p. 44)

In moving, the individual is responding to conditions of self as he operates in the environment of the real physical world. As an object in motion, the body is governed by the same physical principles which effect all objects on this planet. For example, there is the need to overcome inertia, and to maintain the body's position against gravitational forces.

In movement a person needs to integrate the movement elements of time, force, and space in an articulated manner to achieve mastery of gross movement skill. It is assumed that movement performance will be the result of perceived environmental experiences and the neurological input-outgo mechanism.

Metheny has suggested a meaning in movement in the idea that no primary sensory data is more complex or more intimate or more necessary for survival than the kinesthetic data. (21, p. 4) In the words of Metheny, "from these data we derive our awareness of our own identity as a self that
has the power to move about in the universe, to change its relationship to its environment, and to interact in consequential ways with the elements in that environment."

(21, p. 4)

Psychologists and physical educators have acknowledged that the child tends to function primarily on the basis of gross motor activity. The child's early attempts to cope with the environment are facilitated by the ability to control the movement of his body. In later development the individual does not appear to be as dependent on bodily coordination. However, the concept of Piaget's schema implies that the individual's built up sensorimotor schemata may feasibly relate to total self integration. (22)

It is possible that prior development of motor control is later utilized in adaptive behavior which depends on stability as well as flexibility, (18, p. 140) and that the body may continue to be coordinated to spatial relations. (19, p. 327) In terms of the personal meaning that any motor act may have for an individual, Metheny has indicated that at any age level what may seem to be a trivial act, such as throwing a ball at a target, may be an important part of a person's "search for the meaning of his personal existence within the existential scheme of reality-as-he-knows-it."

The writer of this study has assumed that in the
performance of gross motor skills the individual has shown his ability to integrate the movement elements. That is, the performance evidence has shown the degree of movement articulation which has been developed by the individual. Thus the performance of motor skills has been considered to be more than mere shifts, turns, and twists. They are the movements of the whole person as he encounters his immediate environment. In this way a person's movements were held as being a projection of the self, as the individual sees himself, in accordance with established patterns.

In this study self-differentiation is studied from the perspective of the body boundary concept. This concept is based on the idea that in the course of development the individual learns to demarcate his body from that of his environment, and that the definiteness of this demarcation has important behavioral implications. (23, p. 52) Fisher and Cleveland report that the more definite an individual's boundaries, the more likely he is to be "more active, independent, autonomous, communicative and more likely to channel excitation to the exterior layers of the body." (23, p. 52) From their findings they have devised an index which serves as a measure of boundary definiteness and is referred to as the barrier score. It is based on the premise that percepts categorized as well-defined impermeable boundaries correspond to well-differentiated body image boundaries. This premise was first
posited from the use of inkblots to project an individual's kinesthetic sensations. Through the projective technique of inkblot responses, the barrier score taps the personality organization at the unconscious level. (4)

In assessing the perception of body image, concepts of body appearance, especially size, have been used as a potential dimension in studying perceptual organization and psychological functioning. In the process of estimating self-size, the subject is set the task of making a perceptual judgment about his own body in a way not unlike the manner he might evaluate non-self objects. This type of task has been found to relate to the individual's body attitude, and it is conceivable that it also may serve as an indication of the individual's concept of his personal space. (24, p. 211, 212) Obviously, the skin and musculature are the outermost limits of the body and as such represent the contact surfaces of the body with the environment. The space the body occupies in its extended and non-extended positions represents the personal space of the individual. Gross body movements serve as the means by which an individual manipulates his body in his environmental space. Thompson has suggested that there are probable relationships between spatial concepts and concepts that define the body image which are still to be explored. (19, p. 330)
In previous research which has utilized the Popper Height Estimation Test, it is not clear as to what determined the results. Woods pointed out that "on the 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." (5, p. 65) An effort has been made in this study to clarify the role of the symbolic treatment by the design of a grid in which the subject notes directly his perceived dimensions without the intervening symbolizing process. The use of this grid was intended to ascertain the ability of the subject to estimate body dimensions without using a symbolization process. This symbolization was thought to necessitate translating the real estimated body size to a paper-size imagery of the body. The translating may have related more to skill in making proportional relationships rather than relating to a function of body image. Thus, the results may have shown spurious relations. It remains to be seen which technique is more promising for showing relations to developmental hypotheses. The writer has attempted to test whether the results indicate that symbolization of body size is a function of the body image and relates to gross motor ability, or whether the grid estimate is a better indicator of body image and correlates to movement performance.
The previous study used as variables body image boundary, estimates of body space dimensions, and gross motor skills. The results inferred the following:

1. a general increase in the capacity of all three variables was found as a function of age
2. the body image boundary and estimates of body dimensions were co-variables
3. the developmental improvement of gross motor skill was not consistently related to the other two variables
4. the findings were suggested to represent a reciprocity function in which a mutual inter-dependency was implied. (5)

The writer of the present study has expected to show a meaningful relationship between the three variables of body image boundary, estimates of body dimensions, and the selected gross motor tasks. If the differential hypothesis, that a differentiated body concept is a manifestation of the individual's general progress toward psychological differentiation (18, p. 26) is accepted, and motor skills are significantly related to elements of body concepts, then one may infer that gross motor experiences are important for total psychological growth and development.

**Summary**

This chapter has attempted to explain the theoretical rationale considered important in interpreting this study, and has suggested the underlying philosophy apropos to the theoretical concepts.
The organismic theory has been selected by this writer as germane to this study. It was believed that this theory and its holistic principles will eventually prove to be the most meaningful in research that inquires into the nature of human behavior. It was inferred that study of human behavior needs a philosophical framework from which to proceed. The ideas of existential philosophy have been stressed as being most appropriate as a basis for the organismic theorist.

The first section of this chapter has dealt with general theoretical considerations. The second section has directed the focus of theory toward the aspects of this study, which include: human movement, as evidenced by selected gross motor performance; and, assessment of body image as indicated by the body image boundary, and by estimates of certain body dimensions of personal space.

In writing this chapter the intention has been to show that in any study which purports to examine the nature of human behavior, the body/self must be considered as a Being operating in a world environment. The theory that is used stresses that, as a human being develops and learns how to adapt his behavior for appropriate living, the individual is faced with resolving many polar influences both from within and from his outer environment. In this ongoing process of adjusting to life's challenges the individual is
thought to be constantly striving for balance of antinomic factors, and this striving has been called a process of becoming. The motivating force for behavior is considered to be that of self-actualization.

The aspects of this study were selected as important indications of the way man functions. All men move in the process of living and in this process they move as a body/self. In attempting to understand the meaning movement has for the self, indices of the body image have been used as manifestations of the way man differentiates his self from his non-self. Finally, the study has been designed to examine the relationship between man's ability to control his body movement and his ability to demarcate the body boundary of his personal space from that of his environment. It was felt that confirmation of this relationship has important significance for physical educators and psychologists.

This chapter has stated the theoretical framework of this research. In the following chapter the procedures used in this study are described.
CHAPTER III

PROCEDURE

The intent of this study has been to examine the relation between performance of gross motor tasks, and body concept as represented by body image boundary and by estimated dimensions of body space.

The procedures described in this chapter have shown how the research was implemented. It should be noted that administration of the tests used in the previous study were altered slightly to be appropriate for the older age groups. Nevertheless, it was felt that the original integrity of the tests that were repeated was maintained.

Selection of Subjects

The subjects for the study were thirty-eight male and female students enrolled at The Ohio State University and registered in basic physical education courses that were under the auspices of the Department of Physical Education. The following was the breakdown of the subjects used in this study:

1. Eighteen-year olds: 9 males, 10 females
2. Twenty-year olds: 11 males, 8 females.
All subjects volunteered to participate, and any student within the age classification, and enrolled as stated above, was eligible to participate with the following provisions:

1. They had no recent serious illness or physical handicaps
2. They had no uncorrected vision problems
3. They had no previously known psychological illness.

It was assumed that all subjects had at least normal intelligence by virtue of the fact that they were enrolled in a university and thus at minimum had satisfactorily completed a high school education.

**Measurements Recorded per Subject**

**Barrier Score**

**Estimates of Dimensions of Body Space**

1. **Vertical**
   a. Standing Height
   b. Extended Height

2. **Horizontal**
   a. Span
   b. Shoulder Width
   c. Hip Width

**Actual Dimensions of Body Space**

1. **Vertical**
   a. Standing Height
   b. Extended Height
2. Horizontal
   a. Span
   b. Shoulder Width
   c. Hip Width

Performance of Selected Gross Motor Tasks

1. Obstacle Race
2. Basketball Throw for Distance
3. Broad Jump
4. Throwing-Catching
5. Shuttle Run
6. Target Jump

Assessment of Body Image Boundary

The body image boundary was assessed according to the method used in the previous study. This consisted of using the first 25 Holtzman inkblot cards which were projected onto a beaded Radiant screen by means of an overhead projector. All subjects were seated so as to have a clear view of the screen. The following is an account of the group administrative procedures:

1. Each subject was given two sharpened pencils and a copy of the Form A Holtzman Inkblot Technique Record Form.

2. After the pencils and protocol forms were distributed, the test administrator asked the subjects to write only their name on the form and told them the following:
You are going to be shown some inkblot pictures. I think you will find them interesting. The pictures will be scored only for body image boundary and will be scored blindly by a professional. Thus any response will be treated anonymously. As you look at each picture, you will be asked to give only one response, although it is possible that you will see many things in each picture. Write your response in the space provided beside the number and outline of the picture. Elaborate any descriptive details you may see concerning your single response. Now look at picture X, which is a practice picture. When you have finished, circle the part of the picture about which you have written a response.

Both Trial X and Trial Y blots were projected in succession on the screen. During the trial blots the administrator pointed out several types of responses to each blot, illustrating the use of different areas of the blot as well as color, shading, etc., that might determine a response. In the process, the subjects were told:

Some pictures are more difficult than others. If you do not see anything at first, keep trying as long as the picture is on the screen. Remember, there is no right or wrong answer to your response.

The exposure time limits for each blot were administered as suggested by Holtzman for college students. (25, p. 257) Specifically, cards 1, 2, and 3 were exposed 120 seconds; cards 4, 5, and 6 for 100 seconds; cards 7, 8, and 9 for 90 seconds; and the rest of the cards for 75 seconds. These time limits were judged by the examiner to be completely adequate, since all subjects had finished with each inkblot within the exposure time. Apparently, as the subjects got used to the technique, they cued themselves more quickly.
and needed less time to respond.

After the completion of the testing, the protocols were coded with an identifying number, and the subjects' names were then masked. All masked protocol forms were sent to Dr. Seymour Fisher who blind scored them for barrier responses. A Barrier Score was arrived at by tallying the number of responses that were scored for barrier response.

Estimates of Dimensions of Body Space

For estimating the dimensions of body space two methods were used. The first method, was employed in the previous study, and the administrative procedure of the test is detailed there. A general description of the test procedure used by this investigator follows:

Method I: Modification of Popper Test

The Popper Height Estimation Test* was used as the basic tool. This test was extended to include, in addition to the original standing height, the dimensions of extended height, arm span at shoulder level, shoulder width, and hip width.

The test tool consisted of two, two-inch wide, white paper tapes placed on the wall, such that each tape, which

*Note: From henceon the modified Popper test will be referred to simply as the Popper Test throughout this study.
was ten feet long, crossed at the centers at right angles with one tape perpendicular to the floor and the other horizontal to the floor.

The subjects were directed to sit on the floor in a designated area 10 to 20 feet from the wall and facing the white tapes. Each subject was handed a freshly sharpened pencil and a score sheet for vertical dimensions.* The examiner indicated to the subjects that the line on the left was to be used to record the standing height estimate and the line on the right for the extended height estimate. The test directions requested the subject to pretend that he was standing back to the wall measuring his standing height against the tape. He was then asked to imagine that the line on the score sheet was the length of the tape and to place a pencil mark across the line at the point that represented the spot where the top of his head would be. The estimate for extended height was made similarly. After each subject had printed his name on the score sheet, the sheets were collected and the horizontal score sheets distributed.

For the horizontal estimates the attention of the subject was directed to the horizontal tape on the wall. For the span estimate the subjects were asked to imagine themselves

*The reader is directed to the Appendixes for sample score sheets.
standing with back to the wall, arms and hands stretched along the tape. They were asked to mark the score sheet at the two points that represented the distance that the fingertips extended from the head.

The same type of directions were used for the shoulder and hip widths. For the shoulder width the subjects were asked to think about where their shoulders were and where they end. They were to pretend their arms were straight down at their sides.

The scoring for all Popper test items was done by measuring the length of the marked off line in millimeters and converting this to the nearest centimeter. The accuracy of subject estimate was arrived at by finding the difference between the converted estimated dimension and the actual subject measurement. This difference was called the Popper discrepancy score.

Method II: Utilization of Grid

In examining the Popper test as a tool for estimating dimensions of personal space, certain questions were posed. First, as was pointed out in the rationale chapter, previous research does not indicate what determined the result of the test. The use of the grid sought to yield information as to the role of the symbolic treatment of the percept. The writer would agree that man frequently abstractly
symbolizes nonself objects in the process of conceptualizing about the objects. However, it appears reasonable to speculate that in man's efforts to cope with his environment, man does not accept a symbol as a substitute for the body/self, in that his own body would be a more accurate representation of his self.

In the previous study, the Popper test estimates were found to indicate a certain body shape. For example, certain shapes were suggested by the comparison of estimated shoulder and hip widths. Since the score sheets permitted the subject to observe the relative dimensions of shoulders and hips, this investigator theorized that older subjects would be expected to have more accurate knowledge of normal body dimensions, and might tend to estimate ideal dimensions rather than the perceived relationships of the individual's functioning at a reality level.

Procedurally, a third problem of the Popper test became evident in the process of arriving at the score for an individual. In order to find what the individual had symbolically estimated, a metric rule was used to measure the point marked by the subject. In measuring, often the actual point had to be estimated, because the subjects had not made the mark straight or had not made a fine line. Thus, inadvertently errors may have been made. When one considers that this error is greatly magnified in the process
of converting the paper-size to the tape length, the potential of administrative error may have been important. The use of the grid eliminated this potential error.

Two grids were used to estimate the body space dimensions, one for the vertical dimensions, and one for the horizontal dimensions. Representations of the two grids are located in the appendix. Basically, the two grids are the same, except for differences that the horizontal and vertical positioning on the wall necessitated.

Each grid consisted of a sheet of white plastic five feet wide and ten feet long. The width was rather arbitrarily decided as simply being sufficient and not suggestive of any body width dimension. The length was selected as being well over any probable extended height of any subject, and it was the same as the length of the tapes used for the Popper test. On the plastic a series of parallel lines were drawn through the length using a two centimeter unit for the spacing between lines, and a centered reference line running the length of the grid. This unit was selected for three reasons.

1. The Popper test, to which the grid was to be compared, was scored in centimeter units, and thus a direct centimeter reading enabled easier comparison.

2. It was reasoned that people in the United States
normally conceive of their body dimensions in inches rather than any metric unit; and it was desirable to avoid the use of a standard with which the subjects would familiarly associate body size.

3. The two centimeter spacing was found to be the smallest unit of metric length that the subjects could accurately see under the test conditions.

Randomly selected numbers were placed opposite every other line for use in identifying the place of the estimated dimensions. Space was not sufficient for each line to be numbered, since the numbers had to be large enough to be read comfortably at a distance of 20 feet. To facilitate distinguishing between lines and numbers, the lines were black and the numbers green. A pre-test of the grid indicated that at 20 feet subjects with normal or corrected vision could readily determine the desired line by selection of the number beside it.

The investigator desired to permit the subject a one centimeter choice of estimate. Therefore, a system was worked out whereby the spaces and line immediately above a number could be selected and identified. This system is described in the administrative directions.

For the test administration the subjects were seated on the floor in the same area as that of the Popper test in
order to maintain consistent test conditions. During the
test directions the subjects had their backs to the wall,
and the grid, which when open covered the Popper test tapes,
was rolled up. Thus, the subjects were not permitted to
view the grid until all administrative personnel were out
of the area and seated.

Using a blackboard, three lines were drawn a few
inches apart. The top line was numbered 68 and the bottom
line 30. The administrator then said the following:

You will be asked to estimate body dimensions by
selecting a numbered line as most closely repre­
senting your body size. For reasons of space,
only every other line is numbered. It is possible
that you may wish to estimate your dimensions by
the unnumbered line or by either of the spaces
between the numbers. These spaces and the unnumbered
line may be identified by writing the number
immediately below the space or unnumbered line and
then using "A" to identify the first space, "B"
the unnumbered line and "C" the second space.
Thus, if you estimated your body dimensions as
being in space below 68, this estimate would be
identified as 30 C.

The grid was lowered and the subjects asked to swing around
in the sitting position to face the grid. While the sub­
jects looked at the grid, the administrator completed the
test directions for the first grid as follows:

The lines are regularly spaced but the spacing is
not in inches. The numbers on the lines are ran­
domly placed and are only to identify the lines.
Looking at the lines on the white grid in front of
you, select the place which would represent the
top of your head, if you were standing straight
with feet flat and back to the wall. Write the
identification of the spot you have selected on
your score sheet in the space for recording
estimated standing height. Estimate extended height imagining that you are standing as before, only with your right arm and hand extended as far as possible above your head. Select a spot on the grid using the numbered line as before, and write the identification of the spot on your score sheet in the space for recording estimated extended height.

No time limit was imposed on the subjects, so that when all had finished with that grid, the group was directed to rotate around with back to the grid area for the lowering of the horizontal grid. The grid was positioned and administrators left the area. The subjects were asked to face the grid maintaining their sitting position. The administrator told them the following:

The lines on the grid in front of you are to be used to estimate your body dimensions of arm span, shoulder width and hip width. The green line down the middle of the grid represents the midline of your body. Estimate your arm span by imagining yourself standing with your back against the grid with both arms and both hands extended at shoulder level. Using the numbers, select spots on each side of the mid-line that represents the limits of your arm span. Remember, your back is against the wall, so numbers on the left of the green line represent your right side. Write the numbers in the spaces provided for arm span estimate. Again imagine yourself with your back to the grid. Your arms are straight to your sides. Estimate where your shoulders would end at the left and right of the mid-line and select numbers to identify your estimation. Write the numbers in the space provided for shoulder width estimation.

The direction for hip width were the same as those for shoulder width except that the word "hips" was substituted for the word "shoulders."
The score of each body size was obtained by means of a key that identified the number of centimeters represented by each grid number. The accuracy of subject estimate was determined by taking the difference between the grid score and the actual measurement of the subject's body dimension. This difference was the grid discrepancy score.

Performance of Gross Motor Tasks

General test conditions

1. Each test was administered by the same trained examiner, and all examiners were qualified physical education teachers.

2. All test stations were well-spaced to avoid any overlapping and to avoid distraction of one group by another.

3. Subjects within groups were systematically rotated to avoid giving an advantage through the order of testing.

4. All equipment utilized was pre-tested and checked for condition such that:
   a. Balls were of uniform size and weight
   b. Stop watches were synchronized.

5. Standardized directions were used for each test and for each group.
6. Any demonstration was given to the whole group of subjects simultaneously.

**Tasks from Woods' study**

Three motor tasks were selected for the previous study 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. (5, p. 96)

The first and second tests were typical of many motor skill battery items. The third was designed by the previous investigator. The three tests were:

1. Catching-Throwing
2. Shuttle Run
3. Target Jump

A description of the tests and the procedures follows:

1. Catching-Throwing
   a. The subjects were instructed to stand and perform the test from behind a five-foot restraining line.
   b. On the signal "go" the subject threw the ball against the wall and caught the rebound. The subject continued throwing and catching until the signal "stop," which was at the end of 30 seconds.
   c. The score was recorded according to the number of successful catches in 30 seconds.
   d. Each person was permitted three or four practice throws before beginning the test.
e. Two subjects were tested at the same time.

f. An administrative assistant counted the number of successful catches and deducted for restraining line foot fault violations.

g. After all subjects in a group had completed the first trial, a second trial was administered. (5)

2. Shuttle Run

a. Each subject was directed to stand with the toes of the forward foot on the white starting line.

b. On the signal, "ready, go," the subject ran to the white line opposite the starting line and back. This was repeated two more times, for a total of three complete trips, running across the starting line at the end.

c. The score was the number of seconds to the nearest tenth second that was required to make the three trips.

d. At the end of the first trial for each subject in a group, a second trial was given. The best of the two trials was recorded as the subject’s score.

e. If a subject failed to touch or go over a line at any time during the run, a mistrial was called and the subject was allowed to repeat a trial. (5)

3. Target Jump

This test was designed to test the subject's ability to use the correct amount of force needed to project himself to a specific spot. It was thought to have eliminated, as a differentiation factor, the ability to use explosive leg power and broad jumping technique, since all subjects had been predetermined as having the ability
to jump the prescribed distances. (5, p. 99) A description of the task follows:

a. Red masking tape was placed across a tumbling mat at intervals of 60 centimeters, 100 centimeters, and 150 centimeters from the starting edge of a takeoff board.

b. Each of the lines represented a target point on which the subject was to land. The first target was 60 centimeters, the second 150 centimeters, and the third 100 centimeters.

c. All subjects used the same starting line, and were directed to start with both toes just touching the starting line with feet parallel. The examiner pointed to the nearest red line as an indication of the first target. The subject was asked to try to jump to the line so that both toes would be exactly on the target.

d. The score was recorded in plus or minus centimeters from the line to the toes.

e. After each member of group had completed the first target jump, the procedure was repeated for the second and then for the third target lines.

f. Only one trial for each line was permitted, unless the subject fell or failed to land with feet parallel. This was recorded as a mis-trial and one more trial for that target was allowed.

g. The target jump score was determined by disregarding the plus and minus signs and taking the difference between the point where subject landed and the nearest edge of the line. This was the target jump discrepancy score. (5)

Scott-French Motor Ability Tests

The complete Scott-French Motor Ability Battery consists of five test items. For the purpose of this study
only three items of the complete battery were used. The particular items selected were thought to be somewhat parallel to the nature of the motor tasks used in Woods' study. Also, Scott and French state that these three may be substituted for the complete battery. (26, p. 344) It was of interest to determine how standard motor ability items, that frequently are used for classifying students in physical education classes, would compare to the other variables of the study. In addition, the examiner felt that these tests might offer a more appropriate challenge for the college-aged subjects.

The three test items used were:

1. Obstacle Race
2. Basketball Throw for Distance
3. Standing Broad Jump

The administration of all items were according to the directions of the original test designers. The details of test administration may be found in Measurement and Evaluation in Physical Education by Gladys Scott and Esther French. (26)

Each of the motor skills were treated as separate variables rather than combining them into a single criterion score. Each task was thought to utilize the movement elements in a somewhat different way, and it was of interest to explore how the variables of body image tests would relate to each item.
Design of Study

The approach to the study was exploratory, since it was not known whether or not any relationships and/or what type of relationship would be found between the variables. Thus no attempt was made to control the independent variables. The following summary shows the overall pattern of organization of procedures in the design of the study.

The entire testing program was conducted in two sessions. Each subject attended only one session, for the second session was a repeat of the first. The order of testing for each session was:

1. Scott-French Motor Ability Tests
2. Modified Popper Body Space Estimates
3. Holtzman Inkblot Test
4. Grid Body Space Estimates
5. Woods' Motor Tasks
6. Actual Body Measurements

To use the available testing time expeditiously the subjects were divided into three groups. As the subjects entered the testing area they were given blue, pink, or yellow score sheets for the motor tasks. The subjects were then asked to congregate at the Obstacle Race area for the demonstration of that test. The subjects were
directed to proceed to each of the three motor skill stations according to the color of their score sheet. On the following page, Figure 1 shows how the groups were rotated for the various tests.
## Testing Stations

<table>
<thead>
<tr>
<th>Obstacle Race</th>
<th>Broad Jump</th>
<th>Basketball Throw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pink</td>
<td>Blue</td>
<td>Yellow</td>
</tr>
<tr>
<td>Yellow</td>
<td>Pink</td>
<td>Blue</td>
</tr>
<tr>
<td>Blue</td>
<td>Yellow</td>
<td>Pink</td>
</tr>
</tbody>
</table>

### Modified Popper
- **All Subjects**

### Holtzman Inkblot
- **All Subjects**

### Grid Estimates
- **All Subjects**

<table>
<thead>
<tr>
<th>Shuttle Run</th>
<th>Target Jump</th>
<th>Catching-Throwing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pink</td>
<td>Blue</td>
<td>Yellow</td>
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<tr>
<td>Yellow</td>
<td>Pink</td>
<td>Blue</td>
</tr>
<tr>
<td>Blue</td>
<td>Yellow</td>
<td>Pink</td>
</tr>
</tbody>
</table>

---

**Figure 1. Rotation of Testing Schedule**
CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

The study dealt with two problems. The first problem was to investigate the relationships between the selected variables in late adolescent subjects. The second problem was to add the data of the adolescents to the date of the previous study on children ages eight, ten, and twelve years, to note developmental patterns that were indicated.

All of the collected data were recorded on sheets furnished by the statistics laboratory. The data were programmed and processed by The Ohio State University Data Processing Center.

The independent variables were: age, sex, body space estimates, and barrier score. The dependent variables were the six motor tasks.

The interpretation of the data was by means of linear correlations.* The significance of the degree of relationship tested the statistical hypothesis that \( \rho = 0 \). With some exceptions, the .10 level of confidence was accepted

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*Acknowledgment is made to Dr. Ransom Whitney, Professor of Mathematics at The Ohio State University, for his advise on the statistical aspects of this study.
as significant, since the variables were not manipulated, and since it was recognized that there were many uncontrolled variables and unknown factors that may have contributed to the results.

It was of interest in this investigation to note whether Barrier Score increased as a function of age. Table 1 suggests an increase with age. In general the standard deviations were reasonably constant. The slight overall increase in standard deviations may be indicative of somewhat greater individual variation in the groups studied.

Figure 2 illustrates the tendency for a regular increase in Barrier Score with age. It is of interest to note that the picture of sex differences has changed in late adolescent subjects. It suggests that at adolescence the male image boundary may be better articulated. Some of the other data have appeared to support this idea.

The directional discrepancy in the Popper body estimates for ages eight, ten, twelve, eighteen, and twenty are found in Table 2. There were no general age patterns apparent, as each dimension varied from the others. In the vertical estimates the data showed a trend of the prepubescents to underestimate and a directional change toward overestimation in adolescence. As with the younger children, the span estimates of the adolescents were underestimated, but there was an increase in accuracy across all
<table>
<thead>
<tr>
<th>Age</th>
<th>Male Mean</th>
<th>S.D.</th>
<th>Female Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>3.36</td>
<td>2.34</td>
<td>4.35</td>
<td>2.20</td>
</tr>
<tr>
<td>10</td>
<td>3.86</td>
<td>2.73</td>
<td>4.35</td>
<td>2.45</td>
</tr>
<tr>
<td>12</td>
<td>4.93</td>
<td>2.80</td>
<td>5.87</td>
<td>2.84</td>
</tr>
<tr>
<td>18</td>
<td>7.44</td>
<td>2.74</td>
<td>6.60</td>
<td>3.53</td>
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<td>20</td>
<td>8.00</td>
<td>4.09</td>
<td>7.75</td>
<td>3.10</td>
</tr>
</tbody>
</table>
Legend:

- □ = Male
- ○ = Female

Figure 2. Barrier Score
### TABLE 2. MEAN AND STANDARD DEVIATION OF DIRECTIONAL DISCREPANCY IN MODIFIED POPPER ESTIMATE 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>Mean, cm</td>
<td>Mean, S.D.</td>
<td>Mean, cm</td>
<td>Mean, cm</td>
</tr>
<tr>
<td>8 Male</td>
<td>-16.29</td>
<td>27.65</td>
<td>-18.36</td>
<td>41.66</td>
<td>22.65</td>
</tr>
<tr>
<td>Female</td>
<td>-2.84</td>
<td>30.79</td>
<td>8.44</td>
<td>31.87</td>
<td>35.00</td>
</tr>
<tr>
<td>10 Male</td>
<td>-33.22</td>
<td>26.54</td>
<td>-20.69</td>
<td>28.24</td>
<td>22.81</td>
</tr>
<tr>
<td>Female</td>
<td>-22.55</td>
<td>19.00</td>
<td>-7.43</td>
<td>23.89</td>
<td>25.58</td>
</tr>
<tr>
<td>T2 Male</td>
<td>-19.67</td>
<td>25.18</td>
<td>-18.60</td>
<td>28.34</td>
<td>32.58</td>
</tr>
<tr>
<td>Female</td>
<td>-10.86</td>
<td>26.71</td>
<td>-10.43</td>
<td>30.67</td>
<td>32.71</td>
</tr>
<tr>
<td>18 Male</td>
<td>15.11</td>
<td>16.01</td>
<td>30.00</td>
<td>20.85</td>
<td>50.52</td>
</tr>
<tr>
<td>Female</td>
<td>15.4</td>
<td>10.58</td>
<td>20.50</td>
<td>17.93</td>
<td>25.29</td>
</tr>
<tr>
<td>20 Male</td>
<td>5.73</td>
<td>19.65</td>
<td>13.27</td>
<td>25.36</td>
<td>44.63</td>
</tr>
<tr>
<td>Female</td>
<td>21.25</td>
<td>12.86</td>
<td>32.37</td>
<td>20.65</td>
<td>29.21</td>
</tr>
</tbody>
</table>
age groups. All groups overestimated hip width. In this
dimension the children tended to get more accurate with
age. The older groups showed sex differences. The male
twenty-year-olds were more accurate than the eighteen-
year-olds. The pattern of this dimension was reversed for
females in terms of age differences. The shoulder width
estimates showed no age pattern and the data is inconsistent.

Data are not available on the grid body space esti-
mates for children, but Table 3 shows the mean and standard
devation of discrepancies for the dimensions of eighteen
and twenty year old subjects. Males and females over-
estimated both of the vertical dimensions. In the height
estimates the twenty-year-old group males were less accur-
ate, but the female group remained about the same. In
the extended height estimates the males were less accurate
with age, as they were with the standing height dimension.
The females were more accurate with age in this dimension.

A further inspection of Table 3 shows that both ages
and sexes underestimated span, but tended to be more accur-
ate with age. The shoulder and hip widths were similar
in terms of direction of discrepancy. The male twenty-year
olds underestimated both shoulder and hip dimensions. All
other groups overestimated both dimensions. Older males
were more accurate in both dimensions. Older females were
more accurate in shoulder width, but less accurate in hip
<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>Sex</th>
<th>18 Male</th>
<th>18 Female</th>
<th>20 Male</th>
<th>20 Female</th>
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</tr>
<tr>
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<td>mean, cm</td>
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<td>18.80</td>
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<td>12.92</td>
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<tr>
<td><strong>Extended Ht.</strong></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Estimate</td>
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<td>mean, cm</td>
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<td>15.10</td>
<td>4.73</td>
<td>11.12</td>
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<td>S.D.</td>
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<td>11.97</td>
<td>18.09</td>
<td>19.58</td>
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<td><strong>Span</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Estimate</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean, cm</td>
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<td>-25.50</td>
<td>-36.54</td>
<td>-13.25</td>
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</tr>
<tr>
<td>S.D.</td>
<td>31.62</td>
<td>21.73</td>
<td>32.44</td>
<td>31.35</td>
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<tr>
<td><strong>Shoulder Wth.</strong></td>
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</tr>
<tr>
<td>Estimate</td>
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<tr>
<td>mean, cm</td>
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<td>12.20</td>
<td>-3.73</td>
<td>6.62</td>
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<td></td>
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<tr>
<td>S.D.</td>
<td>14.69</td>
<td>14.08</td>
<td>10.37</td>
<td>10.11</td>
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<tr>
<td><strong>Hip Width</strong></td>
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<td></td>
</tr>
<tr>
<td>Estimate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean, cm</td>
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<td>4.40</td>
<td>-5.36</td>
<td>9.87</td>
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<tr>
<td>S.D.</td>
<td>14.39</td>
<td>8.38</td>
<td>10.41</td>
<td>17.81</td>
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<td></td>
</tr>
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</table>
width. The meaning of this is not clear.

The figures that follow, illustrate the patterns of age groups in representing the body space estimates of the five dimensions for both the Popper method and the grid method. All figures show a comparison of age and the mean discrepancy scores. Examination of these figures yields an interesting picture of the differences between the two methods of estimating body space dimensions.

Figure 3 shows the height estimates. The sexes were about the same at aged eighteen on the Popper test, but the aged twenty group had a distinct difference with the males being decidedly more accurate. The grid reflected about the same quantitative accuracy as the twelve-year-olds, but there was a reversal of direction toward overestimation as there was with the Popper test. The general clustering of the grid scores suggested a stabilization of height concept by late adolescence. If this suggestion is correct, the grid estimates of height may give a clearer representation of the individual's perceived body space in the vertical direction than the estimates of the Popper method.

It should be pointed out that, in making comparisons of the grid and Popper methods, only the Popper test was used for all age groups. Thus, the differences in direction and accuracy of the adolescents and children can only be implied as possible, and are not necessarily probable.
Figure 3. Height Estimates
Figure 3 shows that subjects were more accurate with the grid than with the Popper method. In both tests the males were more accurate than the females for the aged twenty group. This pattern held for eighteen-year-olds on scores of the grid method, but the eighteen-year-old males were less accurate than females on the Popper method. The latter pattern is in contradiction to the rest of Figure 3.

Figure 4 shows the extended height estimates. The age trend was similar to that of the standing height estimates. Namely, the children tended to underestimate but the adolescents tended to overestimate this dimension. The Popper test results showed higher overestimation than the grid, but opposite sex differences for ages eighteen and twenty. The grid consistently depicted the males as being more accurate than the females. The data of the grid estimates appears to be more in agreement with the developmental trend that might be expected. Perhaps the Popper method has contributed spurious data for both of the vertical estimates of standing and extended height.

The span estimates shown in Figure 5 presents a somewhat confusing picture when grid and Popper methods are compared. The age groups of the grid measures paralleled each other as did the Popper measures, but the tendency to underestimate was more marked with the grid method than with
Figure 4. Extended Height
Legend:

- Male, Popper
- Female, Popper
- Male, Grid
- Female, Grid

Figure 5. Span Estimates
the Popper method. In all cases the males for each method had a greater underestimate than the females. It may be that individuals vary considerably in the way this dimension is perceived and that the dimension does not have a general role in the function of the body image of adolescents.

Both the shoulder width estimates shown in Figure 6 and the hip width estimates shown in Figure 7 are perplexing. In the shoulder width dimension, female estimates of the grid and Popper methods very closely approximated each other. This was true also of male eighteen-year-olds. However, the scores of the twenty-year-old males for the two methods were in reverse directions with the Popper method resulting in an overestimation that was greater than the underestimation of the grid method.

An examination of Figure 7 of hip width estimates shows that female subjects were consistently more accurate using the grid method and both methods showed an overestimate for all female adolescents. The Popper method shows the males were more accurate than females in both age groups. In the grid measures the males were less accurate than females for age eighteen, while for age twenty the males were more accurate but underestimated. This is the only hip width underestimate for any age group and its meaning is not understood. For this body dimension all grid measures
Figure 6. Shoulder Width Estimates

Legend:
- □ = Male, Popper
- ○ = Female, Popper
- ■ = Male, Grid
- ★ = Female, Grid
were more accurate than all Popper measures made by the same groups. The greater accuracy of the grid is suggested in all estimates with the exception of the span estimates.

Means and standard deviations for age groups of eight, ten, twelve, eighteen, and twenty years for the motor tasks used in Woods' study are shown in Table 4. An inspection of Table 4 shows a developmental trend toward skill improvement for the children aged eight through twelve years, and a general picture of a more stabilized level of performance for the adolescent subjects.

Figures 8, 9, and 10 diagramatically show the results of the motor tasks. Suggested by the figures is a trend toward increased sex difference as a function of age. This trend would be expected in agreement with what is known of motor skill development.

In Figure 8, showing the results of the Catching-Throwing task, a trend of males to improve with age and adolescent females to be less skilled than children aged twelve was indicated. There were relatively small sex differences up to age twelve, but the twenty-year-old subjects showed a marked sex difference on this task.

The Target Jump scores in Figure 9, showed a tendency toward increased accuracy with increased age. The male subjects were more accurate than the females across all age groups. This sex difference is somewhat greater for
Figure 7. Hip Width Estimates
<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 Mean S.D. Female Mean S.D.</td>
<td>Male Mean S.D. Female Mean S.D.</td>
<td>Male Mean S.D. Female Mean S.D.</td>
</tr>
<tr>
<td>8</td>
<td>13.77 5.16 14.1 5.32</td>
<td>21.23 17.06 15.75 11.29</td>
<td>12.25 1.00 12.74 0.90</td>
</tr>
<tr>
<td>10</td>
<td>28.45 3.90 23.95 5.41</td>
<td>11.95 5.24 11.60 6.34</td>
<td>11.34 0.94 11.91 1.10</td>
</tr>
<tr>
<td>12</td>
<td>33.11 5.11 31.93 5.47</td>
<td>9.61 3.72 11.90 6.89</td>
<td>10.29 0.88 11.11 0.74</td>
</tr>
<tr>
<td>18</td>
<td>39.00 9.76 28.00 9.29</td>
<td>6.33 2.87 12.29 0.85</td>
<td>10.73 0.45 8.50 4.62</td>
</tr>
<tr>
<td>20</td>
<td>37.90 11.34 25.50 9.83</td>
<td>5.54 3.53 7.87 4.32</td>
<td>10.73 0.52 12.06 0.46</td>
</tr>
</tbody>
</table>
Legend:

- □ = Male
- ○ = Female

Figure 8. Catching-Throwing
Legend:

□ = Male
○ = Female

Figure 9. Target Jump
Legend:

☐ = Male
○ = Female

Figure 10. Shuttle Run
adolescents than for the prepubescent subjects, which is similar to the type of difference mentioned for the Catching-Throwing task.

The developmental picture, in Figure 10, of the Shuttle Run scores, was considerably different from the other Woods' study motor tasks. The adolescent male scores show relatively little change from the twelve-year-old group. The sex differences are evident for both the eighteen and twenty-year-old subjects. However, the females of eighteen years had a distinct improvement over all other age and sex groups, and the twenty-year-old females scored poorer than any groups except the eight-year-olds. No explanation can be made of this information, except to say that it will be seen that this is the only motor task that resulted in this confounded picture.

The Scott-French Motor Ability Tests, the results of which are in Table 5, do not yield developmental data in this study, since they were not administered to the younger age groups.

In the results of the Obstacle Race there were sex but no appreciable age differences. The results of the Basketball Throw and the Broad Jump show an improved performance for males and a poorer performance for females with both of the older age groups.

Table 6 has presented a summary of the significant
TABLE 5. MEAN AND STANDARD DEVIATION FOR SCOTT-FRENCH MOTOR ABILITY TESTS

<table>
<thead>
<tr>
<th>Age</th>
<th>18</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Obstacle mean, cm</td>
<td>17.81</td>
<td>21.54</td>
</tr>
<tr>
<td>S.D.</td>
<td>1.11</td>
<td>1.45</td>
</tr>
<tr>
<td>Basketball mean, cm</td>
<td>78.56</td>
<td>41.60</td>
</tr>
<tr>
<td>S.D.</td>
<td>17.34</td>
<td>12.53</td>
</tr>
<tr>
<td>Broad Jump mean, cm</td>
<td>91.11</td>
<td>70.70</td>
</tr>
<tr>
<td>S.D.</td>
<td>16.26</td>
<td>8.07</td>
</tr>
</tbody>
</table>
correlation coefficients for all independent and dependent variables for all subjects aged eighteen years. An examination of the grid measures showed that each of the grid estimates of body space dimensions significantly related to two or three other grid estimates. Significantly related at the .001 level were:

1. Standing and extended height (.724)
2. Span and shoulder width (.689)
3. Shoulder and hip width (.709).

Extended height and span correlated .586 at the .01 level; and, span and hip width correlated at the .05 level (.483). The high level of confidence of all of the above significant relationships were sufficient to reject the statistical hypothesis, \( H: \rho = 0 \), for all these relations. In addition to the above correlations, the following grid estimates were related at the .10 level:

1. Standing height and span (.421)
2. Standing height and shoulder width (.383).

In general, the investigator has accepted the .10 confidence level as being significantly important. However, the .10 level may be questionable for testing the significance of interrelatedness of estimates of body space. The actual dimensions of the body generally are considered as being very highly related one to another.

The high degree of relation of standing and extended
| Grid St. Ht. - Est. Dis. | 0.46 | 0.40 | 0.46 | 0.50 | 0.48 | 0.50 | 0.50 | 0.48 | 0.46 | 0.48 | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 |
| Grid Ex. Ht. - Est. Dis. | 0.40 | 0.50 | 0.46 | 0.50 | 0.48 | 0.50 | 0.50 | 0.48 | 0.46 | 0.48 | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 |
| Grid Sh. W. - Est. Dis. | 0.46 | 0.40 | 0.46 | 0.50 | 0.48 | 0.50 | 0.50 | 0.48 | 0.46 | 0.48 | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 |
| Grid Ht. W. - Est. Dis. | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 | 0.48 | 0.46 | 0.48 | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 |

**Significant:**
- a = .001
- b = .005
- c = .01
- d = .02
- e = .10
heights, and of shoulder and hip widths, could be interpreted as measuring the same thing. That is, perhaps standing height and extended height show how the subject operates with the vertical dimensions, and, shoulder width and hip width show the individual's perceived size in the horizontal dimensions.

The data in Table 6 showed that the Popper test had only two inter-estimate correlations of significance. Shoulder and hip width were correlated at the .001 level (.782). The two height measures related significantly at the .05 level (.475).

A further analysis of Table 6 indicated that there were five significant correlations between the grid and Popper methods. These were as follows:

1. Grid span and Popper span at the .001 level (.666)
2. Grid standing height and Popper standing height at the .02 level (.536)
3. Grid extended height and Popper span at the .02 level (.536)
4. Grid shoulder width and Popper span at the .10 level (.391)
5. Grid and Popper hip widths at the .10 level (.408).

Thus, each of the grid measures related significantly to one Popper measure, but showed no significant relation to the Popper estimates of extended height or shoulder width. The Popper span estimate was the Popper measure that most consistently related to the grid test.
An examination of Table 6 shows that motor tasks related exclusively to grid and Popper estimates of the horizontal dimensions. There were two grid estimates that were significantly correlated with motor tasks. These were relations at the .10 level as follows:

1. Shoulder width and the obstacle race (.374)
2. Hip width and the target jump (.373).

For subjects aged eighteen, the Popper test had nine significant correlations with motor tasks. Span and catching-throwing related at .05 level (.467). All other correlations were with only the hip and shoulder dimensions. The following were the relations between shoulder width and:

1. Shuttle run at the .02 level (.525)
2. Target jump at the .05 level (.441)
3. Obstacle race at the .05 level (.479)
4. Broad jump at the .02 level (-.535).

The following were the correlations of hip width and:
1. Shuttle run at the .10 level (.414)
2. Target jump at the .05 level (.434)
3. Obstacle race at the .02 level (.505)
4. Broad jump at the .01 level (-.584).

Table 6 shows that, for the eighteen-year-old subjects, the results of all motor tasks, except catching-throwing, were interrelated. Catching-throwing related significantly
only to the obstacle race. This correlation was at the .10 level (-.396). The following were the other significant correlations:

1. Shuttle run and:
   a. Obstacle race at the .001 level (.902)
   b. Basketball throw at the .001 level (-.816)
   c. Broad jump at the .001 level (-.667)
   d. Target jump at the .10 level (.386)

2. Target jump and:
   a. Obstacle race at the .05 level (.452)
   b. Basketball throw at the .05 level (-.495)
   c. Broad jump at the .05 level (-.493)

3. Basketball throw and:
   a. Broad jump at the .005 level (.644)
   b. Obstacle race at the .001 level (-.801)

4. Obstacle race and broad jump at the .001 level (.708).

That the broad jump is so highly correlated to the basketball throw is of interest, in that, the former tests explosive leg strength, and the latter, arm strength. It is not surprising that the obstacle race and shuttle run were highly related, as both may be thought of as representing the ability of the performer to move his body in space against a time motivation. The obstacle race involves a much greater variety in the body's maneuvering in space
and was therefore expected to be more discriminating than
the shuttle run.

The meaning of the relationships of the other motor
tasks cannot be determined with certainty. However, the
results could be interpreted as indicating that, in general,
the eighteen-year-old subjects that performed poorly in one
motor task performed poorly consistently, or vice versa
for the better skilled.

Table 7 depicts a summary of the correlation coeffi-
cient, for independent and dependent variables for subjects
aged twenty years.

The within-grid estimates all significantly correlated
with all other estimates except for the relation of standing
height and shoulder width. Though this latter relationship
was not significantly related, the two estimates did not
miss the .10 level by very much. Thus, there is a high
consistency evidenced between the various body dimensions
as represented by the grid.

The .001 level correlations were as follows:
1. Standing and extended heights (.921)
2. Span and shoulder width (.791)
3. Span and hip width (.742)
4. Shoulder and hip widths (.828)
At the .02 level were:
1. Span and extended height (.544)
TABLE 7. SUMMARY OF THE CORRELATION COEFFICIENTS FOR INDEPENDENT AND DEPENDENT VARIABLES FOR 
SUBJECTS: AGED TWENTY

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Significant: a = .001  d = .02
b = .005  e = .05
c = .01  f = .10
2. Extended height and shoulder width (.538)
3. Extended height and hip width (.548)
Perhaps the .10 level should not be accepted for the relation of those variables as stated previously for the eighteen-year-olds. These were:
1. Standing height and hip width (.380)
2. Standing height and span (.418)

In addition to the significant relations between the horizontal dimensions and between the vertical dimensions, that were previously discussed, there is the further picture of the relationship of the two measures that deal with extended body space.

Table 7 shows a greater number of inter-estimate relations for the Popper test than was the case for the subjects aged eighteen. The following were significantly related:
1. The two height estimates at the .001 level (.746)
2. The two width estimates at the .01 level (.556)
3. Span and hip width at the .02 level (.522)
In addition there were three correlations at the .10 level:
1. Standing height and shoulder width
2. Extended height and shoulder width
3. Extended height and hip width.
Unlike the results of the grid test, the extended measures of extended height and span were not significantly related.

Further consideration of Table 7 shows a more consistent relation between the Popper and grid methods than was
found for the eighteen-year-old subjects. The following relations were found to be significant:

1. Related at the .005 level were:
   a. Grid standing and Popper extended heights (.628)
   b. Grid and Popper extended heights (.647)
   c. Grid and Popper hip widths.

2. Related at the .02 level were:
   a. Grid hip width and Popper extended height (.535)
   b. Grid hip width and Popper span (.509).

At the .05 level grid span and Popper extended height were related (.452). Related at the .10 level were:

1. Grid and Popper standing heights (.409)

2. Grid shoulder width with:
   a. Popper standing height (.407)
   b. Popper extended height (.390)
   c. Popper hip width (.394).

There was a relation between four motor tasks and the width estimate of the grid, as shown in Table 7. These significant correlations were as follows:

1. Shoulder width and:
   a. Shuttle run at the .05 level (.461)
   b. Obstacle race at the .005 level (.598)
   c. Basketball throw at the .005 level (-.603)
   d. Broad jump at the .10 level (-.395)
2. Hip width and:
   a. Shuttle run at the .02 level (.523)
   b. Obstacle race at the .005 level (.628)
   c. Basketball throw at the .005 level (.607)
   d. Broad jump at the .05 level (.474).

   It was noticed that there were somewhat higher correlations with the hip dimension then with the shoulder dimension.

   Table 7 also shows that the barrier score is significantly and indirectly related at the .10 level to over-estimates of grid standing height (.403), and grid extended height (.379). Evidently an overestimate in the vertical dimension is indicative of a well-defined body image. This may suggest that an individual with a well-articulated body image unconsciously extends his image to include more of the nearby space as part of himself. Table 7, by itself, does not establish a complete meaning for the analysis that has been given.

   The results that show relations between the Popper test and motor skills are interesting in that the pattern was found to be different for the twenty-year-olds than the other groups. The three motor tasks of broad jump, obstacle race and shuttle run had positive significant relationships to Popper estimates. These were:

   1. Standing height and:
a. Shuttle run .10 level (.403)
b. Obstacle race .01 level (.551)
c. Broad jump .005 level (-.643)

2. Extended height and:
   a. Obstacle race .05 level (.484)
   b. Broad jump .05 level (-.500)

3. Hip width and:
   a. Shuttle run .05 level (.498)
   b. Obstacle race .02 level (.530)
   c. Broad jump .10 level (-.403).

There were no significant relations between the Popper estimates and barrier score, as was true also of the age group previously discussed. The other tables showing sex differences may account for the above relations. This is mentioned here, for the apparent sex differences found in this study may well have confounded the meaning of some of the data of the age groups.

Table 8, as with the previous tables, has shown the grid estimates to be inter-correlated. The results were:

1. At the .001 level grid standing and extended heights (.814)

2. At the .01 level:
   a. Hip width and span (.585)
   b. Hip width and shoulder width (.580)

3. At the .05 level:
   a. Extended height and span (.492)
TABLE 8. SUMMARY OF THE CORRELATION COEFFICIENTS FOR INDEPENDENT AND DEPENDENT VARIABLES FOR SUBJECTS: ALL FEMALES

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Significant:  a = .001,  d = .02  
             b = .005,  e = .05  
             c = .01,  f = .10
b. Extended height and hip width (.496)
c. Span and shoulder width (.446)

4. At the .10 level standing height and hip width (.420).

There were four significant inter-estimate correlations on the Popper test. These were:

1. Standing and extended height significant at the .02 level (.540)
2. Extended height and span at the .01 level (.595)
3. Span and hip width at the .10 level (.403)
4. Hip width and shoulder width at the .005 level (.670).

The grid and Popper tests were significantly related at high levels of confidence, as follows:

1. At the .001 level:
   a. Grid standing and Popper extended (.746)
   b. Grid extended and Popper extended (.710)
   c. Grid extended and Popper span (.739)

2. At the .005 level:
   a. Grid and Popper span (.633)
   b. Grid shoulder width and Popper span (.605)
   c. Grid and Popper hip width (.607)

3. At the .01 level grid hip width and Popper extended height.

4. At the .02 level:
   a. Grid and Popper standing height (.550)
   b. Grid standing height and Popper span (.548)
c. Grid span and Popper extended height (.544)
d. Grid hip width and Popper span (.555).

The meaning of the inter-relationships within both the grid and Popper tests may be interpreted as for the previous tables.

Table 8 shows two types of relations between motor skills and grid over-estimated scores. The first type is indirect and was shown by the following correlations:

1. At the .05 level:
   a. Basketball throw and standing height (-.512)
   b. Basketball throw and shoulder width (-.504)
   c. Shoulder width and obstacle race (.465)

2. At the .10 level:
   a. Basketball throw and extended height (-.406)
   b. Basketball throw and hip width (-.432).

The second type of motor skill and grid relation is direct and was only found with the catching-throwing task. The grid estimates significantly related to catching-throwing were:

1. Extended height at the .05 level (.482)
2. Span at the .10 level (.559)
3. Shoulder width at the .05 level (.485).

These results may imply something about the nature of the way an individual perceives his body size, and the way he utilizes the nearby space just beyond his reach.
The relationships of the Popper estimates to motor skills was distinctly different from the grid motor skills relations. Again both direct and inverse relations were present, but in terms of some different skills.

The direct relations were:

1. Broad jump and standing height at the .10 level (.443)
2. Catching and throwing with:
   a. Extended height at the .10 level (.441)
   b. Span at the .001 level (.759)

The indirect relationships were:

1. Basketball and extended height at the .10 level (-.437)
2. Shoulder width and:
   a. Obstacle race at the .10 level
   b. At the .005 level:
      (1) Shuttle run (.614)
      (2) Broad jump (-.638)
3. Hip width and:
   a. Broad jump at the .02 level (-.516)
   b. At the .05 level:
      (1) Shuttle run (.480)
      (2) Obstacle race (.500)

Interpretations that may be suggested by the patterns found with the grid and Popper methods are:

1. Some of the Popper estimates may have shown erratic
relations. The only significant relationship that did not follow the pattern of the other relations was the positive relation of Popper standing height and broad jump. The previous tables have shown that there was no difference between the eighteen and twenty-year-old female performance of the broad jump. There was also no age difference for females on the grid estimate of standing height. On the other hand the Popper height estimate was overestimated more for twenty-year-olds than for the aged eighteen group. Since the broad jump was negatively correlated to body dimension estimates in all other instances, the Popper estimate of standing height appears to have been spurious.

2. The consistently positive correlation between catching-throwing and extended grid and Popper estimates suggests that performance of motor tasks that involve the manipulation of an object in nearby space may be dependent on the individual's perception of the body width dimensions, or vice versa; and, the individual's ability to extend his body into the surrounding space.

3. The reverse direction of correlation was found between the basketball throw and both vertical and horizontal dimensions. Whether the reversal in direction indicates a difference in the use of the force movement element, the use of the space movement element, or both elements, is not clear. Or, it is possible that some
relation to different uses of different body dimensions may be suggested.

4. As previously indicated, there were sex differences indicated by results shown in Tables 2 and 3. The female pattern of the relation of motor tasks and body estimates shows that, in general, motor tasks were positively correlated to estimates of body space of both grid and Pepper methods. Previous data have shown that the females were less accurate in estimating body dimensions, and poorer in performance of motor skills. This may suggest that motor skill and awareness of the actual body dimensions are correlated. If this is the case, accurately represented dimensions may relate to conscious behavior, and imply the need to be consciously aware of an actual body dimension when that dimension has not become an automatically perceived part of the self. If this rationale is accepted, then poor motor performance may relate to the need to perceive the body in a conscious manner. Thus conscious awareness of the body may precede the development of an unconscious mode of performing.

As might be expected from the previous tables, there were several interrelated motor tasks. These were:

1. At the .001 level:
   a. Shuttle run and obstacle race (.841)
   b. Shuttle run and broad jump (-.679)
c. Obstacle race and broad jump (−.680)

2. At the .01 level, the obstacle race and broad jump (−.586)

3. At the .05 level, the shuttle run and the basketball throw (−.505)

4. At the .10 level:
   a. Basketball throw and target jump (−.441)
   b. Broad jump and catching-throwing (−.383).

Of all the above relations, catching-throwing is the only motor task that is inversely related to other motor tasks. There is the suggestion of a pattern of all of the inverse relations of this table. The negative relations were:

1. Broad jump and:
   a. Catching-throwing
   b. Popper standing height

2. Catching-throwing and:
   a. Extended and shoulder grid measures
   b. Popper extended measures.

Interpretations have been suggested in part, but the total meaning is puzzling, and no interpretation seems to account completely for the results.

The barrier score was related to:

1. Shuttle run at the .05 level (.457)
2. Obstacle race at the .05 level (.484)
3. Basketball throw at the .10 level (.405).

There were no other significant barrier score relationships.
for the female subjects. Indicated is the suggestion that performance of motor tasks is related to barrier score as a reciprocity function. This implies that a state of mutual interdependency exists.

In Table 9 all grid estimates interrelated with two other grid estimates. These significant correlations were:

1. At the .001 level:
   a. Standing and extended height (.832)
   b. Shoulder and hip width (.855)
   c. Shoulder width and span (.715)
2. At the .005 level hip and span (.578)
3. At the .02 level span and extended height (.522)
4. At the .10 level extended height and shoulder width (.387).

The significant interrelations of the Popper method were:

1. Standing and extended height at the .001 level (.704)
2. Shoulder and hip width at the .005 level (.641)
3. Span and hip width at the .05 level (.459)
4. At the .10 level:
   a. Standing height and shoulder width (.390)
   b. Extended height and shoulder width (.387)

For male subjects all of the significant relations between grid estimates and motor tasks were directly related. They were as follows:

1. At the .05 level:
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Significant: a = .001 d = .02 b = .005 e = .05 c = .01 f = .10
a. Basketball throw and standing height (.471)
b. Basketball throw and extended height (.438)
c. Target jump and span (-.433)

2. At the .10 level:
   a. Shuttle run and:
      (1) Standing height (-.410)
      (2) Extended height (-.402)
      (3) Span (-.368)
   b. Obstacle race and extended height (-.370)

Table 9 shows that there were no significant relationships between the Woods' motor tasks and any Popper estimates. All three of the Scott-French tests were significantly related at the .10 level to the Popper estimate of shoulder width, as follows:

1. Indirectly related to:
   a. The obstacle race (.419)
   b. The broad jump (-.369)

2. Directly related to the basketball throw (.360).

Perhaps the Popper results were erroneous. However, the suggestion may be made that the relative accuracy, of the representation of the shoulder width dimension as compared to the height estimation, is the common factor in the above relationship. In this light, the male pattern is the same as the female pattern and may be interpreted the same way. Therefore, the only sex differences were:
1. A difference in the level of performance of the motor tasks.

2. A difference in the degree of accuracy in representing the body dimensions.

Both methods of estimating body space showed an inverse relationship between the barrier score and estimates of the vertical dimensions. At the .05 level, the barrier score was related to grid estimates of standing height (−.454) and extended height (−.461). The Popper extended height estimate was related to barrier score at the .05 level. This is the only Popper estimate for any group that was significantly related to barrier score.

There were several fairly consistent patterns shown by the results. The following statements summarize the results:

1. Comparison of the grid and Popper methods.

Both the grid test and the Popper test showed within-method correlations. From this it would seem that each test, when considered separately, appeared to be a consistent tool. In addition the two tests were found to correlate with each other. This result would be expected, since both shared a common reference—namely, that of the actual body dimensions of the individual. All estimates of the grid test were more accurately represented than the estimates of the Popper test, and the grid method more frequently
was significantly related to the other variables of the study. This suggests that the grid is a more potent tool for estimating the dimensions of body space.

2. Comparison of the general relation of variables that were found, for two or more groups:
   a. The barrier score was inversely related to overestimates of the vertical dimensions of body space.
   b. Motor skill was related to the estimates of body space.
   c. All motor skills were inter-correlated.
   d. The catching-throwing task was the only motor skill that was inversely related. This direction of relationship held for both inter-motor task relations and for relations with extended and/or with width dimensions.
   e. Horizontal dimensions were more accurately represented than the vertical dimensions.

3. Comparison of male and female subjects:
   a. Females:
      (1) Barrier score was not significantly related to any estimates of body space.
      (2) Barrier score was negatively related to motor skills.
      (3) The motor skills that related to barrier score were also positively related to horizontal estimates of body space.
      (4) Motor skills were correlated to all dimensions of the body.
(5) The estimates of both the horizontal and vertical estimates of dimensions were consistently less accurate than male subjects.

b. Males:

(1) Barrier score was inversely related to the vertical estimated dimensions.

(2) Barrier score was not significantly related to motor tasks.

(3) The motor performance level of male subjects was distinctly and consistently superior to the performance of female subjects.
CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this study was to explore the relationships between the body image boundary, certain diverse movement tasks, and estimation of the dimensions of body space in late adolescent subjects.

It was theorized that movement performance, and conscious and unconscious body concepts were mutually dependent expressions of the body/self. The treatment of the data was from the organismic theoretical position that was considered to be in keeping with existential philosophical views. The study was designed to support or question the developmental hypothesis that a well-articulated self concept is a process of differentiating the self from the non-self.

The design of the study included three types of variables: The first type was a series of gross motor tasks, the second, an index evaluating body boundary definiteness, and the third, a series of estimates of the body's personal space.

Two years ago, an exploration of the interrelations of these variables was conducted on children aged eight, ten, and twelve years. The present investigation explored the
relations of the same variables in ages eighteen through twenty years.

Thirty eight Ohio State University students were subjects for the study. The number of subjects for the discrete age and sex groups were:

- eighteen-year-old males = 9
- eighteen-year-old females = 10
- twenty-year-old males = 11
- twenty-year-old females = 8

The research design basically replicated the design of the previous study. This replication yielded data, which when added to the data of the previous research, suggested a developmental pattern for the variables considered. The study extended the prior investigation of the variables by including additional motor skill tasks and by introducing a second method of assessing the percept of body space. The specific measures used were as follows:

1. Barrier Score

2. Estimates of dimensions of body space using two methods:
   a. Popper Height Estimation Test modified by the writer of the previous study.
   b. Grid test for estimating vertical and horizontal dimensions designed by this investigator.

3. Actual body dimensions of body space.

4. Motor tasks used in the previous study:
   a. Catching-Throwing
b. Shuttle Run

c. Target Jump

5. Scott-French Motor Ability Test:
   a. Obstacle Race
   b. Basketball Throw for Distance
   c. Standing Broad Jump,

The Barrier Score was assumed to tap unconscious behavior in the assessment of the body image boundary. The projective technique of the Holtzman Inkblot Test was used to assess body image boundary. The protocols for this test were blind scored by Dr. Seymour Fisher. A barrier score was determined by tallying the number of barrier responses.

The manner by which a subject perceives his body dimensions was considered to be a function of his body image concept. The methods used to estimate body space were assumed to tap both conscious and unconscious factors of behavior. The qualitative aspects of the estimated dimensions were held to be as predictive of the body image percept as the quantitative score. Therefore, the direction as well as the degree of discrepancy was analyzed. The Popper method of estimating body dimensions utilized a symbolizing process that suggested a yield of certain spurious results. The grid test was designed to eliminate the role of the symbolization in an attempt to assess the body image as it functions in toto in dealing with the
The main reason for the study intended the use of a linear rule for predicting relationships in the existent population. In making inferences a bivariate normal distribution was assumed. The linear correlation approach was used to analyze the results, since the interest was in actually predicting one individual's status on another in a population where the independent variables represented natural or previously acquired characteristics of the individual.

The following questions posed in Chapter II may be answered as follows:

1. What would be the relations between each of the motor tasks and body image boundary?

   Significant relationships between motor skills and barrier score were found only with the female subjects, for which the Shuttle Run, Obstacle Race and Basketball Throw were the significantly related tasks.

2. How would each of the two methods used to measure estimation of body dimensions compare in relating to body image boundary, and in relating to each of the motor tasks?

   The results as analyzed in Chapter IV may be summarized as follows:

   a. Methods of estimating relating to barrier score.

      Five significant correlations were found. Of
these five, the male subjects' grid estimates of the two vertical dimensions, and the Pepper estimates of the extended height dimension were significantly related; and both vertical grid estimates were found to be significantly related for twenty-year-old subjects. All significantly related grid estimates were at a higher confidence level than the Pepper estimates.

b. Methods of estimating relating to motor tasks.

For the four groups analyzed, the grid method was significantly related to several motor tasks. For eighteen-year-olds the Obstacle Race and the Target Jump related to the horizontal dimensions. For the twenty-year-olds, all motor tasks except the Target Jump and the Shuttle Run were related to the horizontal dimensions. For the female subjects, Catching-Throwing and the Basketball Throw were related to vertical and horizontal dimensions, and the Obstacle Race was related to shoulder width. For male subjects, the Basketball Throw, Obstacle Race, and Shuttle Run were related to the height dimensions. The Target Jump and the Shuttle Run were related to the extended dimensions.

For the four groups analyzed the Pepper method
was significantly related to several motor tasks. For the eighteen-year-olds all the motor tasks, except the Basketball Throw, were related to horizontal dimensions. For the subjects aged twenty the Bread Jump, Obstacle Race, and Shuttle Run were related to the vertical dimensions and to hip width. For the female subjects, the Bread Jump, Basketball Throw and Catching-Throwing were related to vertical dimensions. All motor tasks, except the Target Jump and Basketball Throw were related to the horizontal dimensions. For the male subjects, all of the Scott-French test items related to shoulder width.

3. Would any sex differences occur in the relation between any variables?

a. For female subjects:

There were no significant relationships between barrier score and any variables except the motor tasks of Shuttle Run, Obstacle Race, and Bread Jump. These motor tasks were all negatively related. With the exception of the Catching-Throwing task which was negatively correlated, all other related motor tasks were positively correlated to estimates of body dimensions. Of the latter correlations, nine tasks were correlated with the width dimensions, and
three were correlated with height dimensions.

b. For male subjects:

Barrier score was positively correlated with the height dimensions, but was not significantly related to any motor tasks. The motor tasks that were related to the grid estimates were all negatively correlated. The Broad Jump and Obstacle Race were positively correlated to the Pepper estimates, but the Basketball Throw was negatively correlated. Motor tasks related to the grid estimates only with the vertical and extended dimensions. Motor tasks related to the Pepper test only with the shoulder width estimates.

4. What developmental pattern would be indicated, in terms of the tests which were employed in both studies, when the data of this study was added to that of the previous study?

Figures 2 through 10, discussed in Chapter IV, showed the developmental trend of the variables. These may be summarized as follows:

a. Barrier score increased with age, but, whereas the female children had a higher score than the male children, the adolescent male barrier score was higher than that of female adolescents. The difference between sexes, however, was quantitatively smaller
than the quantitative sex differences of the children.

b. As was pointed out in the previous chapter, only the Pepper method of estimating body space contributed data that may be added to the data of the children used in the previous study.

The standing height was underestimated by children and the two sexes had parallel changes with the female children being consistently more accurate than male children. The adolescent subjects overestimated. There were no sex differences at age eighteen, but at age twenty the females increased their overestimate while the males became more accurate. The quantitative accuracy for adolescents was comparable to the amount of accuracy evidenced by twelve-year-olds, but the sex difference pattern in degree of accuracy was reversed.

For the children of the previous study, there was a trend toward increased underestimation of extended height, and decreased sex differences with the females being more accurate. The adolescent subjects overestimated this dimension. At age eighteen the male overestimation was greater than the overestimation of females. The reverse was found for twenty-year-olds. The quantitative accuracy of this dimension was developmentally about the same as found for standing height.
As with the previous height estimates, the children's span estimates were in the direction of an increased underestimation. Their sex differences were parallel, but the female subjects were more accurate. The only change for adolescent subjects was a trend toward greater accuracy --- more so at age eighteen than at age twenty.

The estimates of shoulder width for children progressed from a tendency toward overestimation toward a slight tendency for underestimation. The sex pattern changed at age twelve with males overestimating and females underestimating. All adolescents overestimated. The aged eighteen females overestimated more than males. The aged twenty pattern was reversed with females being more accurate.

The hip estimates of all children were consistently overestimated, becoming increasingly more accurate, with the females being less accurate than the males. The sex difference changed with age for adolescent subjects. At age eighteen both sexes increased the overestimate from that of twelve-year-olds, but the males were more accurate than females. At age twenty the sex difference was more marked, with females being less accurate and the males more accurate.

c. The results of the testing of motor skill are
depicted in Figures 8 through 10. It can be seen that the children improved with age on all motor tasks with the males consistently showing superior ability.

The adolescent pattern on Catching-Throwing showed an increased sex difference with the males tending toward a consistent skill level that was superior to that of the children, and the females evidencing increasingly less skill than the twelve-year-old children of either sex.

The pattern of skill in the Target Jump, for adolescent subjects, continued in the developmental trend of the children.

The Shuttle Run pattern for adolescents changed with age for females only, so that the eighteen-year-old females performed better than any other group, but the aged twenty group of females were less skilled than any subjects but the eight-year-olds. The male adolescents performed only slightly better than the twelve-year-old males.

Though the developmental picture depicted by the two studies is not conclusive, the developmental trends were toward an overestimation of the dimensions of body space and toward greater accuracy in representing the body dimensions, improved movement performance, and a higher barrier
score. These trends were in agreement with what was expected and predicted for the variables studied.

Figure II shows the interrelationships of variables that may be inferred from the data. The use of such a figure in the final chapter may be considered unconventional, but it helped to clarify, in a diagrammatic manner, the total pattern presented as a conclusion to this study. According to Figure II, the data may be interpreted as inferring relationships between barrier score, motor skill performance, overestimates of the vertical dimensions of body space, and the amount of accuracy represented by the estimates of horizontal dimensions of body space. No inference was made between any two variables unless a significant relation was found for at least one sex. Figure II shows the following:

1. The barrier score was higher for male subjects than it was for female subjects.
2. When sexes are compared, the males' performance on motor tasks was relatively superior. The females' performance on motor tasks was relatively poor.
3. Both males and females overestimated their height dimensions. This overestimate was quantitatively less for the male subjects.
4. The male and female subjects tended to be accurate
Variables | Sex | Direction of Relation
---|---|---
Barrier Score > Male: Female: 
Motor Skill > Male: Female: 
Vertical Over Estimates > Male: Female: 
Horizontal Accuracy > Male: Female: 

Legend:

Arrow length = Relative quantitative difference
Arrow direction = \[\text{Positive degree}\]
\[=\] \[\text{Negative degree}\]

Figure II. Inferred Interrelations of Variables
in representing their width dimensions, but the males were more accurate than the females.

The arrows in Figure II were intended to show whether the data indicated a positive or negative degree of relation. A comparison of any two variables in the figure indicates the actual or inferred direction of relationship. When these arrow directions are compared, the following either was found or may be inferred:

1. A comparison of barrier score and motor skill shows a positive relationship to good motor performance, and an inverse or negative relation to poor performance.

2. A comparison of barrier score and subjects' overestimation of the vertical body dimensions shows an inverse relationship for both sexes.

3. No inference may be made concerning the relation between barrier score and accuracy of representing horizontal dimensions, because there was no significant relationship shown for either sex.

4. A comparison of motor skill and overestimations shows sex differences, such that, the degree of relation is negative for males, and positive for females.

5. A comparison of motor skill and accuracy of estimating horizontal dimensions is directly related
to good motor performance and inversely related to poor motor performance.

6. A comparison of the overestimation of vertical dimensions and the tendency to accurately estimate the horizontal dimensions shows the two to be inversely related.

From these inferences this investigator has theorized that the following statements may be an explanation for the general patterns that occurred in this study:

1. It is meaningful to study both the qualitative and quantitative aspects of the variables of this study.

2. The barrier score represents the body image boundary which has been posited as tapping primarily the unconscious aspects of body image, and as indicating body boundary definiteness.

3. A subject overestimating the vertical dimensions, which has been found to relate to barrier score, may be thought to have operated unconsciously in representing his height dimensions. The opposite type of behavior, namely, conscious behavior, may be implied for the subject who accurately represented the horizontal body dimensions.

4. An accurate concept of the width of the body may relate to conscious aspects of behavior.
5. An individual may consciously estimate body size when the perceived size has not become sufficiently articulated.

6. The conscious direction of the attention to a particular body area may result in a more accurate percept of its size.

7. When the body image is well-articulated, the subject may be able to include more of his environment within his concept of his body size.

8. The ability to extend the self, as shown by an overestimation of body space, may enable the individual to manipulate his body and other objects in the space in which his body maneuvers.

Although the results of this study have been inconclusive, the data suggested certain patterns. These patterns were interpreted as indicating that estimates of body size, assessment of the body image boundary, and the level of movement performance were meaningfully interrelated.

The developmental trends of the data imply a maturational improvement in body image boundary definiteness, accompanied by, improved motor performance, and a tendency toward overestimation of body size. Sex differences in all variables were noted. The role of conscious and/or unconscious aspects of body image may be dependent on the development of the ability to manipulate the body in space;
or, may be a function of developed sex differences.

The value and meaning of the interpretations which have been inferred in this study lie in future research endeavors. The following are suggested:

1. A study of fourteen and sixteen year-olds in respect to the variables of this study.

2. Longitudinal studies on the development of body concept.

3. Collection of data on the variables to yield a picture of a large sample of the population across all age groups.

4. Comparison of the grid and Popper methods for all age groups and in relation to other methods of body image assessment.

5. Further exploration of the significance of estimating the body dimension in terms of accuracy and direction of estimate.

6. Longitudinal research on the developmental relationships of the variables of this study.

7. The study of the effect of motor skill training in relation to body image assessment.

8. A study of the relation of body image and the individual's attitudes of personal space.

9. A scoring of the inkblot protocols to study other personality factors in relation to the variables of this study.
10. A study of the relation of grid estimate of body dimensions and dance performers that are skilled in the art of expressive movement.
APPENDIX A
SCORE SHEET FOR MOTOR TASKS

NAME:______________________ SEX:____ DATE OF BIRTH:________

Number of Quarters enrolled as O.S.U. student = ________

Scott-French Motor Ability Test

1. Obstacle Race
   a. Pre-run estimated time =__________
   b. Post-run estimated time =__________
   c. Actual race time =________________

2. Basketball Throw for Distance =_______

3. Broad Jump =______________________

Woods Motor Tasks

1. Catch - Throw Wall Pass
   Number of catches of best trial =_____

2. Target Jump
   Plus or minus centimeters from toes = 1.___ 2.___ 3.___

3. Shuttle Run
   Time in nearest tenth second =________

Target Throw
   Plus or minus from target to nearest ½ foot______
APPENDIX B

SCORE SHEET FOR MODIFIED POPPER ESTIMATE
OF VERTICAL DIMENSIONS

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APPENDIX C

SCORE SHEET FOR MODIFIED POPPER ESTIMATE
OF HORIZONTAL DIMENSIONS

3.

Estimated Hip Width

2.

Estimated Shoulder Width

1.

Estimated Span

NAME:__________________________
APPENDIX D

SCORE SHEET FOR GRID ESTIMATES OF BODY DIMENSIONS,
AND ACTUAL BODY DIMENSIONS

NAME:_______________________________________________

1. Grid Estimates of Body Dimensions

   a. Vertical dimensions

      NOTE: Write number selected and if estimate is above that number, use A if estimate is at 1st space above number, use B if estimate is at unnumbered line above number, and use C if estimate is at 2nd space above number.

      1) Standing height estimate________
      2) Extended height estimate_______

   b. Horizontal dimensions

      NOTE: Write number selected and if estimate is beyond that number, use A if estimate is at 1st space beyond number use B if estimate is at unnumbered line beyond number, and C if estimate is at 2nd space beyond number.

      1) Estimated span left side: ______ right side:_______
      2) Estimated Shoulder Width left side:________
         right side:________
      3) Estimated Hip Width Left side:_______________
         Right side:________________

2. Actual Body Dimensions

   a. Vertical

      1) Standing height =_______
      2) Extended height =_______

   b. Horizontal

      1) Span =_______
      2) Shoulder width =_______
      3) Hip width =_________
APPENDIX F

GRID FOR HORIZONTAL ESTIMATES OF BODY SIZE
APPENDIX G

SUMMARY OF ALL CORRELATION COEFFICIENTS FOR INDEPENDENT AND DEPENDENT VARIABLES FOR ALL SUBJECTS
Table 10. Summary of the Correlation Coefficients for Independent and Dependent Variables for Subjects: All

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<td>0.02 ^ 0.1 ^ 0.2 ^ 0.3 ^ 0.4 ^ 0.5 ^ 0.6 ^ 0.7 ^ 0.8 ^ 0.9 ^ 1.0 ^</td>
<td>0.02 ^ 0.1 ^ 0.2 ^ 0.3 ^ 0.4 ^ 0.5 ^ 0.6 ^ 0.7 ^ 0.8 ^ 0.9 ^ 1.0 ^</td>
<td>0.02 ^ 0.1 ^ 0.2 ^ 0.3 ^ 0.4 ^ 0.5 ^ 0.6 ^ 0.7 ^ 0.8 ^ 0.9 ^ 1.0 ^</td>
<td>0.02 ^ 0.1 ^ 0.2 ^ 0.3 ^ 0.4 ^ 0.5 ^ 0.6 ^ 0.7 ^ 0.8 ^ 0.9 ^ 1.0 ^</td>
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<td>0.02 ^ 0.1 ^ 0.2 ^ 0.3 ^ 0.4 ^ 0.5 ^ 0.6 ^ 0.7 ^ 0.8 ^ 0.9 ^ 1.0 ^</td>
<td></td>
</tr>
</tbody>
</table>

Significant: a = .001  d = .02
b = .005  e = .05
c = .01  f = .10

Note: Correlation coefficients ranging from 0.01 to 0.99 indicate a significant relationship.
BIBLIOGRAPHY


