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THE EFFECTS OF A FREE EXERCISE COURSE
UPON THE KINESTHETIC SENSE
OF THE LIMBS

by

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A Thesis Submitted to
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pp. 71.

The purpose of this study was to determine the effects of a free exercise course upon the kinesthetic sense of the limbs. A secondary purpose was to determine a possible relationship between the kinesthetic sense of the limbs and free exercise ability.

Two female groups, ranging between the ages of twelve and fourteen were selected from The Curry School, Greensboro, North Carolina. The control group, consisting of ten students and the experimental group consisting seven students were pretested and posttested for kinesthetic sense of the limbs. In addition, the experimental group was rated for free exercise ability after ten hourly lessons in free exercise.

The raw scores were statistically treated to determine changes within and between groups, and to determine the relationship between kinesthetic sense of the limbs and free exercise ability. The results showed there was a significant difference between the pretest and posttest means for the kinesthetic sense of each limb in the experimental group. There was no significant difference between the means in the pretest and posttest battery scores for the control group. There was a significant difference between test items for the posttest results of the experimental group. There was no significant relationship between the kinesthetic sense of the limbs and free exercise ability. There was no significant difference in mean changes between the

experimental and the control groups. There was no significant difference in mean changes between the left and right limbs within the experimental group.

From these results the following conclusions were drawn:

1. Free exercise may have been the factor which contributed to the development of the kinesthetic sense of the limbs in the experimental group.
2. Kinesthetic sense was very specific to each segment of each limb.
3. There was no relationship between the kinesthetic sense of the limbs and free exercise ability.
4. There was no difference between the kinesthetic development of the left and right limbs, following ten hourly lessons in free exercise.

ACKNOWLEDGEMENT

The writer wishes to express her sincere gratitude to Dr. Marie Riley for her patience and understanding throughout this study.

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CHAPTER I

INTRODUCTION

Education deals with the development of the potentials of the individual. Each discipline possesses its own subject matter through which it endeavors to develop these potentials and, since physical education deals with the body and how it moves, motor learning becomes a main objective of physical education. This concept leads to many related factors which include both inherent and environmental elements which either inhibit or contribute to the motor educability of the individual.

It is apparent then, that motor learning takes place more readily when certain conditions are present. McCloy and his students, in investigating motor learning, identified sixteen factors in motor educability, one of which was "general kinesthetic sensitivity and control".¹ Glassow and Cooper observed that little effort on the part of the student or the educator has been made to consciously develop kinesthetic memory and further supported the importance of kinesthesia, not only as an element of motor educability, but also as a means of control for muscle and joint action.²

¹ Charles Harold McCloy, "A Preliminary Study of Factors in Motor Educability," The Research Quarterly, 11:30, May, 1940.

² John M. Cooper and Ruth B. Glassow, Kinesiology (St. Louis: C. V. Mosby Company, 1962), p. 202.

Oberteuffer has stated:

...neither the psychologist nor the physical educator knows enough at the moment about these elements and how they may be developed or improved, to be of much aid to the teacher who wants to teach in the best possible way. The factors are there. A study in them is eminently worth while....³

The importance of kinesthetic sense in motor learning and the need for research in this area provided the foundation for this study. More specifically, the investigator was concerned with the kinesthetic sense as a potential that may be developed like any other sense and in relation to a specific activity, namely, free exercise.

There are various definitions of kinesthesia. They are not conflicting, but rather complement one another and depend upon the purpose of the author. Scott says:

Kinesthesia is defined as that sense which enables the person to perceive the position and movement of the total body and its parts. It is the basis for balance, both dynamic and static, for knowing the gradations of effort put into a movement and for duplicating movement previously performed.⁴

Wells points out that kinesthesia is not only the perception and awareness of the body and its parts but also that "...in learning any given

³ Delbert Oberteuffer, Physical Education (New York: Harper and Brothers Publishing Company, 1951), p. 250.

⁴ Gladys M. Scott and Esther French, Measurement and Evaluation in Physical Education (Dubuque, Iowa: Wm. C. Brown Company, 1959), p. 390.

skill the memory for former sensations and the consciousness of present ones in the performance of this skill help us to judge the correctness of our movements."⁵

Steinhaus gives a philosophical as well as a physiological account of kinesthesia. He says,

... as sunsets stimulate the eyes, so movement and position stimulate the proprioceptors. In fact the substance that lends meaning to most mind symbols with which we remember, think, reason, and dream is compounded in large measure of such kinaesthetic ingredients.⁶

This investigation of the development of kinesthesia was conducted in relation to free exercise for three reasons: first, because of the observable relationship between the ability to sense one's position in space (kinesthetic sense) and the ability to perform free exercise which is a combination of dance and gymnastics; second, because free exercise involves the action of the total body, and is creative and feminine in its composition and performance; third, because free exercise continues to have more importance within the physical education program.

Thus, this study was undertaken in an effort to understand more fully the development of kinesthesia through free exercise. It was also

⁵Katherine F. Wells, Kinesiology (Philadelphia: W. B. Saunders Company, 1960), p. 515.

⁶Arthur Steinhaus, "What is Dance?" Journal of Health, Physical Education Recreation, 23:11, February, 1952.

concerned with a comparison between the physical education program and free exercise as developmental factors in the improvement of kinesthesia.

STATEMENT OF PROBLEM

The purpose of this study was to determine the effect of physical education on the kinesthetic sense of the subject. The study was conducted in a physical education class at the University of Illinois at Urbana-Champaign. The subjects were 20 college students who were divided into two groups. One group received physical education and the other group did not. The study was conducted over a period of six weeks.

DEFINITION OF TERMS

Kinesthesia is defined as the sense of movement or position of the body through the use of the muscles and joints. It is the sense of the position and movement of the body parts. It is the sense of the position and movement of the body parts. It is the sense of the position and movement of the body parts.

A general agreement that free exercise is a form of collaboration, involving the freedom and liberty of movement. This exercise is a form of collaboration, involving the freedom and liberty of movement. This exercise is a form of collaboration, involving the freedom and liberty of movement. This exercise is a form of collaboration, involving the freedom and liberty of movement.

CHAPTER II

STATEMENT OF PROBLEM AND DEFINITION OF TERMS

I. STATEMENT OF PROBLEM

The primary purpose of this study was to determine the effects of a free exercise course upon the kinesthetic sense of the limbs. A secondary purpose was to determine the possible relationship between kinesthetic sense of the limbs and free exercise ability.

II. DEFINITION OF TERMS

Kinesthesia

Kinesthesia is defined as the ability of the individual to assume an assigned positioning of the limbs through the feel of one's limbs in space.

Free Exercise

It is generally agreed that free exercise is a form of calisthenics excluding the formality and rigidity of commands. Free exercise is a combination of dance and tumbling, skillfully and creatively put together into a rhythmical pattern of motor exercise which is referred to as a free exercise routine. The execution of the routine permits the observer to see, and the performer to feel, a continuous flow of movement similar to that of the dance

composition. The free exercise routine is performed in a limited area which requires control and timing of all body movements.¹ In planning this study it was necessary to identify and define components or factors of a free exercise routine for rating purposes. Six factors have been isolated and defined as a result of the review of literature in regard to the nature of free exercise.

The use of dance. The use of dance is the ability of the performer to choose and use individual dance moves to enhance the flow of movements.

Flow of movement. Flow of movement is the ability of the performer to execute all stunts and dance moves in a continuous, rhythmical pattern of movement as opposed to jerky and awkward movements.

Control. Control is the ability of the individual to perform with a reasonable amount of coordination and timing of movements, and at the same time to maintain balance in all stunts, both momentary and moving.

Form. Form is the ability of the performer to execute a routine with a certain amount of finesse and grace. The performer gives the observer the impression that the routine has been well planned and perfected.

The use of different levels. The use of different levels is the ability of the performer to use all possible levels from low to high.

¹Newton C. Loken and Robert J. Willoughby, Complete Book of Gymnastics (Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1959), pp. 137-143; John Piscopo, "Free Exercise," Journal of Health, Physical Education, Recreation, 90:39-42, December, 1959; Mary J. Saver, "Floor Exercise", Gymnastic Guide The Division for Girls and Women's Sports American Association for Health, Physical Education, Recreation, 1963-1963, pp. 35-39.

CHAPTER III

REVIEW OF LITERATURE

Before 1940, very little research was done in kinesthesia, and since then, only sporadic experimentation and theorization has been reported. The exact nature of kinesthesia has not been determined and very few aspects of kinesthesia appear to be factual due to sparse and conflicting research.

I. KINESTHESIS AS A THEORY

Metheny and Ellfeldt, in an attempt to describe movement as a human experience, formulated a theory concerned with the individual's concept of kinesthetic sensation. This theory rests upon the basic assumption that man possesses an intellect and has the ability to think in the abstract. As in any theory, there are certain conditions under which the given theory will apply. The conditions that must be present for the transformation of kinesthetic sensation into meaningful symbols were stated as follows:

- (1) the sense data are perceived or perceivable in an organized form. . .
- (2) this perceptual form is capable of eliciting a reaction from the person. . .
- (3) this reaction has sufficient relevance to some aspect of his life to alter in some way his

total personal conceptualization of reality.¹

In investigating movement as related to all types of activity, Metheny and Ellfeldt found that it was necessary to formulate terminology in order to speak of movement in general. They derived and defined "...three distinct but interrelated aspects of every movement experience...kinestruct, kinescept, and kinesymbol."²

The first and most obvious aspect was the physical manifestation of movement patterns. Yet man in initiating movement cannot isolate any one minute part especially when he must concentrate on the performance and thus can only perceive the movement as a whole. This is also true of the observer. He too is only aware of the general patterns of movement as a whole unless he concentrates on just one part of the whole which would mean the elimination of many parts in the perception of the movement. To identify this whole pattern the authors used the word kinestruct and defined it as "a dynamic, somatic form constructed by body masses in motion."³

Except under special circumstances the performer does not see the kinestruct which he has created or performed. It was thus necessary to

¹Lois Ellfeldt, and E. Metheny, "An Inquiry into The Nature of Movement as a Significant Form of Human Experience," cited by Elwood Craig Davis, The Philosophic Process in Physical Education (Philadelphia: Lea and Febiger, 1961), p. 284.

²Ibid., p. 284.

³Ibid., p. 284.

determine or identify the reactions of the body to the kinestruct which leads the mover to keep some kinestructs and reject others. To identify this phase of movement experience the authors used the word kinescept which they defined as "a dynamic perceptual form resulting from the integration of all kinesthetic perceptions associated with kinestruct. It is this form in which the mover experiences [or feels] his own movement."⁴

From observation and clarification of terms, the authors presumed that the mover had, at this point in his movement experience, conceptualized what he had experienced. This transformation of movement experience into a conceptual or symbolic form was identified by the authors as a kinesymbol and defined as "the meaning a person finds in his perception of the kinescept of a kinestruct."⁵

The authors summarized their theory by describing a movement experience in their own terminology.

... a movement experience is manifested as a kinestruct. This kinestruct is perceived as a kinescept. This kinescept is transformed into a mental abstraction identified as a kinesymbol in the same way that other perceptual forms are transformed into the elements of human thought by human mentality. Kinesymbolic concepts can be retained by the mind and recalled by the mind.... Thus, the mind uses kinesymbols in the process of thought in the same way that it uses all other kinds of symbols, incorporating them into the

⁴Ibid., p. 287.

⁵Ibid., p. 287.

the ever changing organization of concepts, ideas and meaning that constitute a person's personal interpretation of reality.⁶

This method of generalization has been criticized by Hubbard because he believes that such postulations are empirical.⁷ Yet this type of theorizing and generalizing has not been detrimental, but rather has served as a basis for the formulation of hypotheses for experimentation in the area of kinesis.

II. FACTORS OF KINESTHESIS

Many studies have been conducted with the hope of finding the factors which are the components of kinesis. Most of these factorial studies have been in terms of analysis of tests designated to measure the kinesthetic sense.

Witte, in investigating the nature of several of these tests, found seven factors to be associated with kinesis:

- Factor I - force of muscular contraction of the arms,
- Factor II - leg positioning,
- Factor III - arm positioning for short arm movement on the vertical plane,
- Factor IV - arm positioning in long arm movements on the vertical plane,
- Factor V - extent and force of muscular contraction of the arm on the horizontal plane,

⁶ Ibid., p. 288.

⁷ Alfred W. Hubbard, "Comments on the Article by Lois Ellfeldt and Eleanor Metheny, 'Movement and Meaning; Development of a General Theory,' " The Research Quarterly 30:224-225, May, 1959.

Factor VI - arm positioning on the horizontal plane, and
Factor VII - force of muscular contraction of the legs.⁸

Wiebe, attempting to define specific factors associated with kinesthesis, determined four factors by studying previous kinesthetic tests. These four factors included; "arm static function, kinesthetic response in balance, thigh leg static function and arm dynamic function."⁹

Russell, in an exploratory study, attempted to construct three factor tests. Within this study seven factors were suggested.

- (1) adaptive arm movements
- (2) balance involving learning arm positioning on the horizontal
- (3) awareness of the extent of muscular contraction
- (4) leg positioning factor
- (5) a factor that operates in arm movements
- (6) orientation of the body in space
- (7) arm positioning in the vertical plane.¹⁰

All of these factorial studies support the hypothesis that kinesthetic sense is made up of factors that are very specific to each body part.

However, as Russell observed, these factors "do not operate equally in all

⁸Fae Witte, "A Factorial Analysis of Tests of Kinesthesis" (unpublished Doctorate dissertation, Indiana University, Bloomington, 1953) p. 104.

⁹Vernon R. Wiebe, "A Factorial Analysis of Tests of Kinesthesis" (unpublished Doctorate dissertation, State U. of Iowa, Iowa City, 1954) p. 55.

¹⁰Ruth Irene Russell, "A Factor Analysis of The Components of Kinesthesis" (unpublished Doctorate dissertation, State University of Iowa, Iowa City, 1954) p. 55.

tasks that involve responding to kinesthetic stimuli."¹¹

III. GENERAL KINESTHETIC SENSITIVITY

Wiebe constructed and compiled twenty-one tests of kinesthesia and formulated a prediction battery. Because of the low intercorrelation between test items, he found no general kinesthetic sensitivity but rather there were numerous factors associated with kinesthesia.¹²

Scott, in a study of items in a battery of tests, arrived at similar conclusions. She stated, "...kinesthesia, like flexibility, is highly specific to the respective areas of the body."¹³

Phillips, whose prime purpose was to investigate the relationship between kinesthesia and motor learning, also concluded that kinesthetic sense is specific.

There is no justification for the use of the phrase 'general kinesthetic sensitivity and control,' unless reference is made to the sum total of many specific abilities for the uniformly low correlation coefficients among the tests seems to indicate that kinesthesia is quite specific to the stimulus patterns involved in the tests.¹⁴

¹¹ Ibid., p. 55.

¹² Vernon R. Wiebe, "A Study of Tests of Kinesthesia," The Research Quarterly, 25:222-230, May, 1954.

¹³ Scott and French, op. cit., p. 390.

¹⁴ Bernath E. Phillips, "The Relationship Between Measures of Kinesthesia and Performance During the Early Stages of Acquiring Two Perceptuo-motor Skills," The Research Quarterly, 12:571-586, October, 1941.

IV. SECONDARY FACTORS

Several studies have investigated what Wiebe terms secondary factors. These factors are **related** to kinesthesia but are not actual elements of kinesthesia. They are so interrelated that, in some instances, they seem to depend on **kinesthesia**, and in other instances, kinesthesia seems to depend on them. For example, Wiebe identified sports ability, size, and strength as secondary factors.¹⁵ Phillips also found that there is, at times, some relationship between kinesthesia and motor learning.¹⁶

Phillips and Summers investigated the relationship between kinesthesia and the learning of bowling skills. They concluded:

...there is a relationship between motor learning, ... and positional measures of kinesthesia. There is some evidence to support the hypothesis that kinesthesia is more related to learning in the early stages of acquiring a motor skill than it is in the later stages.¹⁷

Young studied kinesthesia in relation to movements commonly used in gymnastics and sports activities. She found a low but positive relationship

¹⁵ Vernon R. Wiebe, "A Factorial Analysis of Tests of Kinesthesia," (unpublished Doctorate dissertation, State University of Iowa, Iowa City, 1956) p. 67.

¹⁶ Phillips, *op. cit.*, p. 583.

¹⁷ Marjorie Phillips and Dean Summers, "Relation of Kinesthetic Perception to Motor Learning," *The Research Quarterly*, 25:468, December, 1954.

between kinesthesia and selected movements.¹⁸

Roloff had similar results in her study of kinesthesia. She found a low but positive correlation between kinesthesia and motor ability and concluded that there is some relationship between kinesthesia and motor ability.¹⁹

Wiebe found a kinesthetic difference between athletes and non-athletes in favor of the athlete.²⁰ Stevens compared the kinesthetic test scores of majors and non-majors in physical education and concluded that kinesthesia is more developed in the trained person than in the untrained.²¹ These results further support the hypothesis that there is a relationship between kinesthesia and motor ability.

Roney investigated the learning of relaxation in relation to kinesthesia. She found no significant relationship and stated, "a more significant relationship might be found if the components of kinesthesia could be measured more accurately."²²

¹⁸Olive Young, "A Study of Kinesthesia in Relation To Selected Movements," The Research Quarterly, 16:277-287, December, 1945.

¹⁹Louise Roloff, "Kinesthesia In Relation to the Learning of Selected Motor Skills," (unpublished Doctorate dissertation, State University of Iowa, Iowa City, 1952) p. 49.

²⁰Vernon R. Wiebe, "A Study of Tests of Kinesthesia," The Research Quarterly, 25:222-228, May, 1954.

²¹Mildred Stevens, "The Measurement of Kinesthesia in College Women," (unpublished Doctorate dissertation, Indiana University, Bloomington, 1950) p. 99.

²²Carolyn P. Roney, "Some Factors of Kinesthesia and Relaxation," (unpublished Doctorate dissertation, University of Oregon, Eugene, 1960) p. 76.

Clapper compared kinesthetic test scores of a junior high school group with a senior high school group. She found a significant difference in all scores in favor of the senior high group and concluded that there is possibly a growth factor involved in kinesthesia.²³

V. FREE EXERCISE

The review of literature, undertaken to examine the existing material on free exercise, revealed very little has been written on this relatively new activity, except for a few consistent definitions and suggested routines for teaching purposes.²⁴

In a final effort to obtain information pertaining to free exercise Mr. Patrick Yeager, United States Olympic gymnastic coach was contacted. Mr. Yeager responded;

...I know of no information available in this country pertaining to the history and evolvment of free exercise.... I would hazard a guess that it possibly developed from the dance, and in all probability had its origin in the Scandinavian Countries.... The major development occurred in the Iron Curtain Countries, with Russia,

²³Dorothy Jean Clapper, "Measurement of Selected Kinesthetic Response At The Junior High School Levels" (un published Doctorate dissertation, State University of Iowa, Iowa City, 1954) p. 47.

²⁴Newton C. Loken and Robert J. Willoughby, Complete Book of Gymnastics (Englewood Cliffs, New Jersey: Prentice Hall Inc., 1959), pp. 137-144; John Piscopo, "Free Exercise," Journal of Health, Physical Education, Recreation, 30:3942, December, 1959; Mary J. Saver, "Floor Exercise," Gymnastics Guide The Division For Girls and Women's Sports American Association For Health, Physical Education, and Recreation, 1963-1965, pp. 35-39.

Czechoslovakia, and Hungary leading the field, and I seriously doubt that you could obtain much information from them."²⁵ (Appendix)

VI. SUMMARY

Kinesthesia continues to be of interest to the physical educator because of its apparent relationship to the various aspects of movement. Research shows that it is a sense present in all individuals, but varying in its potential and development. It is made up of factors specific to each body part, and thus there is no general kinesthetic sense unless one speaks of the sum total of all these factors. The exact number or precise nature of these factors has not been fully realized. It is also known that kinesthesia is related to motor learning, motor ability, size, strength, and growth; yet the closeness of these relationships are not known.

It thus appears from the research that specific parts of kinesthesia must be chosen for investigation. The investigator has chosen to study the kinesthetic sense of the limbs as affected by free exercise.

²⁵ Patrick Yeager, personal letter.

CHAPTER IV

METHODS AND PROCEDURES

The following methods and procedures were used to determine the effect of participation in a free exercise course upon the kinesthetic sense of the limbs, and to determine if there was a relationship between the kinesthetic sense of the limbs and free exercise ability.

I. SELECTION OF TEST ITEMS AND MEASURING DEVICES

Test Battery

A review of literature dealing with reliable and valid kinesthetic tests revealed no one test battery for measuring only the kinesthetic sense of the limbs. Since this study was concerned with positional measures for kinesthetic sense of the limbs, it was necessary to compose a battery from the existing tests. The test items with the greatest reliability were selected from the reviewed tests and combined into a battery for this study. The kinesthetic test battery included: arm raising forward 90 degrees, forearm flexion 90 degrees, leg flexion 90 degrees and hip flexion 90 degrees.¹

¹ Scott and French, *op. cit.*, pp. 390-393; Witte, *op. cit.*, pp. 44-74; M. Gladys Scott, "Measures of Kinesthesia," *The Research Quarterly*, 26: 324-339, October, 1955; Wiebe, *op. cit.*, pp. 73-84.

The final score for the battery was the sum of all deviation scores which were determined by subtracting from 90 degrees the degrees obtained from the measurement of the joints. When limbs were independently analyzed, the score for each limb was the sum of the two deviation scores involved in testing that limb. Consequently, the lower the deviation the better the score.

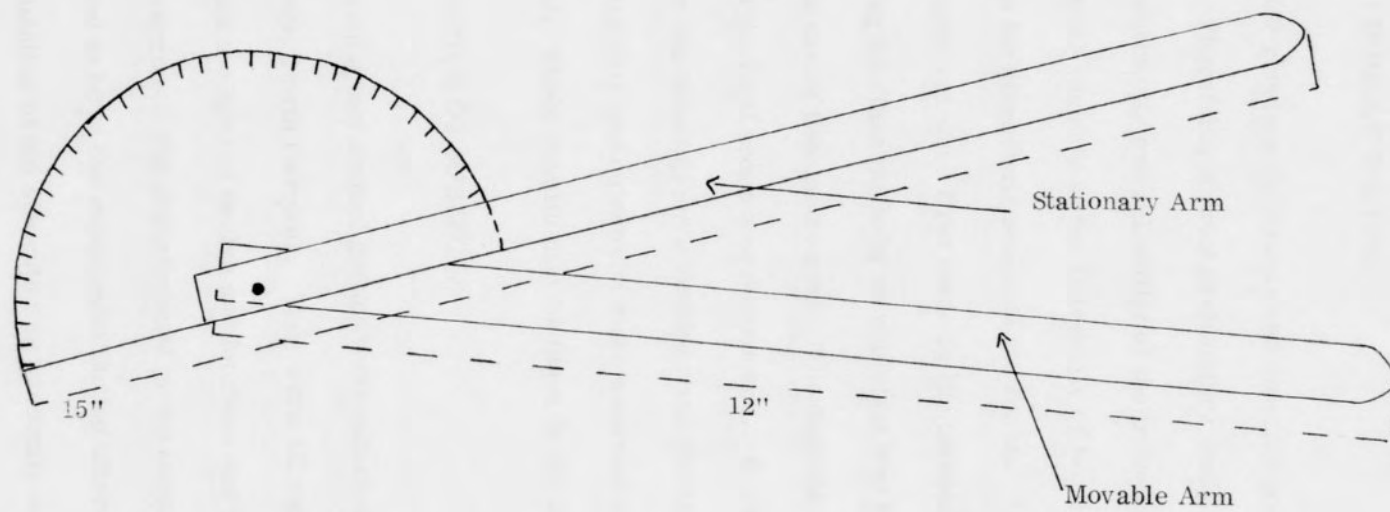
The Goniometer

The goniometer, (Figure 1) which is generally accepted in the field of research as a reliable and valid instrument for the measurement of joint angles, was used to measure the angles of the shoulder, elbow, hip and knee joints in testing for kinesthetic sense of the limbs.

Rating Scale

The rating scale, constructed for appraising free exercise ability, included the following categories: degree of difficulty for each stunt, form for the individual routines, and general impression for each routine. The completed rating scale was submitted for critical analysis to three faculty members at the University of North Carolina at Greensboro. Terms were revised and clarified on the advice of the committee to facilitate a more complete understanding of the scale. Curricular validity was then assumed by the investigator. This scale may be found in the appendix.

FIGURE 1
GONIOMETER



II. PRELIMINARY TESTING

The use of the goniometer requires deliberate and constant positioning at the joints to be measured. Therefore, a brief preliminary study was undertaken to determine the objectivity and reliability of the investigator. On December 2, 1963, four graduate students at the University of North Carolina at Greensboro were measured for kinesthetic sense of the limbs. The placements and readings of the goniometer were first made by the investigator; a second placement and reading was then made by an assistant who has had considerable experience in the use of this instrument. The degrees for each joint angle were recorded and the final score was determined. A rank-difference correlation between the investigator's readings and the assistant's readings was calculated. Reliability and objectivity were assumed since a coefficient of .97 was obtained. These results may be found in the appendix.

III. SELECTION OF SUBJECTS

Subjects for the experimental and control groups were selected from The Curry School in Greensboro, North Carolina. They were all right-handed females ranging between the ages of twelve and fourteen and had no previous experience in free exercise. The experimental group consisted of twelve students who volunteered to be in the experiment during after-school hours. The control group consisting of ten students was randomly selected by the physical education instructor. Both groups had similar backgrounds

in physical education and were participating in the same physical education class activities, namely square and folk dance.

IV. SEQUENCE OF THE STUDY

Pretesting

On January 6, 1963, both groups were tested for kinesthetic sense of the limbs. Stick figures were drawn on a blackboard to demonstrate each desired position (Figure 2) and the directions for each test item were read by an assistant from an index card. The investigator measured the angle of the joint and all placements and readings of the instrument were checked by an assistant to insure reliability and objectivity of each test item. The testing of each subject was administered in the standard manner.² The directions for each test item and the scores may be found in the appendix.

Free Exercise Course

Ten one-hour lessons in free exercise were planned and taught to the experimental group by the investigator during an after-school period. With the cooperation of the physical educator at The Curry School two motivational factors were introduced. At the beginning of the course the subjects were informed that they would receive a mark for their routines which would be

²Ibid.

FIGURE 2

TEST ITEMS DRAWN ON BLACKBOARD



Arm Raising
Forward 90°



Forearm Flexion 90°



Leg Flexion 90°



Hip Flexion 90°

included within their total physical education grade. The second motivational factor was introduced near the completion of the course when the subjects were informed that a few of them would be chosen to perform their routines at a Parent-Teacher meeting.

The aim of the free exercise course was to help each individual gain basic skills in free exercise which would enable her to create and perform a free exercise routine. Specifically the objectives of this course were:

1. to improve individual skills in dance and free exercise,
2. to improve balance, control, agility, and kinesthetic sense of the limbs,
3. to gain a general knowledge of a free exercise routine,
4. to provide an opportunity for each individual to experience the satisfaction of creating and performing a free exercise routine.

The content of the course was determined by the investigator after careful consideration of the ages and previous experience of the subjects. The skills chosen included both dance and gymnastic moves. All of the subjects were exposed to the skills even if they were unable to master them. However, because of vacation, weather and examinations it was impossible to conduct the lessons three times a week as originally planned. The lessons were given in the sequence which follows.

Lesson I

January 10

- A. Free exercise discussion
- B. Warm-ups and dance moves
 - a. Arm circle to toe touching
 - b. Head circle
 - c. Split
 - d. Wave sit ups
 - e. Scale
 - f. V sitting position
- C. Skills
 - a. Forward roll
 - b. Backward roll
 - c. Side roll
- D. Combination
 - a. Group evaluation

Lesson II

January 15

- A. Warm-ups and dance moves
 - a. Review lesson I
 - b. Falls
 - 1. Forward
 - 2. Side
 - 3. Backward
- B. Skills
 - a. Single leg circle
 - b. Shoot through
 - c. Tripod
 - d. Head stand
 - e. Review rolls
- C. Combinations
 - a. Group evaluation based on rating scale

Lesson III

January 17

- A. Warm-ups and dance moves
 - a. Ballet position
 - b. Double leg kick
 - c. Jumps (tuck, split, straddle)
 - d. Straddle bend
 - e. Arabesque
 - f. Review
 - 1. Single leg circle
 - 2. Shoot through
 - 3. Falls
- B. Skills
 - a. Cartwheel
 - b. Round off
 - c. Back extension
- C. Combinations
 - a. Group evaluation based on rating scale

Lesson IV

January 20

- A. Warm-ups and dance moves
 - a. Body sweeps
 - b. Curl and stretch
 - c. Swan dive
 - d. Leaps
 - e. Walk up from back fall
 - f. Review
 - 1. Ballet positions
 - 2. Arabesque
 - 3. Straddle bend
 - 4. Split
- B. Skills
 - a. Review
 - 1. Rolls
 - 2. Tripod
 - 3. Headstand
 - 4. Cartwheel
 - 5. Round off
- C. Combinations
 - a. Group evaluation based on rating scale

Lesson V

January 22

- A. Warm-ups and dance moves
 - a. Prone position arch up
 - b. Backfall half turn
 - c. Toe stand
 - d. Pirouette
 - e. Tour jete
 - f. Review
 - 1. Swan dive
 - 2. Leaps
 - 3. Walk up from back fall
- B. Skills
 - a. Back bend
 - b. Kip
- C. Combinations
 - a. Group evaluation based on rating scale

Lesson VI

January 24

- A. Warm-ups and dance moves
 - a. Starting position ballet
 - b. To a leap to a lung position to a
 - c. Single leg circle to head stand to
 - d. Knee scale, to a shoot through to
 - e. V sitting position, to a walk up
 - f. To a toe stand hold
 - g. Review
 - 1. Back bend
 - 2. Back fall half twist
 - 3. Pirouette
 - 4. Tour jete
- B. Skills
 - a. Hand stand
 - b. Hand spring
 - c. Walk over
- C. Combinations
 - a. Group evaluations based on rating scale

Lesson VII

January 27

- A. Warm-ups and dance moves
 - a. On knees rock back and forth
 - b. Single arm swings
 - c. Arch with front fall
 - d. Shoot through
 - e. Walk up
 - f. Scale hold

- B. Skills
 - a. Review
 - 1. Hand stand
 - 2. Hand spring
 - 3. Walk overs

- C. Individuals work on skills they need to

- D. Written Copy of routines due next lesson

Lesson VIII

February 3

- A. Warm-ups and dance moves
 - a. Back fall half twist
 - b. Side leap
 - c. Arch with front fall
 - d. Back bend

- B. Skills
 - a. Kip
 - b. Hand stand
 - c. Hand spring

- C. Practice routines

- D. Collect copies of routines from students

Lesson IX

February 6

- A. Warm-ups and dance moves
 - a. Ballet position
 - b. Side fall
 - c. Pull up sideways
 - d. Straddle lean
 - e. Body sweep
 - f. Toe stand
 - g. Scale
 - h. Double leg kick
 - i. Jump (tuck position)
 - j. Scale hold

- B. Practice routines

Lesson X

February 6

- A. Warm-ups and dance moves
 - a. Ballet position
 - b. Body sweep
 - c. Arm circles
 - d. Toe touch
 - e. Back fall
 - f. Wave sit ups
 - g. Forward roll
 - h. Walk up
 - i. Scale
 - j. Hold

- B. Practice routines

The following methods were used to facilitate learning during the free exercise course.

1. Emphasis was placed upon the mechanics of each skill and those factors which would be rated.

2. Neither the left nor the right side of the body was favored in any stunt; for example, the subjects practiced the scale on both legs.

3. Kinesthetic teaching techniques such as practicing with the eyes closed were not used.
4. The investigator demonstrated all stunts and moves, student practice and individual corrections followed each demonstration.
5. During the course the subjects first worked in groups and then progressed gradually to individual work.
6. Both dance and gymnastics received equal emphasis.
7. Subjects were given the choice of performing with or without mats.
8. At the end of each lesson the subjects created short routines followed by group evaluation based on the rating scale.
9. All of the students had complete knowledge of the rating scale.
10. A list of moves were placed on the blackboard to help each individual create a routine.
11. Each routine included all of the stunts that the individual was able to perform.

Rating Session

The three judges, chosen because of their past experience with free exercises, received rating and score sheets a week prior to the judging of routines. A meeting with the judges was held on February 6, and all questions were answered. Three days prior to the rating session, copies of the individual routines were given to the judges. On February 10 the actual rating session took place at The Curry School. The three judges were seated

around the room to assure accurate perception of each routine. The rating session took approximately one hour and the judges did not compare scores during or after the judging of the routines. The degree of difficulty for each routine was then calculated by the investigator. Each stunt was given a rating of one to ten, one being the least difficult. Stunts were rated only once even if they were repeated within a routine. The total score was then divided by the number of stunts and recorded as the degree of difficulty for the entire routine. The scores for form and general impression were determined by taking the average of the three judges' scores. The final score for free exercise ability was then calculated by taking the average of these three categories. A description of the free exercise routines and free exercise ability scores may be found in the appendix.

Posttesting

On the same day as the rating session both experimental and control groups were retested for the kinesthetic sense of the limbs. The posttest was administered under the same conditions as described in the pretesting session. At this time, however, five of the original twelve in the experimental group had been eliminated because of examinations, sickness and conflicting schedules.

V. STATISTICAL TREATMENT

Master score sheets showing all test scores were made and a statistical analysis was undertaken. The means and standard deviations were calculated for both groups on all measures. Fisher's "t" formula for small correlated groups was used to determine whether or not the changes within groups were significant. An analysis of variance was computed for the posttest items of the experimental group to determine if there was any variance among test items. This was followed by Fisher's "t" tests of significance between the means of test items to determine where the variance lay.

A rank-difference correlation was computed between the posttest battery scores and free exercise ability scores to determine if a relationship existed between these two variables. Finally, a test of significance was calculated between the mean changes in the experimental and the control groups to determine if there was a significant difference between groups.

CHAPTER V

ANALYSIS AND INTERPRETATION OF DATA

This study was conducted to determine the effect of ten hourly lessons in free exercise upon the kinesthetic sense of the limbs. A secondary purpose was to determine if a relationship existed between the kinesthetic sense of the limbs and free exercise ability. Both groups were pretested and posttested for the kinesthetic sense of the limbs, and the experimental group was rated for free exercise ability.

Before a statistical analysis was undertaken, Fisher's "t" test of significance between independent means was calculated between the pretest results for the experimental and the control groups. Since there were no significant differences it was assumed that the groups were from a common population.

I. CONTROL GROUP

The means and standard deviations in Table I were calculated for the pretest and posttest results. The test battery had a mean improvement of .7. However, none of the limbs except the left arms showed any improvement in the means. These changes between the means may indicate that kinesthetic awareness of the limbs actually decreases from a lack of continuous use.

TABLE I
 MEANS AND STANDARD DEVIATIONS FOR
 TESTS OF KINESTHETIC SENSE OF
 THE LIMBS FOR THE CONTROL GROUP

Kinesthetic Tests	Pretest		Posttest		
	M	S. D.	M.	S. D.	M. D.
<u>Test Battery</u>	97.9	22.1	97.2	29.0	+ .7
<u>Limbs Tested</u>					
Right Arms (arm raising and forearm flexion)	13.2	5.1	17.1	7.5	-3.9
Left Arms (arm raising and forearm flexion)	21.6	8.5	15.6	10.3	+6.0
Right Legs (leg flexion and hip flexion)	31.0	8.6	34.1	6.7	-3.1
Left Legs (leg flexion and hip flexion)	29.3	11.6	36.7	14.3	-7.4

This hypothesis certainly needs considerably more investigation, and is offered here only as a point of interest. All of the standard deviations, except the one for the right legs, were higher in the posttest results. Thus, no one directional change was observed between the pretest and posttest mean and standard deviation scores.

A Fisher's "t" test of significance between correlated means for the pretest and posttest battery resulted in a "t" of 1.3 which was not significant since a 2.2 was needed. This indicates that there was no significant improvement of the kinesthetic sense of the limbs within the time limit of this study.

II. EXPERIMENTAL GROUP

The means and standard deviations for the pretest and posttest battery and for each test of the limbs are shown in Table II. In all incidents there was an improvement in the means between the pretest and posttest results. The standard deviation also exhibited a similar improvement except for the left legs. This tendency of the experimental group to decrease the spread of scores from the mean may possibly be attributed to a uniforming effect of the free exercise course upon the group.

Fisher's "t" was calculated to test the significance of differences in the mean scores for the pretest and posttest results. The improvement in kinesthetic battery scores was significant at the 1% level of confidence and may be found in Table III. This result indicates that there was a significant improvement in the kinesthetic sense of the limbs following a course in free

TABLE II
 MEANS AND STANDARD DEVIATIONS FOR
 TESTS OF KINESTHETIC SENSE OF
 THE LIMBS FOR THE EXPERIMENTAL GROUP

Kinesthetic Tests	Pretest		Posttest		
	M	S. D.	M	S. D.	M. D.
<u>Test Battery</u>	121.8	51.8	81.8	33.9	+40
<u>Limbs Tested</u>					
Right Arms (arm raising and forearm flexion)	22.7	24.1	22.6	9.8	+ .1
Left Arms (arm raising and forearm flexion)	27.8	11.0	17.8	9.6	+10
Right Legs (leg flexion and hip flexion)	27.0	27.4	24.7	13.0	+ 2.3
Left Legs (leg flexion and hip flexion)	34.2	11.8	25.7	16.1	+ 9.5

TABLE III
SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS
IN PRETEST AND POSTTEST RESULTS
FOR THE EXPERIMENTAL GROUP

<u>Kinesthetic Test</u>	<u>"t"</u>
<u>Test Battery</u>	4.08*
<u>Limbs Tested</u>	
Arm Raising Forward 90 degrees	3.33**
Forearm Flexion 90 degrees	2.06
Leg Flexion 90 degrees	7.70*
Hip Flexion 90 degrees	1.48

* Significant at the 1% level of confidence.

** Significant at better than the 5% level of confidence.

exercise. Since the control group did not exhibit such an improvement, the free exercise course may have been the factor responsible for this improvement. Two of the test items also showed a significant improvement within the experimental group. Arm raising forward and leg flexion were significant at better than the 5% level of confidence. Possibly the latter was due to the individual moves taught to and practiced by the group since arm raising and leg flexion seemed to be more involved than forearm flexion and hip flexion, within the free exercise course.

An analysis of variance for posttest items was computed to determine if there was any variance between the segments of the limbs. An "F" of 10.02, significant at the 5% level of confidence, was obtained and may be found in Table IV.

Since the investigator could reject the null hypothesis, Fisher's "t" was computed between all test items in order to determine where the variance lay. These results, found in Table V, show that kinesthetically the following occurred:

1. Left and right hip flexion were not significantly more developed than any other segment of the limbs.
2. Left and right leg flexion were significantly more developed at the 1% level of confidence than left and right hip flexion.
3. Left forearm flexion was significantly more developed at the 1% level of confidence than left hip flexion.

TABLE IV

ANALYSIS OF VARIANCE OF POSTTEST ITEMS
FOR THE EXPERIMENTAL GROUP

Source of Variance	Sum of Squares	df	Mean Square	F
Between Treatment	4878	7	696.8	10.05*
Within group	3336	48	69.5	

*Significant at better than the 5% level of confidence.

TABLE V

SIGNIFICANCE OF DIFFERENCE BETWEEN THE MEANS
OF POSTTEST ITEMS FOR THE EXPERIMENTAL GROUP

Test Items	"t"
Left Hip Flexion and	
Right Hip Flexion	.325
Left Leg Flexion	4.30 *
Right Leg Flexion	4.23 *
Left Forearm Flexion	1.91
Right Forearm Flexion	3.09 **
Left Arm Raising	4.78 *
Right Arm Raising	5.11 *
Right Hip Flexion and	
Left Leg Flexion	3.97 *
Right Leg Flexion	3.88 *
Left Forearm Flexion	1.41
Right Forearm Flexion	2.77 **
Left Arm Raising	4.48 *
Right Arm Raising	4.87 *
Left Leg Flexion and	
Right Leg Flexion	.093
Left Forearm Flexion	2.32
Right Forearm Flexion	1.18
Left Arm Raising	.511
Right Arm Raising	.883
Right Leg Flexion and	
Left Forearm Flexion	2.23
Right Forearm Flexion	1.09
Left Arm Raising	.604
Right Arm Raising	.976
Left Forearm Flexion and	
Right Forearm Flexion	1.12
Left Arm Raising	2.82 **
Right Arm Raising	3.20 **
Right Forearm Flexion and	
Left Arm Raising	4.23 *
Right Arm Raising	1.93
Left Arm Raising	
Right Arm Raising	.372

*Significant at the 1% level of confidence.

**Significant at the 5% level of confidence.

4. Right forearm flexion was significantly more developed at the 1% and 5% level of confidence than left and right hip flexion respectively.

5. Left arm raising was significantly more developed at better than the 5% level of confidence than left and right hip flexion, and right and left forearm flexion.

6. Right arm raising was significantly more developed at better than the 5% level of confidence than left and right hip flexion and left forearm flexion.

These results support the findings of Wiebe, Scott, Russell and Phillips who concluded that kinesthetic sense cannot be spoken of as a general sense but rather it must be considered as specific to the individual body parts.¹ This also seems to be true of the limbs because these results indicate that kinesthetic sense is not only specific to each limb but also to each segment of the limbs.

A rank-difference correlation was computed between the kinesthetic posttest battery and the free exercise ability scores. A coefficient of .47 was obtained and found to be positive but not significant indicating there was little relationship between kinesthetic sense of the limbs and free exercise ability.

¹ Wiebe, op. cit., p. 229; Scott and French op. cit., p. 390; Russell, op. cit., p. 55; Phillips, op. cit., p. 583.

² Allen L. Edwards, Experimental Design in Psychological Research (New York: Rinehart and Company, Inc., 1950), p. 408.

III. BETWEEN GROUPS

A test of significance between the mean changes in the experimental and the control groups was calculated to determine if there was any significant improvement of the kinesthetic sense of the limbs between groups. The results in Table VI show that neither the arms nor the legs had improved significantly over the control group.

Table VI also shows no significant difference between the right and left limbs in a comparison of arms to arms and legs to legs. When Phillips and Summers investigated the relationship between kinesthesia and the learning of bowling skills, they observed that there was a significant difference between the preferred and non-preferred arms, in favor of the preferred arm.³ The investigator thinks that the disagreement between that study and the present one is due to the fact that bowling favors the development of the preferred side whereas free exercise involves both sides of the body. Since the subjects in the present study were junior high school age, a second explanation may be that the kinesthetic sense of the group was not developed to the extent that a difference between right and left limbs would be significant. This explanation would be in agreement with Clapper who compared kinesthetic development between junior and senior high school students and found kinesthesia to be more developed in the senior high school student. Thus she

³Phillips and Summers, *op. cit.*, p. 486.

TABLE VI
SIGNIFICANCE OF DIFFERENCE BETWEEN
MEAN CHANGES IN THE EXPERIMENTAL
AND THE CONTROL GROUPS

Limbs Tested	"t"
Arms (left and right arm raising and forearm flexion)	1.77
Legs (right and left leg flexion and hip flexion)	1.56
Right and Left Arms (arm raising and forearm flexion)	.227
Right and Left Legs (leg flexion and hip flexion)	.438

concluded that there was possibly a growth factor involved in kinesthesia.⁴

From the interpretation of the results obtained in this study it might be assumed that kinesthesia is a very complex sense varying in its development from one individual to another and from one body part to another. It also seems that kinesthetic sense of the limbs may be developed through free exercise. Yet, at the same time, no relationship existed between these two factors. Consequently the question arises, is kinesthesia so complex and specific that its relationship to a particular activity would only prove to be significant with a further breakdown of the components involved in kinesthesia, or with a larger number of subjects?

⁴Clapper, op. cit., p. 47.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The purpose of this study was to determine the effects of a free exercise course upon the kinesthetic sense of the limbs. A secondary purpose was to define the relationship between the kinesthetic sense of the limbs and free exercise ability.

Two female groups, ranging between the ages of twelve and fourteen were selected from The Curry School, Greensboro, North Carolina. The control group, consisting of ten students, and the experimental group consisting of seven students were pretested and posttested for kinesthetic sense of the limbs. In addition, the experimental group was rated for free exercise ability. Neither group had any past experience in free exercise and both groups had similar backgrounds in physical education.

The raw scores were statistically treated to determine changes within and between groups and the relationship between kinesthetic sense of the limbs and free exercise ability. The following results were obtained.

1. There was a significant difference between the pretest and posttest means for the kinesthetic sense of each limb in the experimental group.
2. There was no significant difference between the means in the pretest and posttest battery scores for the control group.

3. An analysis of variance showed a significant difference between test items for the posttest results of the experimental group.

4. There was no significant relationship between the kinesthetic sense of the limbs and free exercise ability.

5. There was no significant difference in mean changes between the experimental and the control groups.

6. There was no significant difference in mean changes between the left and right limbs in experimental group.

From these results the following conclusions have been drawn within the limits of this study.

1. Free exercise may be the factor which contributed to the development of the kinesthetic sense of the limbs in the experimental group.

2. Kinesthetic sense is very specific to each segment of each limb.

3. There is no significant relationship between the kinesthetic sense of the limbs and free exercise ability.

4. There is no difference between the kinesthetic development of the left and right limbs, following ten hourly lessons in free exercise.

CHAPTER VII

CRITIQUE AND SUGGESTIONS

FOR FURTHER STUDY

The greatest limiting factor of this study was the number of subjects within each group. Although every effort was made to have at least twenty students in each group, this was impossible due to the situation.

Motivational factors which are always present within any teaching or testing situation are difficult to assess. Even though a conscious effort was made to control such variables the investigator believes that the control group lacked sufficient motivation during its testing session. This lack might be attributed to the fact that the control group was not completely involved in the study and thus did not fully comprehend its significance and importance.

The time span of the experiment limited the investigation to a consideration of only beginning students. Yet the investigator did feel that the progress of the group was beyond expectations and the objectives of the course were fulfilled.

The investigator, in examining the statistical analysis and the results obtained from the study, believes that its greatest contribution lies in the questions that it has stimulated in the area of kinesthesia and makes the

following suggestions for further study.

1. Since the correlation coefficient between free exercise ability and kinesthetic sense of the limbs was positive it might be of value to conduct a similar study with a larger group and for a longer time period.

2. A study to determine if kinesthesia is lost during certain activities or absence of activity would be pertinent to the physical educator.

3. A study to determine if there is any transfer of kinesthetic sense from the learning of one activity to another might supplement the knowledge of kinesthetic teaching methods.

4. A study to determine if there is any relationship between kinesthesia and intelligence at the junior high school level would be interesting.

5. Further studies might be conducted to determine the value of other activities in developing kinesthesia at the elementary and the junior high school level.

6. A study to determine if there is a growth factor involved in kinesthesia would be of value in a further analysis of kinesthesia.

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Yeager, Patrick, personal letter, March 15, 1964.

COPY OF LETTER FROM [Name] TO [Name]

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APPENDIX

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[Name] [Address]

[Name]

COPY OF LETTER FROM PATRICK YEAGER

GEORGIA SOUTHERN COLLEGE

Athletic Department Statesboro, Georgia

March 15, 1964

Miss Elinor F. Cosgrove
North Spencer Annex, Box 287
University of North Carolina
Greensboro, North Carolina

Dear Miss Cosgrove:

In reply to your letter of March 7, I know of no information available in this country pertaining to the history and evolution of free exercise. As you may know, all of the events in the Women's Gymnastics Program are established by the International Federation for Gymnastics, and as far as I can remember, this event has been part of the competitive program.

I would hazard a guess that it possibly developed from the dance, and in all probability had its origin in the Scandinavian Countries. A Danish lady, Agnete Bertram, was responsible for many of the rhythmic exercise plus which tend to form some of the movements of free calisthenics. The major development occurred in the Iron Curtain Countries, with Russia, Czechoslovakia, and Hungary leading the field, and I seriously doubt that you could obtain much information from them.

I am truly sorry that I cannot be of further help to you.

Sincerely,

(Sgd.) Patrick Yeager

Patrick Yeager

RATING SCALE FOR FREE EXERCISE

Study Sheet Definition of Terms

Control: Is to be considered balance in all stunts, momentary and moving. Good coordination and timing of body movements.

Use of Different Levels: "Using all levels from low to high."¹

Use of Dance: Used to make each movement, whether it be gymnastics or dance, to enhance the flow of movement.

Use of Space: All floor space should be used and thus a change of direction must be included as seen in the diagram.

Flow of Movement: "Permits the observer to see continuous movement as opposed to jerky, awkward action. Occasional stops and pauses are permissible...."² No trick should be held for more than three seconds.

Form: Considered as the proper body position for any stunt, finesse which includes pointing the toes and arching the back, lightness of tumbling, "Spring in the legs and hands for reaction."³ Performance of stunt in the proper line of direction.

¹Mary J. Saver, "Floor Exercise," Gymnastics Guide The Division For Girls and Women's Sports American Association for Health, Physical Education, and Recreation, 1963-1965, p. 36.

²Ibid., p. 36.

³Ibid., p. 36.

Study Sheet for Image of Stunts

Side Roll: Prone position, arms close to body, legs close together; head initiates the turn and is the last part of the body to turn.

Forward Roll: Squat position, or dive; weight is caught on hands, head tucked, land on shoulders, tuck knees up tight and roll over in a straight line.

Forward Roll Variation: Straddle leg---Squat of dive, tuck head, push with hands, legs straddle, roll in straight line, bring hands to in between legs, push as you are coming up to feet, with legs straight and straddling.

Straight leg---Dive, catch weight on hands, roll on shoulders, legs straight, hands beside hips, push as you come up, with legs straight and together.

Back Roll: Squat, roll back, place hands palms down, fingers pointed away from body, tuck chin, push with hands, tuck legs, roll over in a straight line.

Back Extension: Squat, roll back, place hands back as in back roll, roll on shoulders; as weight goes on to hands and hips are over hands; push straight up, extend arms and entire body; pike at the hips as you come down on to feet.

Tripod: Place hands on floor, place head on floor to form a triangle with head and hands; knees tucked and place on elbows, hips extended.

Tip Up: Place hands on floor, about shoulder width apart; push off with one or both feet, look up, and balance on hands in tuck position.

Head Stand: Go into a tripod position, extend legs and hips up; arch back.

Hand Stand: Go into tip-up position, extend, hips and legs straight up and entire body, arch and look up; balance is kept by pressing against floor, and it should be noticeable. Entire body over hands.

- Cartwheel:** Side is toward desired direction, arms are spread, one hand is thrust to the mat as the foot pushes off, then other hand, legs come up, spread apart and directly over hands, body extended; it is similar to a side hand stand, with legs apart. The performer comes down on one foot, then the other. So you should see and hear hand, hand, foot, foot. The body travels in an arc of 180 degrees.
- Round Off:** The same as the cartwheel except the body travels to 90-degree pikes, and cuts the half circle. If the trick is performed correctly, it should give the body a great deal of spring or rebound when the feet hit the floor.
- Mule Kick:** The body springs from the floor, from a standing position, lands on hands, and the arms give; the performer tucks the legs and springs from the hands back to starting position by extending arms and extending legs. The body has traveled through a 180 degree arc.
- Kip:** Body in a backward roll position, weight on hands and shoulders, the legs are extended over head and parallel to the floor; the body rocks forward and the legs are shot up and over as the hands push, there is a definite arch. The performer's head and shoulders are the last part of his body to come up. The landing should be such that the legs bend, only to absorb shock, not to compensate for not arching.
- Back Bend:** The performer looks back, places hands and arms extended beside ears and goes over slowly until hands touch the floor; there should be an exaggerated arch.
- Hand Spring:** The performer runs, takes a hop, and at the same time hands are up and overhead; and he drives down with hands toward his foot; drives up with free leg, his legs come together as the momentum carries him over, his arms should not bend, and the back is arched to help him over. He should drop out of the stunt, and there should be little distance traveled. On the landing, his knees bend only to absorb the shock.
- Split:** Starting in a stride position, the body goes down as the legs split, and the entire area of the legs becomes flush with the floor, arms are in graceful position.

- Walk Over: The same approach and technique as the hand spring, except the legs do not come together; one leg goes over at a time, and there is a terrific arch, to carry the trunk and head up. There should be a definite split in the legs as they go over. It is a slow and rhythmical movement.
- Scale: Standing position, one leg is lifted to in back of body and goes to a position parallel with the floor; the head looks up and the back is arched. The body should not shake, for this is a balance stunt. Arms are shoulder height and extended.
- V Sitting: Sitting position, legs straight out in front and together, hands beside hips. Legs are brought up to a 45-degree angle, slowly and with control, with a pause at the 45-degree angle.
- Double Leg Kick: Standing position, legs are brought up straight in front of body, by springing and piking at the hips, in such a manner that the body is in a sitting position, with both legs straight and in front in the air.
- Jumps and Leaps: May be done in a variety of positions, straddle, tuck, stride. The stunts should be high, controlled and light.
- Side Leap: Is a run with a leap where one leg goes straight in front and parallel with floor. The other leg is extended to the side, straight and parallel with the floor at the same time. The movement should be graceful and controlled.
- Single Leg Circle: In squat position, "With hands on the floor in front of the body, with left leg stretched out to the left side of the body. Bring left leg forward and round in front of the body, lifting one arm at a time as the leg passes under them. Continue the swing of the left leg behind and under the right leg, which is continually fixed, and finish up in starting position."⁴
- Arabesque: The same as a scale, only one arm is held straight up in the air, and the other arm is horizontal and shoulder straight.

⁴C. Newton Loken and Robert S. Willoughby, Complete Book of Gymnastics (New Jersey: Prentice-Hall, Inc., 1959), p. 55.

Pirouette: The performer does a half turn, focusing on one spot, in standing position, arms extended out at 90 degrees and brought to the body for the turn. Turn is done on the balls of the feet.

Tour Jete: Kick one leg straight up until parallel with the floor; turn leg over so the top of foot is now facing the floor; pivot the balance foot so that the toe is pointing in opposite direction. The body has rolled from a position that is somewhat sitting in the air to a position that is prone in the air.

All of the movements or stunts should not be segmented as done here, but rather should be considered as one continuous pattern.

Classification of Stunts into Degree of Difficulty. 9-10

<u>Greatest Difficulty</u>	<u>Score</u>
Walk over	10
Hand spring	10
Back bend	9
Kip	9
 <u>Great Difficulty</u>	
Mule kick	8
Hand stand	8
Round off	7
Head stand	7
 <u>Average Difficulty</u>	
Back extension	6
Single leg circle	6
Cartwheel	6
Shoot through	5
Split	5
Roll variations	5
Tip up	5
 <u>Less Difficult</u>	
Side leap	4
Tripod	4
Tour Jete	3
Double leg kick	3
Backward roll	3
 <u>Least Difficult</u>	
Jumps, Leaps	2
V sitting position	2
Forward roll	2
Pirouette	2
Arabesque	1
Scale	1
Side roll	1

General Impression 1-5

Superior 5

Control, use of different levels, use of dance, use of space and flow of movement are all perfected.

Above Average 4

Use of different levels, use of space, both or one needs perfection. All other components are perfected.

Average 3

Use of different levels, use of space and use of dance needs improvement. All other components are perfected.

Below Average 2

Use of different levels, use of dance, and flow of movement needs improvement. The other component is perfected.

Poor 1

Control, use of different levels, use of dance, use of space, and flow of movement need perfection.

Form 1-10

Superior 9-10

Positioning of body, finesse, lightness of tumbling, and reaction time are all perfected.

Above Average 7-8

Finesse needs improvement; all other components are perfected.

Average 5-6

Finesse and lightness of tumbling needs improvement; all other

components are perfected.

Below Average

3-4

Finesse, lightness of tumbling and reaction time need improvement;
other component is perfected.

Poor

1-2

Positioning of body, finesse, lightness of tumbling and reaction time
need improvement.

TABLE VII
SCORES FOR PRELIMINARY STUDY ON GONIOMETER

Subjects	Test	Investigators		Scores	Assistants		Scores
		Limbs		Rank	Limbs		Rank
		right	left		right	left	
1	Arm Raising 90 ⁰	90	102	2	97	100	2
	Forearm Flexion 90 ⁰	92	92		90	92	
	Leg Flexion 90 ⁰	96	98		98	96	
	Hip Flexion 90 ⁰	100	100		100	100	
2	Arm Raising 90 ⁰	94	98	1	95	97	1
	Forearm Flexion 90 ⁰	85	86		85	86	
	Leg Flexion 90 ⁰	90	94		90	94	
	Hip Flexion 90 ⁰	88	84		88	84	
3	Arm Raising 90 ⁰	88	86	3	88	86	3
	Forearm Flexion 90 ⁰	90	93		90	93	
	Leg Flexion 90 ⁰	100	104		100	104	
	Hip Flexion 90 ⁰	98	100		98	100	
4	Arm Raising 90 ⁰	90	90	4	90	90	4
	Forearm Flexion 90 ⁰	88	82		88	82	
	Leg Flexion 90 ⁰	100	105		100	105	
	Hip Flexion 90 ⁰	108	108		108	108	

TABLE VIII

RAW DATA FROM THE TEST OF KINESTHESIS
OF THE LIMBS FOR THE CONTROL GROUP

Subject	Test Items	Pretest Scores		Posttest Scores	
		Limbs		Limbs	
		Right	Left	Right	Left
1	Arm Raising Forward 90 ⁰	89	80	90	85
	Forearm Flexion 90 ⁰	105	120	101	115
	Leg Flexion 90 ⁰	93	92	93	93
	Hip Flexion 90 ⁰	115	110	130	130
2	Arm Raising Forward 90 ⁰	85	102	94	90
	Forearm Flexion 90 ⁰	95	102	105	105
	Leg Flexion 90 ⁰	100	99	95	98
	Hip Flexion 90 ⁰	110	100	115	112
3	Arm Raising Forward 90 ⁰	90	93	90	94
	Forearm Flexion 90 ⁰	105	118	108	120
	Leg Flexion 90 ⁰	100	105	95	95
	Hip Flexion 90 ⁰	120	98	114	108
4	Arm Raising Forward 90 ⁰	94	95	94	91
	Forearm Flexion 90 ⁰	100	115	100	95
	Leg Flexion 90 ⁰	95	90	95	98
	Hip Flexion 90 ⁰	115	115	125	124
5	Arm Raising Forward 90 ⁰	85	92	91	94
	Forearm Flexion 90 ⁰	97	115	95	100
	Leg Flexion 90 ⁰	100	98	95	95
	Hip Flexion 90 ⁰	130	140	126	127

TABLE VIII - cont'd.

RAW DATA FROM THE TEST OF KINESTHESIS
OF THE LIMBS FOR THE CONTROL GROUP

Subject	Test Items	Pretest Scores		Posttest Scores	
		Limbs		Limbs	
		Right	Left	Right	Left
6	Arm Raising Forward 90 ⁰	85	80	95	95
	Forearm Flexion 90 ⁰	110	95	105	100
	Leg Flexion 90 ⁰	66	88	88	98
	Hip Flexion 90 ⁰	112	115	119	125
7	Arm Raising Forward 90 ⁰	90	90	89	91
	Forearm Flexion 90 ⁰	98	110	100	90
	Leg Flexion 90 ⁰	92	96	95	98
	Hip Flexion 90 ⁰	109	110	110	108
8	Arm Raising Forward 90 ⁰	92	89	91	89
	Forearm Flexion 90 ⁰	100	110	100	95
	Leg Flexion 90 ⁰	94	89	90	96
	Hip Flexion 90 ⁰	105	115	125	126
9	Arm Raising Forward 90 ⁰	90	90	93	90
	Forearm Flexion 90 ⁰	100	103	120	110
	Leg Flexion 90 ⁰	84	80	90	107
	Hip Flexion 90 ⁰	110	115	115	120
10	Arm Raising Forward 90 ⁰	90	90	95	95
	Forearm Flexion 90 ⁰	75	85	95	100
	Leg Flexion 90 ⁰	100	88	100	90
	Hip Flexion 90 ⁰	120	125	120	120

TABLE IX
 RAW DATA FROM THE TEST OF KINESTHESIS
 OF THE LIMBS FOR THE EXPERIMENTAL GROUP

Subject	Test Items	Pretest Scores		Posttest Scores	
		right	left	right	left
1	Arm Raising Forward 90 ⁰	85	92	86	92
	Forearm Flexion 90 ⁰	97	96	98	96
	Leg Flexion 90 ⁰	94	88	95	90
	Hip Flexion 90 ⁰	101	100	100	100
2	Arm Raising Forward 90 ⁰	90	90	90	90
	Forearm Flexion 90 ⁰	138	135	105	102
	Leg Flexion 90 ⁰	83	94	95	94
	Hip Flexion 90 ⁰	124	122	120	122
3	Arm Raising Forward 90 ⁰	94	95	90	90
	Forearm Flexion 90 ⁰	90	109	90	100
	Leg Flexion 90 ⁰	95	85	90	85
	Hip Flexion 90 ⁰	115	120	115	120
4	Arm Raising Forward 90 ⁰	92	95	90	90
	Forearm Flexion 90 ⁰	100	114	100	105
	Leg Flexion 90 ⁰	105	98	102	95
	Hip Flexion 90 ⁰	125	120	120	115
5	Arm Raising Forward 90 ⁰	95	98	90	98
	Forearm Flexion 90 ⁰	105	109	105	110
	Leg Flexion 90 ⁰	105	105	92	90
	Hip Flexion 90 ⁰	116	122	100	108
6	Arm Raising Forward 90 ⁰	93	98	92	95
	Forearm Flexion 90 ⁰	155	120	120	120
	Leg Flexion 90 ⁰	105	105	102	98
	Hip Flexion 90 ⁰	128	122	120	120
7	Arm Raising Forward 90 ⁰	90	100	95	93
	Forearm Flexion 90 ⁰	95	100	95	100
	Leg Flexion 90 ⁰	95	101	88	98
	Hip Flexion 90 ⁰	110	110	100	100

SAMPLE SCORE CARD

<u>Pretesting</u>			
<u>Name</u>	<u>Group</u>		
Test Items	Right Limb	Left Limb	Limb Score
Arm Raising Forward 90 ⁰			
Forearm Flexion 90 ⁰			
Leg Flexion 90 ⁰			
Hip Flexion 90 ⁰			
			Total Score

FREE EXERCISE ROUTINES

Subject 1

Ballet position
 Arm circling
 Toe touching
 Foot scale
 Back fall
 Two wave sit ups
 V sitting position
 Walk up
 Cartwheel
 Half twist to front fall
 Shoot through
 Forward roll
 Backward roll
 Tripod
 Backward roll
 Walk up
 Pirouettes
 Front fall
 Three side rolls
 Walk up
 Double leg kick
 Three leaps
 Cartwheel
 Ballet position

Subject 2

Ballet position
 Arm circling
 Back fall
 Wave sit up
 Walk up
 Foot scale
 Three leaps
 Cartwheel
 Two front rolls
 Double leg kick
 Knee scale
 One side roll
 Back bend
 Back roll
 Knee scale
 Ballet position

Subject 3

Ballet position
 Back fall
 Back bend
 Two forward rolls
 Walk up
 Arm circling
 Toe touch
 Two leaps
 Tour jete
 Scale
 Double leg kick
 Foot scale
 Tour jete
 Body sweeps
 Forward roll
 Tour jete
 Pirouettes
 Forward roll
 Walk up
 Tour jete
 Ballet position

FREE EXERCISE ROUTINES (Cont'd.)

Subject 4

Ballet position
 Back fall
 Wave sit up
 Side roll
 Shoot through
 Walk up
 Scale turn
 Toe touch
 Forward roll
 Knee scale
 Forward roll
 Walk up
 Pirouette
 Cartwheel
 Scale turn
 Leap
 Scale turn
 Forward roll
 V sitting position
 Walk up
 Round off
 Two double leg kicks
 Scale
 Ballet position

Subject 5

Ballet position
 Toe stand
 Arabesque
 Double leg kick
 Scale
 Leaps
 Back fall
 Back bend
 Tip up
 Knee scale
 Tripod
 Toe touches
 Back bend
 Walk up
 Round off
 Ballet position

Subject 7

Ballet position
 Back fall
 Wave sit up
 Walk up
 Tripod
 Forward roll
 Backward roll
 Walk up
 Double leg kick
 Pirouette
 Swan dive
 Shoot through
 Walk up
 Round off
 Head stand
 Forward roll
 Walk up
 Ballet position

Subject 6

Ballet position
 Two leaps
 Toe touch
 Forward roll
 Wave sit up
 Walk up
 Two leaps
 Split
 Tip up
 Forward roll
 Walk up
 Swan dive
 Shoot through
 Single leg circle
 Walk up
 Two double leg kicks
 Tour jete
 Back fall
 Back roll
 Tour jete
 Pirouette
 Ballet position

TABLE X
RAW DATA FROM RATING OF ROUTINES

Subjects	Degree of difficulty 1 - 10	General impression 1 - 5 Judges			Form 1 - 10 Judges			Final Score
		1	2	3	1	2	3	
1	2.8	5	4	2	5	6	4	3.8
2	3.4	2	3	3	4	4	4	3.3
3	3.1	3	2	3	4	3	4	3.1
4	3.1	4	4	4	4	6	3	3.8
5	4.0	2	2	2	2	2	3	2.7
6	3.4	4	4	3	3	4	4	3.5
7	3.7	4	3	2	5	5	5	3.9

TEST ITEMS AND INSTRUCTIONS
FOR KINESTHETIC TEST
OF THE LIMBS

1. Arm Raising Forward 90°

Instructions: Stand, look at the figure on the blackboard, close your eyes and raise your arm to a horizontal position matching that of the figure with palm down. Repeat with left arm.

2. Forearm Flexion 90°

Instructions: Stand, look at the figure on the blackboard, close your eyes and raise your forearm to a horizontal position matching that of the figure, with palm facing down. Repeat with left arm.

3. Leg Flexion 90°

Instructions: Stand, look at the stick figure, and hold on to the chair, close your eyes and raise your lower leg to a horizontal position matching that of the figure. Repeat with left leg.

4. Hip Flexion 90°

Instructions: Stand, look at the stick figure and hold on to a chair, close your eyes and raise the thigh to a horizontal position matching that of the figure. Repeat with left thigh.