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An Analysis of the Lincoln-Osbretsky Motor Development Scale with an Emphasis on the Reduction of Total Test Items

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AN ANALYSIS OF THE LINCOLN-OSERETSKY MOTOR DEVELOPMENT SCALE WITH AN EMPHASIS ON THE REDUCTION OF TOTAL TEST ITEMS

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INTRODUCTION TO THE PROBLEM

Introduction

There is little doubt that the physical aspects of life are stressed less and play a less important role in modern life than in any previous era. Likewise, a person is at a distinct disadvantage when he or she possesses poor coordination, lacks precision and is generally clumsy in what he or she attempts to perform. Children who have poor coordination, those who have little skill and slow learners tax the skill and ingenuity of the teacher whose class is heterogeneous in ability. Almost everyone has witnessed the example of a child being chosen last on a team for a competitive game because of a lack of speed, strength, skill, or a combination of these or other factors on the part of the individual concerned. Fat, slow and uncoordinated children are sometimes excluded from activities altogether on the grounds that they are a hindrance, rather than a help, to teacher and teammates alike. Physical performance still plays a role of great importance in the daily lives of school children, not only in their ability to perform adequately but also in matters such as social well-being and

general status.

Proficiency in motor activities is a respected quality in contemporary civilization, and with it comes social status. There appears to be no doubt of the positive relationship between athletic success and social acceptance and adjustment, especially with younger children. Proficiency in motor skills not only leads to social acceptance and prestige, but it also has an important impact on the personality of the individual. Participation in physical activities may even make the difference between a child finishing or not completing high school. There is little doubt that social status can be greatly enhanced through success in sports. Moreover, interest and participation in many activities lead to and is part of healthy social development. Certain actions of an individual, as reflected by his values, needs and interests will also determine his social acceptance.

It is probable that the development of motor abilities is important in the psychological adjustment of children. Boys and girls with serious motor skill deficiencies suffer generally in their social acceptability to their peers; conversely, children with highly developed motor skills are not only more acceptable in many play activities, but are also more able to enhance their social status by assuming positions of leadership. Games and activities involve varying degrees of motor ability and if a child is to be accepted as a member of a group that plays these games, then

he is expected to participate in those undertakings.

There is a great deal of interest, both physically and mentally, in the ability of individuals to coordinate their movements so that a certain act can be accomplished at exactly the right instant, at the correct speed with the correct amount of force and accuracy. Unfortunately, however, relatively few attempts have been made to include motor skills in the clinical evaluation of a child. While intelligence tests, personality tests, behavior rating scales and various scales of physical maturation and fitness have been utilized and studied, the field of motor skills has remained relatively untouched.

Statement and Purpose of The Problem

The Lincoln-Oseretsky Motor Development Scale is designed to test the motor ability of children between the ages of six and fourteen. It is an individually administered scale consisting of thirty-six motor skill items such as finger dexterity, eye-hand coordination and gross activity of the hands, arms, legs and trunk. Both unilateral and bilateral motor tasks are involved in the scale. Because of this fact, fifty-three test items are actually presented since seventeen of the thirty-six items involve right and left limb performances. The time for administering all the items is usually less than one hour.[1]

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[1]William Sloan, Manual for Lincoln-Oseretsky Motor Development Scale (Chicago: C. H. Stoelting Co. 1954), p. 19.

The purpose of this study was to determine whether or not the number of test items could be significantly reduced so that a reliable assessment or the motor ability of an individual can be made in a much shorter period of time.

Need for The Study

There has always been great interest in the measurement of motor ability and many researchers, primarily those concerned with Physical Education, have made efforts to measure gross, fine, and complex aspects of motor ability. The Lincoln-Oseretsky Scale is claimed to be an index of motor development.[1] While the specific aim of this scale is to measure this motor ability, a more general purpose is to provide measurement of traits that are important in understanding the whole child. Any indication of an individual's level of motor development is a much needed supplement to evidence obtained from other techniques concerning his or her intelligence, social, emotional and physical development.

Tests of motor development, such as the Lincoln-Oseretsky test, have been used extensively by researchers in the United States of America with groups of children classified as "exceptional children." In this field of special education, concerned only with the exceptional, there is a great need for a measure of motor performance

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[1] Ibid., pp. 1, 4, and 14.

both to add to the individual child's clinical diagnosis and to aid in the building of an educational program around his needs and abilities. Carpenter states clearly that,

> "all in all, we don't know much about youngsters at the elementary school levels but we could if we studied them more. In order to study them more we must use tests which measure their abilities and capabilities."[1]

Sloan states,

> "while the present version of this scale is still in experimental form and is being published mainly as a research tool, it is believed that the instrument should be of value and interest to those concerned with the individual child in clinics, schools, institutions and private practices."[2]

Carpenter adds strength to Sloan's convictions by saying,

> "in addition to using available scales, we need to develop many more achievement levels scaled to age, height, weight and the 'motor age' of the students so that both teachers and students can judge accomplishment objectively in relation to what can be expected in performance for each individual pupil."[3]

In Oseretsky's original eighty-five test battery many items lacked reliability.[4] In 1955 Sloan excluded forty-nine of these items after a correlation of each item

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[1]Aileen Carpenter, "The Future of Tests and Measurements in Elementary Schools," Journal of Health and Physical Education, 15:9 (November, 1944), p. 479.

[2]Sloan, Manual for Motor Development Scale, p. 1.

[3]Aileen Carpenter, "The Future of Tests and Measurements in Elementary Schools," Journal of Health and Physical Education, 15:9 (November, 1944), p. 479.

[4]Sloan, Manual for Motor Development Scale, p. 51.

with age had been undertaken.[1] Many researchers are of the opinion that this scale is one of the best available tests for measuring motor performance. However, this researcher believed that if a further breakdown of these thirty-six items was possible, an assessment of an individual's motor ability could be determined in considerably less time. It was thought that some of the sub-tests might contribute little or nothing to t · factors measured in the scale, in which case such sub-tests could be eliminated from the test battery. The possible saving in administration time would be obvious. If this were the case, the tests would be used more extensively and profitably by those in related fields. Also, the fact that the tests have to be administered on an individual basis does not encourage general use of the scale, even though it is held in high esteem by many.

Finally, there is overwhelming evidence to show that as a result of fatigue the quality of a motor movement is impaired. Thus, if the Lincoln-Oseretsky battery of tests take approximately one hour to administer individually, the subjects may become mentally, as well as physically fatigued. Any possible reduction of test items and, consequently, time taken to administer the tests, would be of considerable value in alleviating such a criticism.

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[1] Ibid., p. 6.

Delimitations of The Study

The subjects in this study were all students in the fourth, fifth and sixth grade classes at The Training School, Western Kentucky University, Bowling Green. Students in these classes were selected on the basis of age at the time of testing. All students between the ages of nine years six months and eleven years five months were selected for testing purposes. Fifty-five students were found to be in this age-range category, as shown in Table 1.

TABLE 1

GRADE AND RESPECTIVE AGE-GROUP OF SUBJECTS TESTED

Grade	No. of 10 yr. old Males	No. of 10 yr. old Females	No. of 11 yr. old Males	No. of 11 yr. old Females	Total
4th	12	6	--	--	18
5th	7	5	6	8	26
6th	1	--	6	4	11
Totals	20	11	12	12	55

When reviewing the various tables and results of this study this researcher urges the reader to consider the following facts:

1. It must be remembered that no differentiation was made between the performance of the boys

and girls.

2. The age of the subjects ranged only from nine years six months to eleven years five months and so the results of this study may be applicable only to this particular age-range.
3. The actual number of subjects used in this study was a relatively small sample and when comparing this study with others, it should be kept in mind that these fifty-five subjects might differ in important aspects with other population samples.

Definitions of Terms Used in This Study

MOTOR ABILITY. The measured present ability to perform basic skills under standard conditions of instruction and demonstration.

MOTOR SKILL. Muscular movement or motion of the body required for the successful execution of a desired act.

MOTOR EDUCABILITY. The ease with which one learns new athletic skills.

MOTOR DEVELOPMENT. The advancement of motor ability with chronological age due to maturational and/or learning factors.

AGE GROUP. A subject belonging to the ten year old group is one who is between the ages of nine years six months and ten years five months, inclusive, on the day of testing. The same principle applies to the eleven year old age group.

EXCEPTIONAL CHILDREN. Those children, who because of abnormally high or low mental abilities or because of unusual talents or physical handicaps, should have specialized schooling in addition to or in place of that given to normal children.

Summary

The Lincoln-Oseretsky Motor Development Scale is considered to be the best available test of its kind in the field of motor development for children between the ages of six and fourteen. However, there has been a noticeable lack of interest shown in the general motor ability and motor development of the growing child. The clinical application and evaluation of a child's motor ability, outside the field of the exceptional individual, is a sadly neglected aspect of the overall educational assessment of the individual.

It was the main purpose of this study to attempt to reduce the number of tests in the Scale, thereby lowering the overall testing time, so that a diminished number of test items would be a more practical and profitable method of determining an individual's motor ability than the presently used Lincoln-Oseretsky Motor Development Scale.

CHAPTER II

A SURVEY OF RELATED LITERATURE

History of the Development of the Lincoln-Oseretsky Scale

Motor development has received the attention of many researchers in the United States. The great majority of such work has been done by those primarily interested in physical education. Since the Lincoln-Oseretsky Motor Development Scale received the impetus directly from the Oseretsky Tests of Motor Proficiency, the development of that scale will serve as the commencing point for this section of the survey of related literature.

Nicolaus Oseretsky, a Russian, first began to publish research around 1920 and in 1923 he published his motor proficiency scale which purported to measure the following six areas of motor proficiency:

(1) General Static Coordination
(2) Dynamic Manual Coordination
(3) General Dynamic Coordination
(4) Motor Speed
(5) Simultaneous Voluntary Movement
(6) Asynkinesia or lack of precise movements[1]

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[1]Nicolaus I. Oseretsky, A Metric Scale For Studying The Motor Capacity of Children, 1923, pp. 24, Quoted in Rudolf Lassner, "Annotated Bibliography on the Oseretsky Tests of Motor Proficiency," Journal of Consulting Psychology, 12, 1948, p. 40, no. 1.

Naturally, the first scale appeared in Russian, and while it was successfully used at various continental European Centers, it failed for many years to attract attention and interest in the United States. While in use in Europe it was translated into various languages, including Portuguese. It was the translation from the Portuguese, by Elizabeth Joan Fosa, and edited by Doll, which made the scale generally available in the United States and other English speaking countries after 1946.[1]

In 1925 the scale appeared in German for the first time.[2] This publication was undertaken by Oseretsky because of certain deficiencies of the 1923 scale published in Russian. In it he mentioned his feeling that there had been many methods of research regarding intellectual ability. Oseretsky utilized 410 Moscow school children for his early experimental work. He envisioned the possibilities of using his scale as a vocational guidance instrument for adults and as a clinical instrument for children.

In preparing an annotated bibliography, Lassner[3]

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[1]Edgar A. Doll, The Oseretsky Tests of Motor Proficiency; a Translation from the Portuguese Adaptation (Minneapolis: Educational Test Bureau, 1946), pp. 47.

[2]Nicolaus I. Oseretsky, "Eine Metrische Stufenleiter Zur Untersuchung Der Motorischen Begabung Bei Kindern," (A Metric Scale For Studying Motor Aptitude of Children), Zeitschrift Kinderforsch., 30, (1925), pp. 300-314, quoted in Lassner, op. cit., p. 40, no. 6.

[3]Rudolf Lassner, "Annotated Bibliography of the Oseretsky Tests of Motor Proficiency," Journal of Consulting Psychology, 12, (1948), pp. 37-47.

located fifteen Russian references to the Oseretsky Scale, only two of which have been abstracted in the English language. His efforts to obtain the original articles through the American-Soviet medical library failed. Many other works on the Oseretsky Scale are in languages such as Spanish, Italian, Portuguese and Dutch. Reports on such studies are, therefore, necessarily made from abstracted data, in particular from the Psychological Abstracts. Thams[1] and Carey[2] have been instrumental in translating many French and German research works which utilized the Oseretsky Scale.

The Oseretsky Tests of Motor Proficiency covered all major types of motor behavior. The six areas, previously mentioned, served as indices of the following:

(1) General coordination of hands
(2) Motor speed
(3) Ability to perform without superfluous movement
(4) Simultaneous voluntary movement

The original test included eighty-five items, all scored on a pass-fail basis. The total scores gave a motor age of children from four to sixteen years of age, divided into ten age levels, the ages above ten being combined into two year groups.

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[1]Paul Fredrik Thams, "A Factor Analysis of the Lincoln-Oseretsky Motor Development Scale," (Unpublished Ph.D dissertation, University of Michigan, 1955.)

[2]Robert A. Carey, "A Comparison of the Lincoln Revision (1948) of the Oseretsky Tests of Motor Proficiency with Selected Motor Ability Tests on Boys at the Elementary Level," (Unpublished doctoral dissertation, Indiana University, 1954.)

At each age level there are six tests, each intended to measure one of the previously listed aspects of motor proficiency. Thus, Test One at year four, Test One at year five, Test One at year six, et cetera, are all progressive measures of general static coordination. Likewise, Test Two is a measure of dynamic manual coordination and similarly for the remainder of the tests. It can be seen therefore, that the test is a developmental age scale, comparable in the motor field to the Binet Scale in the intellectual field. Materials used in the tests included matchsticks, wooden spools, thread, paper, boxes, balls and sieves. Examples of the tasks are "thread a spool" (five years), and "walk a line two meters long" (seven years).[1]

It appears that the tests were categorized on the basis that if at least ninety percent of the children in the next age group passed an item, the item was included. Using this new standardization a study was conducted on 1,500 Russian children from children's homes, trade schools and general public schools. In addition two hundred insane, nervous and psychopathic children were included. Grades of motor deficiency were suggested according to the following categories: "light" - one to one and one-half years to three years below; "great" - three to five years

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[1]Edgar A. Doll, editor, "The Oseretsky Tests," Training School Bulletin, 43, (1946-47), pp. 1-13, 27-38, 62-74.

below; "idiocy" - more than five years below.[1] It can be seen therefore that the tests were designed not only for normal children but also for the feeble minded or those with possible motor disorders.

Merkin[2], in 1925, felt that the test showed promise because the directions could be given without the use of language and because it was not a test of knowledge. But he also felt that there was too much variation among the tests assigned to the same age level. It was felt that this was due to improper scaling, especially between the ages of seven and nine.

In 1929 Oseretsky published another Russian study, showing the presentation of a group method of examining motor functions of children. This might serve as a clear indication that Oseretsky himself felt a need for the reduction of time required to administer his tests. The number of tests was shortened to thirty and by this method, twelve or thirteen younger children or twenty to twenty-five older children were tested in forty to forty-five minutes.[3]

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[1]Oseretsky, (1925), op. cit.

[2]Regina Merkin, "Tests d'Oseretsky; Pour le Development des Functions Motrices de l'enfant, "Oseretsky's Tests of the Motor Development of Motor Functions of the Child) Archives de Psychologie, XIX, (Geneve, 1925), No. 75, pp. 244-59, quoted in Thans, op. cit., p. 15.

[3]Nicolaus I. Oseretsky, "A Method of Group Rating of Motor Abilities in Childhood and Youth," Gosmedizat, Moscow, (original in Russian), (1929), pp. 60, quoted in Lassner, op. cit., p. 41, no. 12.

Numerous experiments by Russian and other European workers had indicated to Oseretsky the existence of weaknesses in his earlier scale, so in 1931 he published a revision of his scale.[1] Since he selected the tests to measure single components, he felt that one could determine not only a general motor age, but also the development of single motor components. He did not claim that the single component tests were pure measures of such factors, but did feel that the designated component was predominant in each case. Generally, the Oseretsky test was accepted as a good working tool, in spite of its imperfections.

Discrepancies in the German translation of the 1931 revision and the Belgium translation of 1934 led Abramson and Kopp to return to the original Russian test for another translation in 1937.[2] The translation was then published in French for the benefit of doctors and educators, in an attempt to iron out observed discrepancies. The scale was translated and published in its entirety. It was felt by

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[1]Nicolaus I. Oseretsky, "Psychomotorik: Methoden zur Untersuchung der Motorik," (Methods of Investigating Motor Components), Zeitschrift fur Angewandte Psychologie, XVII, (1931), pp. 162, English translation by Elizabeth Lang, unpublished term paper, Northwestern University, 1949, quoted in Thams, op. cit., p. 15.

[2]Jagwiga Abramson and Helene Kopp, "L'echelle Metrique du Development de la Motricite chez l'enfant et chez l'adolescent par N. Oseretsky; Traduite et Adaptee," ("The Metric Scale N. Oseretsky of the Development of Motor Functions in the Child and the Adolescent; Translated and Adapted.) L'hygiene Mentale, 31, 3(1936), pp. 53-75, quoted in Lassner, op. cit., p. 44, no. 30.

Abramson and Le Garrec[1] that the scale was reliable for determining motor rating, particularly for analyzing the essential motor elements of static and dynamic coordination and the presence or absence of synkinesia.

Van der Lugt, after an exhaustive survey in the field of motor testing, offered in 1939 the following criticisms of the Oseretsky Scale:

(1) the tests have not been selected discriminatively
(2) the diagnostic significance varies from test to test
(3) insufficient allowance has been made for sex differences
(4) Practice opportunity, as afforded in certain environments, may influence a given subject's performance.
(5) the technique of administration was too complicated, the number of tests were too large, and the instructions were not precise enough.[2]

The reference above to "the number of tests were too large" was supported by Juarros, who found (1939) that the individual method of giving the Oseretsky tests for determining motor age or physical development required too much time. He revised the battery of tests so that they could

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[1]Jagwiga Abramson and Suzanne Le Garrec, "Notes sur Auelques Correlations Psychomotrices chez les Ecoliers Normaus," (Notes on certain Psycho-Motor Correlations in Normal School Children.) L'hygiene Mentale, 32, (1937), pp. 1-8, quoted in Psychological Abstracts, 11, (1937), no. 3933.

[2]Maria J. A. Van Der Lugt, "Un Profil Psycho-Moteur; D'apres une Etude Motometrique de l'habilete Manuelle," (A Psychomotor Profile; from a Metric Study of Manual Ability) Paris; Aubier, (1939), quoted in Lassner, op. cit., p. 45, no. 35.

be given as group tests. The writer suggested some practical values of such tests in physical evaluation of normal children and in the determination of physical characteristics of psychopathic and neurotic children.[1]

In a review of previous literature on motor performance in adolescence, Espenschade, in 1940, briefly discussed the Oseretsky revised tests. She felt that:

> ".....tests of rhythm and tempo, of strength, movement and certain other aspects of behavior should be included. Since no tests are available for some of these, and others require very complex apparatus, they cannot be used in the metric scale,"[2]

She thought the scale was a valuable tool for the study of certain aspects of motor development and contended that no comparable scale existed at that time.

In 1943 the scale was made available to Portuguese speaking countries. This adaptation was made by Leite Da Costa and included an account of its development, a description of the materials, directions for calculating a motor age and a sample test form. Two years later her work was translated by Elizabeth Fosa. This first English trans-

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[1]C. Juarros, "Valor Practico de la Pruebas Colectivas de Oseretsky Para la Determinacion de la Edad Motora," (Practical Psicotecnia,1, (1939), pp. 40-60, quoted in Psychological Abstracts, XIV, (1940), no. 1302.

[2]Anna Espenschade, "Motor Performance in Adolescence; Including the Study of Relationships with Measures of Physical Growth and Maturity," Monographs of the Society for Research in Child Development, 5, 24, (1940), p. 6, quoted in Lassner, op. cit., p. 45, no. 37.

lation of the complete scale was sponsored and edited for technical content by E. A. Doll and the scale appeared in the Training School Bulletin in four different issues during 1946 and 1947.[1] In his preface the editor commented on the need for the clinical evaluation of developmental motor performances, particularly in the field of mental deficiency, and on the apparent relation of motor defect to certain mental patterns. He anticipated the necessity of modification in content and procedure for an American Standardization of the scale, in particular that of freeing some of the tests from their intellectual "loading." A reprint of the series was then made available by the Educational Test Bureau and a kit of test materials was also made available by the same organization.[2]

Just as Lassner carried out an extensive review of the Oseretsky scale prior to 1948, it was Rabin[3] who published, in 1957, an extensive review of the post 1947 research with the adaptations of the Oseretsky scales.

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[1]Leite Da Costa, "The Oseretsky Tests; Method Value and Results," (Portuguese Adaptation), translated by Elizabeth Joan Fosa, Training School Bulletin, 43, (1946-47), pp. 1-13, 27-38, 50-56, 62-74.

[2]Edgar A. Doll, The Oseretsky Tests-English Translation, quoted in Lassner, op. cit., p. 46, no. 44.

[3]Herbert M. Rabin, "The Relationship of Age, Intelligence and Sex to Motor Proficiency in Mental Deficiency," American Journal of Mental Deficiency, 62, (1957), pp. 507-516.

In 1946, Sloan[1] began a study of the Educational Test Bureau's edition of the scale and made a start in the adaptation of the test materials, instructions and scoring. The purpose of this revision was to make the items more usable with American subjects and to make the administration and scoring conform more closely to test practices prevailing in this country. No effort was made to derive any standardization data, the primary objective being to offer a form of the test which would find some common acceptance and lead to the collection of data which may be comparable, hoping that eventually some sort of standardization would be achieved. It was expected that experience would dictate modifications as it was presented. He enumerated the following criticisms of the test as translated from the Portuguese:

(1) The locations of some tests seemed to be grossly out of place.
(2) Scoring would have to be modified to fit American children.
(3) Some tests appeared much too difficult
(4) Time limits on some tests would have to be changed

All of Oseretsky's original sub-tests were retained in this revision but Sloan modified the instructions and equipment. This served the purpose of clearing up any difficulty in understanding how to perform the tasks and provided definite specifications for equipment. The re-

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[1]At the time Dr. William Sloan was supervising psychologist at The Lincoln State School and Colony, Lincoln, Illinois.

vision was compiled in 1948 and was distributed in limited number of mimeographed copies under the title, "The Lincoln Adaptation of the Oseretsky Test."

Fallers[1] used this adaptation in a study of mentally defective girls. Intelligence quotients ranged from forty-five to sixty-nine and chronological ages ranged from six years nine months to fifteen years and six months. The girls performed with the least success on items in which speed played a prominent role. There was a slight tendency for intelligence to be positively related to Oseretsky performance and a clear positive relationship between chronological age and motor age.

In 1949, Cassel published the Vineland Adaptation of the Oseretsky Tests,[2] in which the tasks were made more specific, the scoring more objective and the materials simpler than in the original Oseretsky. Utilizing this adaptation Cassel found that an endogenous group of mental defectives performed significantly higher than a comparable exogenous group.

The method of going about this adaptation was simple

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[1]Jeanne Fallers, "An Investigation of the Motor Ability of Thirty High Grade Mentally Defective Girls with the Oseretsky Tests of Motor Proficiency" (unpublished Master's thesis, Macmurray College, 1948), quoted in Rabin, op. cit., p. 508.

[2]Robert H. Cassel, "The Oseretsky Tests: Vineland Adaptation," American Journal of Mental Deficiency, LV (1950), pp. 251-56.

and direct. The scale was timed with ten or so subjects, careful observations were made, procedures were changed when indicated, the scale was timed again, and so on. Cassel found many difficulties appearing while administering the tests which were not obvious at first. The administration time of between sixty and ninety minutes was considerably reduced in order to prevent fatigue. The large amount of floor area seemed impractical. Difficulties were also found with certain tests. One test appeared to be dangerous and was therefore deleted. The task of picking up coins appeared to depend not only upon motor proficiency but also upon the length of the subject's fingernails, the size and condition of the coins used, and the table surface, so that test was discarded. One of the sub-tests, that of asynkinesia, was eliminated since it was considered impossible to score objectively.

In 1950 Pertejo stated that Oseretsky's test of motor function attempts to measure innate motor capacities and says that "motor quotients may be computed by the formula motor age/chronological age."[1] He claims that results of the test on mongoloid children show them to be severely retarded, simple oligophrenics less so, and children with behavior problems the least of the three. He concluded by

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[1]Sensena J. Pertejo, "La Escala Metrica de Oseretsky Para el Examen de la Motorica," (The Oseretsky Test for the Examination of Motor Function) Rev. Psicol. Gen Apl., 5, (1950), quoted in Psychological Abstracts, 25, (1950), No. 6283.

saying that tests of motor development should be more widely used in diagnosis and as a guide to training.

In 1951, Sloan published a synopsis of his doctoral dissertation which investigated the relationship between motor proficiency and intelligence.[1] Two groups of subjects, one endogenous mental defective and one of normal intelligence, matched for age (mean age 10) and sex, were administered the First Lincoln Adaptation of the Oseretsky. Sloan came to the following conclusions from his research:

(1) Motor proficiency was found to be positively related to intelligence.
(2) No sex differences were found
(3) With mental defectives, the degree of difficulty was found to vary directly with task complexity.[2]

In the following year Turnquist[3] compared the motor proficiency of eleven mentally retarded pupils (mean Binet I. Q. 69) in a Special Education School with that of eleven mentally normal pupils (mean chronological age of both groups being thirteen years and six months.) The mentally retarded pupils performed at a clearly lower level on the First Lincoln Adaptation of the Oseretsky Scale when compared to the normal children.

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[1]William Sloan, "Motor Proficiency and Intelligence," American Journal of Mental Deficiency, 55, (1951), pp. 404-5.

[2]Ibid., pp. 404-5.

[3]Donald A. Turnquist, "A Study of Physical Education Needs for Mentally Retarded Pupils in Illinois Public Schools," unpublished Master's thesis, Illinois State Normal University, 1952, quoted in Rabin, op. cit., pp. 508-9.

In 1954, Carey compared a forty-six item version of the First Lincoln Adaptation of the Oseretsky with three other motor tests: - The Iowa Revision of the Brace Test, the Methany Revision of the Johnson Test and the Cowan-Pratt Test.[1] His subjects were 169 fourth, fifth, and sixth grade school boys. It was found that:

(1) The Oseretsky, only to a small degree, measures whatever the other motor tests measures.
(2) The Oseretsky scores differentiated between both grade level and age groups.
(3) Height and weight were suggested as independent variables in motor ability, at least as measured by Oseretsky.[2]

Carey also recommended that the Oseretsky Tests were not feasible for general use in classroom situations because of the time required for its administration and suggested that a revision of the Oseretsky Tests for group administration would be a worthwhile contribution to the field of Physical Education.[3]

In 1955, Thams[4] factor analyzed scores of the First Lincoln Adaptation of the Oseretsky of 211 males, ages seven years six months to twelve years five months. All previous research had been conducted on the assumption that six areas of motor proficiency were measurable as groups

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[1]Carey, op. cit., pp. 147.

[2]Ibid., pp. 59-60, 96-100.

[3]Ibid., pp. 103-104.

[4]Thams, op. cit., pp. 193.

within the structure of the test battery. However, Thams concluded that the Oseretsky scale was apparently best described by a single factor, which was very highly correlated with age. He said that there was insufficient evidence to indicate that six factors were measured as Oseretsky originally claimed. Thams suggested that more extensive validation studies be made before the scale could be used as a diagnostic tool on an individual.[1]

Sloan's continuous and long-lasting interest in motor proficiency was culminated in 1954 by publication of the Lincoln-Oseretsky Motor Development Scale Manual.[2] This scale is methodologically, by far, the soundest adaptation of the original Oseretsky Scale and it is with this scale that this present study is concerned. Forty-nine of eighty-five original Oseretsky items were excluded for such reasons as item unreliability, too much cultural loading, possibility of physical injury, et cetera, thus leaving thirty-six items, seventeen of which require testing to be administered to both left and right limbs.

The subjects in the normative-standardization group consisted of 380 males and 369 females, ages six to fourteen, obtained from public schools in central Illinois

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[1]Ibid., pp. 69, 76.

[2]William Sloan, Manual for the Lincoln-Oseretsky Motor Development Scale, #37018 (Chicago: C. H. Stoelting Co., 1954) pp. 63.

cities with populations from ten to sixty thousand.[1] It should be noted that norms were not collected on the test in its present form. The test administered was the eighty-five item First Lincoln-Oseretsky Motor Development Scale, from which a score for the thirty six item Lincoln-Oseretsky Motor Development Scale was obtained.[2] There is no definite evidence indicating whether the changes of (1) reduction in number of items and (2) arranging them in order of difficulty affects the norms. Rabin warns that "until such evidence is forthcoming, the norms should be used with caution."[3]

Sloan reported that no sex differences were found and that correlations of age with total scores were very high (.87 for males and .88 for females) which indicates that this scale can be considered a developmental scale.[4] However, Sloan himself questions the scoring of the test items; the maximum possible score on each test is three points, the only alternative score on fourteen items is zero. Six items are scored 3 - 2 - 0 and the remaining sixteen, 3 - 2 - 1 - 0. There appears to be no logical reason for this variation.[5]

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[1] Ibid., p. 6.

[2] Ibid., p. 7.

[3] Rabin., op. cit., p. 509.

[4] Sloan, (1954), op. cit., pp. 14, 51.

[5] Ibid., p. 22.

The best Sloan can say is that "items retained in the present scale represent a fair sample of some motor skills."[1] He found that the items could be placed in order of difficulty and success in passing them seemed to depend upon age, suggesting that "the test may be a scale of motor development involving both maturational and learned factors." He believed that the scale should be of value and interest "to those concerned with the individual child in clinics, schools, institutions, and in private practice," although he admitted that the scale was still "in experimental form and is being published mainly as a research tool."[2]

In his factor analysis of the Lincoln-Oseretsky Tests, Vandenberg correlated the seventeen items in the scale in which the task must be performed first with the preferred and then with the non-preferred limb. He found that correlations between the preferred and non-preferred limb performances and also between the respective limb scores and the total test scores were "rather high."[3] He suggested that it may be possible to test only the preferred hand for these items without seriously affecting the value of the total test. He added that if this were so, some adjustment would have to be made to the total

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[1] Ibid., p. 1.

[2] Ibid., p. 1.

[3] Steven G. Vandenberg, "Factor Analytic Studies of the Lincoln-Oseretsky Test of Motor Proficiency," Perceptual and Motor Skills, 19, (1964), p. 36.

scores, to keep them comparable to data obtained, e.g. norms, with the scale when both limbs were tested.

Vandenberg concluded that the factors measured by the Oseretsky test need further classification. He contends that we still know far too little about the development of motor ability in the growing child and that "the likelihood that a well constructed scale of motor proficiency may have clinical usefulness for individual assessment of motor deficits."[1] He added that the Lincoln-Oseretsky tests appear to be the best available scale of motor development at the present time.

The Relationship of Motor Proficiency to Age, Sex and Intelligence

Integration of research findings are strongly suggestive that there is a positive relationship between motor proficiency, as measured by the Lincoln-Oseretsky Motor Development Scale, and chronological age. Carey,[2] Sloan,[3] Thams,[4] and Rabin[5] have found this to be so with children of both sexes and of all intellectual levels, except probably the very severely retarded, as for example, below 40 intelligence quotient.[6] Thus the Lincoln-

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[1] Ibid., p. 25.

[2] Carey, op. cit.

[3] Sloan, (1954), op. cit.

[4] Thams, op. cit.

[5] Rabin, op. cit.

[6] Ibid., p. 515.

Oseretsky scale has the potentiality of wide utility as a motor development scale for children.

Carey, using nine to thirteen year old public school boys, found that a forty-six item version of the First Lincoln Adaptation of the Oseretsky did discriminate between age groups. He found a .37 correlation between the Oseretsky Tests and age.[1] Sloan, with a very large sample of public school boys and girls (749), ages six to fourteen, found a systematic increase in scores on the first Adaptation of the Lincoln-Oseretsky, which paralleled increasing chronological age. The correlation of the motor scale with age was extremely high, .87 for boys and .87 for girls.[2] Tham's factor analysis study of the scores of school boys, ages eight to twelve, on the first Lincoln Adaptation of the Oseretsky revealed that the single factor which best describes the Oseretsky Scale, is highly correlated with age (0.70).

The motor proficiency of a sample of four, five, and six year old children of superior intelligence was investigated by Phelps[3] with the First Lincoln Adaptation of the Oseretsky. It was found that motor scores tended to vary

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[1]Carey, op. cit., p. 53.

[2]Sloan, (1954), op. cit., p. 14.

[3]Mary L. Phelps, "A Study of the Oseretsky Tests of Motor Proficiency at the Fourth, Fifth, and Sixth Year Levels," (unpublished Masters thesis, University of Nebraska, 1950), quoted in Rabin, op. cit., p. 513.

directly with age, Fallers studied the motor performance of a small group of institutionalized mentally defective girls ages seven to fifteen with intelligence quotients ranging from forty-five to sixty-nine. Again, a clear positive relationship between chronological age and motor age resulted on the First Lincoln Adaptation of the Oseretsky.[1]

The variance of the Lincoln-Oseretsky Motor Development scores of mentally deficient children, which was attributable to age, proved to be statistically significant in Rabin's study, however, Rabin admitted having too small a sample of subjects at the various age levels for him to have confidence in plotting a developmental curve of motor proficiency in mentally defective children. Future research determining the motor proficiency of mental defectives, ages fifteen to twenty-five, is anticipated by Rabin who suggests it will prove to be of considerable value in more effective job placement.[2]

Few researchers have reported data bearing on the effects of sex differences on Oseretsky performance. Kemal[3] published a study in 1928 after administering the

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[1]Quoted in Rabin, op. cit., p. 513.

[2]Rabin, op. cit., p. 512.

[3]C. Kemal, "Contribution A l'etude des Tests de Development Moteur D'Oseretsky," (Contribution to the Study of Oseretsky's Tests of Motor Development), Archives de Psychologie, 21, 81, 1928, pp. 93-99, quoted in Lassner, op. cit., p. 41, no. 11.

Oseretsky test to 110 normal children (fifty-five boys and fifty-five girls). He found that between the ages of four and eight the boys and girls did equally well. This he described as the period of sexual non-differentiation from the motor point of view. However, from ages nine to fourteen boys performed better than girls but by how much we are not told.

Two investigations by Sloan[1,2] one with the First Lincoln-Oseretsky and the other with the Lincoln-Oseretsky Motor Development Scale, resulted in the finding of no differences in motor performance attributable to sex. Both of these studies meet rigorous standards of experimentation and thus strongly suggest that sex differences do not appear to play an important role in Lincoln-Oseretsky performance, at least for the ages studied, i.e. six to fourteen. Investigations by Rabin[3] in 1957 and Malpass[4] in 1960 are in complete agreement with Sloan.

It should be carefully noted that the fact that sex appears to play an unimportant role in Lincoln-Oseretsky performance should not be generalized to the role of sex

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[1]Sloan, "Motor Proficiency and Intelligence," p. 405.

[2]Sloan, (1954), op. cit., p. 9.

[3]Rabin, op. cit., p. 514.

[4]Leslie F. Malpass, "Motor Proficiency in Institutionalized and Non-Institutionalized Retarded Children and Normal Children." American Journal of Mental Deficiency, 64, (1960), pp. 1012-15.

differences with other measures of motor ability. To illustrate this point, Espenschade,[1] utilizing measures of gross motor performance, many of which relied heavily on muscular strength, found adolescent boys superior to adolescent girls in most of the activities.

In studies concerned with the relationship of motor proficiency to intelligence, practically all research supports the contention that motor ability is positively related to intelligence, although the actual correlations have been low.

In 1923, Garfiel predicted, on the basis of her study, a correlation between 0.10 and 0.12 for adults between motor ability and intelligence.[2]

Kemal reported that no correlation existed between motor ability as measured by the Oseretsky tests and mental development as measured by the Terman tests.[3] Di Giovanna substantiated this by saying, "there is no correlation between intelligence and athletic ability, and intelligence and motor ability in college men."[4]

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[1]Quoted in Rabin, op. cit., p. 514.

[2]Evelyn Garfiel, "The Measurement of Motor Ability," Archives of Psychology, 62, (April, 1923), quoted in Carey, op. cit., p. 34.

[3]Kemal, op. cit.

[4]Vincent Di Giovanna, "A Comparison of Intelligence and Athletic Ability of College Men," Research Quarterly, VII (October, 1937), p. 101.

His correlation ranged from -0.20 to 0.22.

Other correlations between motor ability and intelligence have been reported by the following people: Johnson, with junior high school pupils, 0.13;[1] Abramson and Le Garren, 0.31 with girls and 0.30 with boys;[2] Ray, from -0.11 to 0.27;[3] and McCloy, -0.1250.[4]

Carey reported a correlation of .0636± .0766 between results on the Oseretsky tests and intelligence. Again, although not statistically significant, it compares favourably with several earlier studies, substantiating their findings.[5] It appears that in many studies a positive, but low, correlation has been found between motor ability and I. Q.

Abramson and Le Garrec wanted to verify the Russian scoring of the Oseretsky to see if it was applicable to French children. They presented the following five findings:[6]

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[1]Granville B. Johnson, "Physical Skill Test for Sectioning Classes into Homogeneous Units," Research Quarterly, III, (1932), p. 133.

[2]Abramson and Le Garrec, op. cit.

[3]Howard C. Ray, "Inter-Relationships of Physical and Mental Abilities and Achievements of High School Boys," Research Quarterly, XI, (March, 1940), pp. 135-6.

[4]Charles Harold McCloy, "The Measurement of General Motor Capacity and General Motor Ability," Research Quarterly Supplement, V, (March, 1934), p. 50.

[5]Carey, op. cit., p. 58.

[6]Quoted in Thams, op. cit., pp. 19-20.

(1) The scale can serve to depict motor deficiencies of school children who have normal, superior, or sub-normal intellectual development.
(2) The correlations are most clear-cut for the ages eight, nine and ten. Before this age range, the tests are much too difficult; after this age they are a little too easy.
(3) The tests are more valid for boys than they are for girls.
(4) Intelligence, as measured by the Binet-Simon method, progresses more rapidly with age than does motor development as measured by the Oseretsky Scale.
(5) Students with a superior mental level often have a mediocre or insufficient global motor development.

In Faller's study of mentally defective girls there was a slight tendency for intelligence to be positively related to performance on the First Lincoln Adaptation of the Oseretsky Scale.[1] Both Sloan and Turnquist[2] found statistically reliable differences on the First Lincoln-Oseretsky between groups of mentally defective children and children of average intelligence. Sloan administered the test to twenty feebleminded and twenty normal subjects, who were matched for age and sex. Neither group showed any evidence of organic-pathology. Statistically reliable differences were found between the two groups on all six areas measured by the test, the normals scoring higher. The best scores for the mental defectives were obtained on synkinesia and the poorest in

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[1]Quoted in Rabin, op. cit., p. 513.

[2]Ibid.

simultaneous movement. He concluded that motor proficiency is related to intelligence and suggested that it is not a distinct aspect of functioning which can be isolated from general behavior, but is another aspect of total functioning of the organism.[1]

In Rabin's study, the correlation between the intelligence quotient and motor proficiency only approached statistical significance. He found that there had been insufficient control of, as he termed it, the "Examiner-Institution" variable during the administration of the test that strongly militated against the obtaining of a difference due to intelligence. He felt that certain test administration procedures by the two examiners involved raised the total test scores, for example highly motivating the subjects to respond more rapidly by such techniques as continuing to demonstrate while the child was performing the motor task and counting movements or verbalizing "right" - "left" - "right" et cetera in a rapid rhythmic manner, thus implying speed and aiding the child in keeping tract of the laterality of the limb movement required.[2]

In 1960 Malpass revealed highly significant score differences when retarded and normal children were com-

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[1]Sloan, (1951), op. cit., pp. 403-5.

[2]Rabin, op. cit., p. 511.

pared, in favor of the latter group.[1] These findings strongly confirm claims by previous researchers that motor proficiency is related to intellectual ability, at least in so far as comparisons of mildly retarded and normal children are concerned.

Evidence reviewed by Yates in 1961 shows that various types of mental illness may be associated with specific types of motor impairment.[2] In writing about these findings, it has generally been stated that the relationship is a casual one, in which the mental illness interferes with, or otherwise impairs, the motor performance. It is conceivable that both mental illness and impaired motor performance are the result of a common forerunner, be it a biochemical abnormality or a reduced participation in normal ventures and adventures of childhood and adolescence. It is quite possible also that impaired motor development contributes to the mental illness or at least is closer to the true cause of it, than are measures of cognitive skills.

Motor Development Scales

A well standardized test of motor development in children, as compared to the most widely used intelligence

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[1]Malpass, op. cit., pp. 104-5.

[2]Aubrey J. Yates, Abnormalities of Psychomotor Functions, in Hans Jurgen Eysenck, editor, Handbook of Abnormal Psychology, (New York: Basic Books, 1961), pp. 32-61.

tests for children, (for example, the Stanford-Binet or the Wechsler Intelligence Scale for Children: WISC.) does not, unfortunately, exist. This is probably due to the relative lack of interest, in the United States at least, in the motor development of the child of elementary school age. It is not until the child reaches the age when he may participate in high school athletics that some interest appears in assessing his or her motor proficiency.

There are several reasons why a reliable and suitable scale of motor proficiency is needed to assess motor proficiency in children. There is the possibility that such a scale might prove useful as a predictor of adolescent athletic ability or lack of it, and of adult motor skills of the type required for various civilian occupations.

Also, there is little doubt that a well constructed scale of motor proficiency will have clinical usefulness for individual assessment of motor deficits. Evidence shows that various types of mental illness may be associated with specific types of mental impairment. And, of course, there is the purely theoretical concern with the development of motor ability in the growing child. As Vandenberg states, "We still know far too little about this important area of child development."[1]

Only a small number of studies have been reported on

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[1]Vandenberg, op. cit., p. 25.

neuromuscular development and on age changes in development sequences in motor abilities. Gessel's Development Schedule[1] (1940) for pre-school age children included among its tests at the fifteen months age level:

(1) turning book pages
(2) putting pellets in a bottle
(3) climbing stairs
(4) placing cubes in cups

Example of items included in the seventy-two months level are:

(1) jumping from a twelve-inch height landing on toes
(2) advanced throwing
(3) standing on each foot alternately

Fleishman points out that,

> "Many intelligence tests for children contain tasks which involve motor components. Many investigators view tests for growing children not so much as evaluation of intelligence as a general developmental level. There are a number of other individual performance tests for children such as the Pittner-Patterson, Cornell-Cox, and the Arthur Point Scales of performance. However, these performance tests are not tests of motor skills. They are, essentially, non-verbal scales of mental ability involving perceptual, spatial or unsightful behaviour."[2]

One test overcame this weakness. It was the Mervill-Palmer Scale which contained predominately sensori-motor

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[1]Arnold L. Gessel, The First Five Years of Life, (New York: Harper and Brothers, 1940), pp. 319-43.

[2]Edwin A. Fleishman, Psychomotor Tests in Drug Research, in Leonard Uhr and James G. Miller, Drugs and Behaviour, (New York: Wiley, 1960), p. 275.

items, such as throwing a ball, pulling a string and crossing the feet.

Brace devised a Scale of Motor Ability which has proved useful in classifying students for training in Physical Education. His scale consists of

> "tests or stunts which measure natural rather than acquired motor ability, which involved a general functioning of the whole body in a variety of activities and which are economical of administration in point of time and equipment."[1]

He reported, however, that success on his scale is little dependent upon age and hypothesized:

> "If motor ability is a native trait, it probably develops with age to some limit. Until this limit is reached a positive correlation with age should be expected."[2]

Several items contained in the original Oseretsky Test are included in Brace's Scale. Rabin is quoted as saying that the Scale is not a "very adequate developmental scale."[3]

Although not designed to measure motor aptitude developmentally, Dimock[4] gave the Oseretsky Test annually to two hundred boys within the age range of twelve to fifteen

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[1]David Kingsley Brace, Measuring Motor Ability (New York: A. S. Barnes and Co., 1927), p. 93.

[2]Ibid., p. 98.

[3]Rabin, op. cit., p. 507.

[4]Hedley S. Dimock, "A Research in Adolescence," Child Development, 6, (September, 1935), pp. 177-195.

and reported that motor ability increased less rapidly during pubescence than in either pre- or post pubescence. A substantial improvement in motor coordination accompanied the period of most rapid growth in height; thus, loss of motor control with subsequent awkwardness, did not take place when growth in height was especially rapid.[1]

Espenschade also concerned herself with motor performance in adolescence and its relationship to measures of physical growth and maturity. She tested the coordination, speed, accuracy and strength of 165 adolescent boys and girls for seven consecutive school semesters. She reported that motor performance in boys correlated positively with chronological age, and emotional and physiological measures of maturity, while the relationships between motor performance of girls and all measures of physical growth proved low. In most cases, the latter were not statistically significant. She summarized that "motor performance is related to age, weight and height during the elementary and junior high school years but shows slight correlation with body-build."[2]

While Brace and Espenschade have undoubtedly made valuable contributions to the understanding of motor performance, neither has produced a year scale of motor

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[1] Ibid., p. 195.

[2] Quoted in Carey, op. cit., p. 31. and Lassner, op. cit., p. 38.

maturation. In contrast to this conspicuous lack of an acceptable motor scale in the United States, there has been somewhat more interest in the assessment of motor ability in Europe, where three motor scales have been produced and have generated substantial interest. One, confined to manual ability, was constructed by the Dutch psychologist, Maria J. A. Van der Lugt.[1] It was published in French in 1939 and translated into English in 1944. The scale was designed to measure speed, pressure, accuracy, motor memory and coordination. It has been in clinical use in Holland, Belgium and France but so far as is known no adequate norms are available for use in America.

Ten years after the Oseretsky scale went to press, another Russian, Yarmolenko, reported a second motor scale, based on methods suggested by A. Dernowa-Yarmolenko. This scale investigates "life-essential movements" such as grasping and walking, required little equipment, was standardized on school children between eight and fifteen years, and yields motor profiles, in which individuals are rated normal if all points fall between plus or minus one standard deviation. Yarmolenko recommended her scale for its ability to determine the level of a child's motor development and the possible measurement of impairment as a result of pedagogical work. Her work with it on group

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[1]Van der Lugt, op. cit.

deviations of different types of defective children has not been made available in the English language. It is interesting to note that she felt that the Oseretsky scale was inadequate for her purpose because the data revealed only the child's poor motor coefficient and could not be analyzed.[1]

Casell's Vineland Adaptation of the Oseretsky Test has been described previously as has the development of the Lincoln-Oseretsky scale. The Oseretsky scale was, of course, the first, in order of appearance (1923) of motor development scales.

Summary

The Oseretsky Scale is a Russian year-scale of tests of motor proficiency. It was well received in Europe, and was translated into many languages. In 1946, Fosa translated the Portuguese version into English. This was first presented in the Training School Bulletin. A manual, together with test materials, was made available by the Educational Test Bureau. In 1948, Sloan made the Lincoln Adaptation of the Oseretsky Test, but made no effort to standardize it. He was concerned at that stage mainly with the adaptation of materials, instructions, and scoring.

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[1]A. Yarmolenko, "The Motor Sphere of School Age Children," Journal of Genetic Psychology, 42, (1933), pp. 298-318.

The Test was further refined in 1955 when Sloan presented a new version under the Lincoln-Oseretsky Motor Development Scale. This version was accompanied by norms and other standardization data, which appear in the form of a manual and a kit of materials.

Investigations into the relationship of age, sex, and intelligence to motor proficiency, as measured by the Lincoln-Oseretsky Motor Development Scale, showed that there is substantial agreement in research findings. Motor proficiency was found to have a significant positive relationship to age. Practically all research supports the contention that motor ability is positively related to intelligence, although actual correlations have been low. Motor proficiency was not found to vary as a function of sex, but it must be remembered that although sex does not play an important role in Lincoln-Oseretsky performance, it may be just the opposite in other scales of motor ability, many of which require speed, power, and strength.

There has been a relative lack of interest in the motor ability and development of young children, except in the field of the exceptional child, and a well standardized, practical test of motor development does not exist. However, the Lincoln-Oseretsky Scale has the potentiality of wide utility as a developmental scale for children. There is little doubt that a well constructed scale of

motor proficiency will have clinical usefulness for the individual assessment of motor deficits.

CHAPTER III

EXPERIMENTAL DESIGN AND PROCEDURES

Tests Used

The tests used throughout this study were those outlined in Sloan's "Manual for Lincoln-Oseretsky Motor Development Scale, #37018."[1] In 1954, Sloan, then working at the Lincoln State School, Illinois, revised the Original Oseretsky Tests, of which there were eighty-five, to a more reasonable thirty-six items.

The Manual, along with scorecards and equipment box were provided by the Department of Physical Education, Health and Recreation, Western Kentucky University, Bowling Green. No additional equipment, except for a stopwatch, was used. A complete description of the instructional and administrative standards for each of the thirty-six test items can be found in the booklet.[2]

Thirty-six individual test item cards were prepared. These showed the verbal instructions, the number of attempts allowable, the conditions required for

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[1]William Sloan, Manual for Lincoln Oseretsky Motor Development Scale, #37018, Chicago, C. H. Stoelting Co. 1954. 63 pages.

[2]Ibid., pp. 23-50.

passing and failing, and the scoring criteria for each test item. These cards considerably facilitated the administration of the tests.

Selection of Subjects

The Principal of the Training School, Western Kentucky University, Bowling Green, Mr. J. Carpenter, was approached for permission to select ten and eleven year old boys and girls from the fourth, fifth, and sixth grade classes of his school. Permission was willingly granted and Mrs. J. Park, the Coordinator of Instruction of the Resource Center of the School was instrumental in providing the class rolls for the respective three grade classes involved in this study. The researcher carefully checked the ages, in years and completed months, of the children listed on the three class rolls, each child being placed in his or her respective age and sex group. A total of fifty-five subjects fell within the required age limits, a breakdown of which appeared in the introductory chapter (see "Delimitations of the Study"). Each subject was designated a number, 01 through 55, so as to protect the identity of the individual performer. It may be of interest to note that approximately eighty per cent of the subjects' fathers were employed as faculty members at Western Kentucky University.

The Administration of the Tests

Ideal arrangements were made at The Training School for the administration of the tests. Firstly, testing schedules showing names, dates, and times for the three classes involved were drawn up by this researcher and posted in the respective classrooms. Copies of these schedules were also given to the Coordinator of Instruction. Secondly, full cooperation in the execution of the prepared schedules was forthcoming by the three class teachers as each child was allowed to leave class when required for testing. Only in three instances was it necessary to reschedule, and then only because inclement weather conditions forced school closing. Testing dates were from December 11th, 1967, through February 6th, 1968. No tests were administered through the Christmas vacation. Testing times were set for the mornings only under the assumption the subjects would be "fresher" and therefore able to give their best performance at this time. Thirdly, a spacious, vacant classroom was made available by the Principal for administering the battery of tests over the whole scheduled testing period. The room was free from disturbances and situated in a quiet part of the school building so that the tests were administered with full concentration and cooperation on the part of the subjects. A fairly large teacher's table and two straight-back chairs, necessary for administering the tests, were

fixtures within the room.

Before any testing commenced, a short explanatory talk was given to the fourth, fifth, and sixth grade classes. This served as an opportunity to introduce the administrator to the subjects and explain such things as what the tests involved, the duration of the tests, and the type of footwear to be worn.

The Lincoln-Oseretsky Motor Development Scale was administered individually to fifty-five subjects. The test items were administered in the same order and with the same directions as set down in Sloan's Manual, using the individual test item cards, mentioned previously.

Throughout the testing period, every attempt was made to hold the variables constant in the battery of tests. They were administered in a friendly, enjoyable atmosphere, attempting to nullify any tension that the subjects possessed. This researcher was safety conscious throughout the administration of the tests as a number of the test items could easily have resulted in injury to the subject, e.g. jumping over a rope, balancing with eyes closed. No subject incurred any injury.

Every attempt was made to minimize the "fatigue factor." All tests were administered before mid-day and rest was given if a subject showed signs of fatigue or irritability. Adequate rest periods, as suggested by Sloan, were allowed between trials.

While it was difficult to control the type of shoes the subjects wore during the testing period, they were asked in the explanatory talk to wear rubber-soled shoes of some description. The subjects cooperated one hundred per cent with this request, the majority of them wearing tennis shoes.

Assistance was given to the individual performer in understanding the task. For example, after giving the instructions or while the instructions were being given, the researcher demonstrated the task, hoping to convey the idea, "see how easy it is." This possibly served as a positive motivational factor for the subjects. It was felt that it was of utmost importance for the investigator to be highly skilled and proficient in demonstrating all the test items. Subjects were not allowed to practice the test while the item was in the act of being demonstrated. Nor did the demonstration continue once the subject had commenced performing. Scores would not have been truly representative of an individual's motor ability as measured by the Lincoln-Oseretsky Motor Development Scale if either of these actions had been permitted. However, verbal encouragement was given while tasks were being performed, providing it did not interfere with the actual performance.

After each subject had completed the tests, the individual concerned was asked not to demonstrate or discuss with others who were to follow what was involved in

the battery of tests. The reasons for this are obvious.

Finally, the length of time it took to administer the tests was carefully noted. Every subject was given the full battery of tests, which, although only thirty-six were listed, in fact numbered fifty-three because seventeen of the tests required limb performances on both sides of the body, one at a time. Total testing time for the fifty-five performers ranged from forty-nine to fifty-eight minutes.

The Recording of Collected Data

Information concerning the subjects was checked before the actual testing began. This included such factors as name, grade, sex, date of birth, and physical defects. The age of the subject on the actual day of testing was then determined in years and completed months. It was also determined whether the subject preferred to use his or her right or left hand. Where tests required separate limb performances, the preferred limb test was always administered first.

As each of the fifty-three items were tested, the results (either a points score or time taken in seconds to complete the task) were recorded on the scoresheet (see Appendix). At the conclusion of the tests, items which involved checking (for example, tracing mazes, cutting circles, and counting dots and lines) were scored, re-

corded, and finally converted into points scores as indicated in Sloan's Manual.

All the fifty-three tests were scored on the three point system. When all the conversion scores had been completed, the fifty-three scores were added to give a total score. The maximum score was 159 points. Although the time required to actually administer the tests individually was less than an hour, a further twenty minutes or so were required for counting, converting, checking, and adding the performances of each individual.

Itemized individual performances were then recorded on large scorecard charts. Four charts were constructed, one for ten year old males, ten year old females, eleven year old males, and eleven year old females. These charts served in facilitating data processing punch card operations.

The Treatment of Collected Data

Two sets of fifty-five cards were key-punched at the Computer Center, The Administration Building, Western Kentucky University. The first set of cards contained the following information:

(1) Student number
(2) Individual item scores for the fifty-three tests
(3) Age, in months, on the day of the test
(4) Grade in school
(5) Sex
(6) Total raw score

The second set of cards differed in only one respect from the first set. Instead of fifty-three individual item scores being shown, only thirty-six were recorded. The right (or preferred) and left limb (or non-preferred) performance scores for seventeen tests were combined, giving a maximum score of six points for those tests, while the remaining nineteen tests still had a maximum of three points.

The two original sets of cards were then mailed to Dr. Walter P. Kroll at the University of Massachusetts. Dr. Kroll had kindly offered to analyze various aspects of this study. The University of Massachusetts possessed both the appropriate program cards and type of computer to accomplish the necessary analysis.

In detail, the following analyses were requested from Dr. Kroll:

(1) Intercorrelations of both thirty-six and fifty-three test items.
(2) An item analysis in which individual item scores were correlated with total scores.
(3) Correlations between preferred and non-preferred limb performance.
(4) Correlations between preferred and non-preferred limb performance and total scores.

The latter two analyses only involved test items 3, 5, 12, 13, 14, 15, 17, 21, 23, 24, 25, 26, 27, 32, 34, and 36 as numbered in the test Manual.

Summary

The tests used throughout this study were those outlined in Sloan's "Manual for Lincoln-Oseretsky Motor Development Scale, #37018." Fifty-five boys and girls attending The Training School, Western Kentucky University, Bowling Green, aged between nine years six months and eleven years five months, were selected as subjects for the study.

Every attempt was made to hold the existing variables constant during the administering of the tests. Such things as safety, fatigue, understanding of instructions, demonstrating, and encouragement were all taken into consideration throughout each testing session. The time taken in administering the complete battery of tests ranged from forty-nine to fifty-eight minutes.

Itemized individual performances and total scores were recorded on large scorecard charts along with such information as grade, sex, date of birth, and whether the subject preferred to use his or her right or left hand. As seventeen of the thirty-six test items required separate limb performances, in all there were fifty-three sub-tests to administer. Each sub-test had a maximum score of three points, thereby giving a total maximum score of 159 points.

Data processing cards, containing all relevant

information on each of the fifty-five subjects, were then punched at the Computer Center, Western Kentucky University, Bowling Green. These cards were carefully checked before being dispatched to the University of Massachusetts for the necessary analysis.

CHAPTER IV

ANALYSIS OF DATA

The data used in the final analysis was obtained by testing fifty-five boys and girls, whose ages ranged from nine years six months to eleven years five months, attending The Training School, Western Kentucky University, Bowling Green, Kentucky. The primary approach in this study was to score the performance of these subjects on a large variety of especially designed psychomotor tasks, known collectively as the Lincoln-Oseretsky Motor Development Scale.

Method of Analysis

The general approach used in the analysis of the data was by correlation. The Pearson-Product Moment method was used, each test item being correlated with every other test item in the battery and also with the composite score of the entire battery. The objective of the item intercorrelation was to try to eliminate any duplication of measures within the battery, the assumption being that if two (or more) test items correlate highly with each other, they measure or predict the same factor and so one of the items could be discarded as unnecessary. A high corre-

lation meant that the two items combined would be little better as a test than a single test, using either item. In fact, the two item test would have less value since it would take more time to administer.

On the other hand, items which showed little or no correlation with any of the other test items indicated that the item apparently measured a different aspect of motor ability, something highly specific.

There very well could be innumerable specific factors in "general motor ability", assuming such a general ability exists. Groupings or individual tests with low intercorrelations with other items would indicate such specific factors in general motor ability, assuming the entire test was a valid criterion measure of motor ability. It could also be interpreted to mean that it may have something in common with other test items of motor ability not included in the present battery of tests.

For the purposes of this study, item intercorrelations of .40 or above were selected for analysis. This purely arbitrary figure was selected because it was apparent from the data sheets that a sufficiently large number of intercorrelations of .40 or above were present upon which an analysis could be based. Should analysis of these items yield a simplified test which correlates highly with the composite score of all items in the Lincoln-Oseretsky Test, the search for such a test would

be at an end. On the other hand, a final test or tests with low correlation with the criterion composite score would have to be unusable, and further techniques or analysis would be required.

In an effort to pair and/or group items with substantial relationships (0.40 or greater) to other items, a major step in the analysis was to select items with two or more intercorrelating items with a greater than .40 correlation, assuming that items with such intercorrelations measure or predict the same factor in the items concerned. Recognizing that some items might not have any influence on the test but still influence the total criterion, logic would dictate that selecting one of several inter-related and similar items would be the most convenient method of reducing the total number of items in the test battery.

Relationship of Individual Items to Total Test Scores.

Scores obtained in individual test items were correlated with total scores obtained in the Lincoln-Oseretsky Motor Development Scale. The item number and its description, together with the actual correlation are shown in Table 2. Although the interpretation of the values of r (coefficient of correlation) depends upon the variables under consideration, the following could be classified as

TABLE 2

ITEM CORRELATION WITH TOTAL SCORE OBTAINED IN THE LINCOLN-OSERETSKY MOTOR DEVELOPMENT SCALE.

Rank No.	Item No.	Correlation with Total Score.	Description of Item.
1	31	.76	Tap feet & describe circles.
2	15	.66	Balancing rod crosswise.
3	14	.61	Winding thread.
4	17	.60	Tapping for 15 seconds.
5	13	.56	Making a ball.
6	35	.54	Opening & closing hands. (2)
7	18	.53	Placing coins & matchsticks.
8	5	.49	Touching fingertips.
9	16	.48	Describing circles in air.
10	29	.47	Tapping with feet & fingers.
11	24	.47	Drawing lines.
12	8	.46	Finger movement.
13	30	.44	Jump, touching heels.
14	23	.43	Sorting matchsticks.
15	12	.40	Catching a ball.
16	11	.40	Making dots.
17	27	.40	Tracing mazes.
18	26	.37	Putting coins in box.
19	25	.36	Cutting a circle.
20	6	.34	Tapping rhythmically.
21	1	.33	Walking backwards.
22	32	.32	Standing on one foot. (2)
23	21	.31	Winding thread, walking.
24	4	.31	Touching nose.
25	20	.30	Putting matchsticks in box.
26	2	.30	Crouching on tiptoe.
27	22	.30	Throwing a ball.
28	34	.27	Balancing on tiptoe.(1)
29	36	.26	Balancing rod vertically.
30	19	.25	Jump, turn about.
31	28	.24	Balancing on tiptoe. (2)
32	3	.24	Standing on one foot. (1)
33	9	.14	Standing on toes.
34	10	.10	Opening & closing hands. (1)
35	33	.04	Jump and clap.
36	7	-0.15	Jump over rope.

a fair guide: r of .00 to .20 = negligible relationship; r of .20 to .40 = slight relationship; r of .40 to .70 = substantial or significant relationship, and r of .70 to 1.00 = high to very high relationship.

There is a considerable range shown in the correlations between items and total scores--from +.74 to -0.15. Items showing substantial relationships to total scores would predict a reasonably accurate assessment of what an individual would be expected to score if the whole battery of tests were administered. Seventeen of the thirty-six items show a correlation of .40 or greater with the total score.

Interrelationships of Individual Items

All highest item intercorrelations, for the complete test battery, were recorded from the information data sheet and can be seen in Table 3. Table 4 was constructed from the information given in Table 3. Every test item found to have two or more other items correlating .40 or above with it were recorded. From Table 4 it was found that patterns of "common groupings" appeared. For example, it can be seen from Table 4 that items 2, 8, and 16 all correlate (above .40) with item 4. Also from the same table, items 4, 15, and 16 correlate with item 8; and that items 4, 8, 14, and 21 all correlate with item 16. In this example, it is clearly visible that items 4, 8, and 16 are common items to all three groups. These three items be-

TABLE 3

HIGHEST INTERCORRELATIONS BETWEEN THE 36 ITEMS IN THE LINCOLN-OSERETSKY MOTOR DEVELOPMENT SCALE.

ITEM	1	2	3	4	5	6	7	8	9	10	11	12
1		-0.27	.36	-0.04	-0.08	.16	-0.04	-0.07	-0.15	-0.14	-0.07	.39
2			-0.08	.45	-0.01	-0.13	-0.06	.20	.11	.10	-0.10	.36
3				-0.05	.15	-0.12	-0.05	-0.09	.08	.10	.17	.42
4					-0.07	-0.04	-0.02	.57	.26	-0.67	-0.03	.34
5						.26	.06	.34	.11	.18	.65	-0.07
6							-0.04	.20	-0.17	.23	.48	-0.03
7								-0.03	-0.07	.26	-0.03	-0.10
8									.13	-0.02	.30	.08
9										.06	-0.13	.20
10											-0.02	.11
11												-0.08
12												
13												
14												
15												

TABLE 3 CONTINUED

ITEM	13	14	15	16	17	18	19	20	21	22	23	24
1	.23	.32	.18	-0.07	.15	.00	.20	.03	.06	.04	.23	.09
2	.12	.23	.11	.20	.13	.16	.10	.09	.32	-0.09	.12	.07
3	.13	.15	.21	-0.04	.01	.14	.16	.16	-0.22	.13	.29	.04
4	.17	.31	.27	.57	-0.01	.00	.10	-0.08	.14	.37	.09	.08
5	.14	.11	.33	.34	.51	.45	.18	.48	-0.02	-0.10	.16	.26
6	.10	.27	.20	.20	.23	.30	-0.04	.18	.12	-0.14	.16	.18
7	-0.06	-0.13	-0.10	-0.03	-0.12	-0.32	.10	-0.08	-0.21	-0.06	-0.29	-0.06
8	.29	.39	.48	.65	.24	.19	.01	.09	.39	.27	.10	.22
9	.08	-0.13	.13	.06	-0.10	.00	.09	-0.14	-0.23	.17	.02	-0.09
10	-0.14	.09	-0.14	.08	-0.10	.10	-0.25	.12	-0.20	-0.32	.06	.01
11	.20	.03	.37	.29	.43	.38	.01	.44	.04	-0.04	.32	.31
12	.10	.21	.27	.08	-0.03	.11	.07	.01	.00	.19	.28	.04
13		.43	.30	.25	.33	.30	.06	.21	.28	.18	.03	.61
14			.25	.49	.36	.22	.25	-0.02	.50	.08	.11	.33
15				.26	.36	.35	.11	.21	.19	.50	.28	.14

TABLE 3 CONTINUED

ITEM	13	14	15	16	17	18	19	20	21	22	23	24
16					.37	.19	.01	.09	.44	.08	.15	.22
17						.30	.22	.29	.27	.03	.29	.33
18							.00	.50	.16	.03	.30	.22
19								.00	-0.12	.23	.10	-0.11
20									.02	-0.08	.13	.28
21										.05	.11	.34
22											.05	.04
23												-0.08
24												
25												
26												
27												
28												
29												
30												

TABLE 3 CONTINUED

ITEM	25	26	27	28	29	30	31	32	33	34	35	36
1	.13	.34	.22	.09	-0.03	.19	.28	.18	.11	-0.07	.17	.06
2	.12	.22	.01	-0.08	.10	.11	.17	.03	-0.14	.12	.05	.09
3	.08	.22	-0.08	-0.05	-0.07	.09	.20	.15	-0.11	-0.06	.10	.09
4	.00	.13	-0.16	-0.17	.12	.26	.13	.09	-0.34	.04	.08	.03
5	.16	.23	.33	.20	.11	.20	.29	.15	.12	.07	.15	.06
6	-0.13	.11	.28	.13	.29	.14	.18	.21	-0.06	.10	.19	.07
7	-0.13	-0.15	.06	.11	-0.15	-0.07	-0.14	-0.14	.06	.04	-0.22	.03
8	-0.08	.06	.10	-0.13	.22	.26	.24	-0.17	-0.14	-0.07	.15	.05
9	.15	.04	-0.10	-0.13	-0.03	.14	.09	.15	-0.04	-0.10	.14	-0.01
10	.10	.10	.03	.08	.22	.01	.30	.13	.32	.10	.05	.11
11	.00	.15	.16	.20	.22	.07	.08	.16	.10	.07	.15	.05
12	.17	.25	.00	-0.02	-0.01	.35	.21	.12	-0.08	.10	.19	.17
13	.07	.16	.48	.02	.15	.18	.38	-0.06	.12	-0.02	.35	.13
14	-0.03	.19	.14	.14	.19	.40	.47	.11	-0.05	.14	.22	.25
15	.23	.15	.20	-0.02	.21	.16	.46	.17	.00	.11	.44	.16

TABLE 3 CONTINUED

ITEM	25	26	27	28	29	30	31	32	33	34	35	36
16	.07	.15	.04	.03	.22	.26	.24	.02	.14	.07	.15	.05
17	.27	.13	.49	.22	.32	.06	.44	.03	.21	.00	.22	.20
18	.16	.35	.17	.09	.26	.31	.34	.00	.00	.16	.38	.26
19	.01	.10	-0.09	.11	-0.13	.11	.20	.18	.11	.01	-0.02	.07
20	.04	.29	.17	.01	.19	.19	.12	.13	-0.09	-0.04	.14	-0.11
21	-0.05	.02	.22	-0.04	.08	.17	.08	-0.16	.06	.01	.00	.06
22	.00	.04	-0.14	-0.10	.15	.11	.29	.00	.13	-0.01	.27	.01
23	.37	.15	-0.03	.10	.24	.18	.24	.34	.01	-0.16	.30	-0.06
24	.12	.08	.49	.06	.41	.13	.37	-0.03	.04	.19	.07	.04
25		.02	.17	-0.02	.30	.12	.30	.34	-0.10	.11	.17	.17
26			.10	.02	-0.08	.05	.30	.21	-0.01	.07	.21	.13
27				.10	.11	.08	.30	-0.03	.09	.03	.13	.13
28					.22	-0.11	.16	.10	.28	.29	.08	.05
29						.22	.49	.15	-0.09	.19	.34	-0.09
30							.17	.12	-0.04	.16	.22	.22

TABLE 3 CONTINUED

ITEM	25	26	27	28	29	30	31	32	33	34	35	36
31								.17	.01	.23	.46	.23
32									.021	.08	.23	-0.15
33										-0.12	-0.05	-0.09
34											.15	.36
35												-0.01
36												

TABLE 4

ITEMS SHOWING TWO OR MORE CORRELATIONS OR .40 OR ABOVE WITH OTHER ITEMS IN THE LINCOLN-OSERETSKY MOTOR DEVELOPMENT SCALE.

Item No. and Description.	No. and Description of Items with .40 or above Correlation.		
4. Touching nose	2	Crouching on tiptoe.	.45
	8	Finger movement.	.57
	16	Describing circles in air.	.57
5. Touching fingertips.	11	Making dots.	.65
	17	Tapping for 15 seconds.	.51
	18	Placing coins & matchsticks.	.45
	20	Putting matchsticks in box.	.48
8. Finger movement.	4	Touching nose.	.57
	15	Balancing rod crosswise.	.48
	16	Describing circles in air.	.65
11. Making dots.	5	Touching fingertips.	.65
	6	Tapping rhythmically.	.48
	17	Tapping for 15 seconds.	.44
13. Making a ball.	14	Winding a thread.	.43
	24	Drawing lines.	.61
	27	Tracing mazes.	.48
14. Winding thread.	13	Making a ball.	.43
	16	Describing circles in air.	.49
	21	Winding thread, walking.	.50
	31	Tap feet & describe circles.	.47
15. Balancing rod crosswise.	8	Finger movement.	.58
	22	Throwing a ball.	.50
	31	Tap feet & describe circles.	.46
	35	Opening and closing hands. (2)	.44
	30	Jump & touch heels.	.40
16. Describing circles in air.	4	Touching nose.	.57
	8	Finger movement.	.65
	14	Winding thread.	.49
	21	Winding thread, walking.	.44

TABLE 4 CONTINUED

17. Tapping for 15 seconds.	5	Touching fingertips.	.51
	11	Making dots.	.43
	27	Tracing mazes.	.49
	31	Tap feet & describe circles.	.44
18. Placing coins & matchsticks.	5	Touching fingertips.	.51
	20	Putting matchsticks in box.	.50
20. Putting matchsticks in box.	5	Touching fingertips.	.48
	11	Making dots.	.44
	18	Placing coins & matchsticks.	.50
21. Winding thread, walking.	14	Winding thread.	.50
	16	Describing circles in air.	.44
24. Drawing lines.	13	Making a ball.	.61
	27	Tracing mazes.	.49
	29	Tapping with feet & fingers.	.41
27. Tracing mazes.	13	Making a ball.	.48
	17	Tapping for 15 seconds.	.49
	24	Drawing lines.	.49
29. Tapping with feet & fingers.	24	Drawing lines.	.41
	31	Tap feet & describe circles.	.49
31. Tap feet & describe circles.	14	Winding thread.	.47
	15	Balancing rod crosswise.	.46
	17	Tapping for 15 seconds.	.44
	29	Tapping with feet & fingers.	.49
	35	Opening & closing hands. (2)	.46
35. Opening & closing hands. (2)	15	Balancing rod crosswise.	.44
	31	Tap feet & describe circles.	.46

came Group No. 1 in the next stage of analysis.

In all, seven of these groups appeared. Groups II through VII were selected on exactly the same basis as Group 1.

Group II was composed of items 15, 31, and 35. Items 8, 22, 30, 31, and 35 all correlated (0.40 or greater) with item 15. Items, 14, 15, 17, 29 and 35 correlated with item 31. Items 15 and 31 correlated with item 35. Items 15, 31 and 35 were "common" to all three groups.

Group III was composed of items 13, 24 and 27. Items 14, 24, and 27 correlated with item 13. Items 13, 27 and 29 correlated with item 24. Items 13, 17 and 24 correlated with item 27. Items 13, 24, and 27 were "common" to all three groups.

Group IV was composed of items 5, 20 and 18. Items 11, 17, 18 and 20 correlated with item 5. Items 5, 11 and 18 correlated with item 20. Items 5 and 20 correlated with item 18. Items 5, 20 and 18 were "common" to all three groups.

Group V was composed of items 11, 5 and 20. Items 5, 6, 17 and 20 correlated with item 11. Items 11, 17, 18 and 20 correlated with item 5. Items 5, 11 and 18 correlated with item 20. Items 5, 11 and 20 were "common" to all three groups.

Group VI was composed of items 21, 14 and 16. Items 14 and 16 correlated with item 21. Items 13, 16, 21, and

31 correlated with item 14. Items 4, 8, 14 and 21 correlated with item 16. Items 21, 14, and 16 were "common" to all three groups.

Group VII was composed of items 11, 5 and 17. Items 5, 6, 17 and 20 correlated with item 11. Items 11, 17, 18 and 20 correlated with item 5. Items 5, 11, 27 and 31 correlated with item 17. Items 11, 5, and 17 were "common" to all three groups.

Table 5 shows the composition of the seven groups. Item 5 appeared in three groups (IV, V and VII), while items 11, 16 and 20 appeared in two groups each (V and VII, I and VI, and IV and V respectively). This indicates the overlapping of factors measured in this particular test battery.

The items contained in each of the seven groups were assumed to measure the same factors since all had intercorrelations of 0.40 or above with each other. It was decided, therefore, that two of the three items in each group could be eliminated, leaving one item as the representative for each of the seven groups. Of the three items in each group, the item with the highest rank position when correlated with the total score was chosen as the group representative. Table 2 shows the rank position held by all thirty-six items when correlated with total scores. Table 6 shows the seven group representative items and their rank position when correlated with total score. In the case of Group VII, item 17 was chosen as

TABLE 5

GROUPINGS OF COMMON ITEMS WITHIN THE LINCOLN-OSERETSKY MOTOR DEVELOPMENT SCALE BASED ON INTERCORRELATIONS OF 0.40 OR MORE

Group No.	Items Included in the Group.
I.	4, 8, 16.
II.	15, 31, 35.
III.	13, 24, 27.
IV.	5, 20, 18.
V.	11, 5, 20.
VI.	21, 14, 16.
VII.	11, 5, 17.

TABLE 6

RANK POSITION OF THE GROUP REPRESENTATIVE WHEN CORRELATED WITH TOTAL SCORE

	Item No.	Rank Position when Correlated with Total Score.
Group I Representative	16	9
Group II Representative	31	1
Group III Representative	13	5
Group IV Representative	18	7
Group V Representative	5	8
Group VI Representative	14	3
Group VII Representative	17	4

the representative of that group because item 5 (which held the highest rank position when correlated with total score) had already been selected to represent Group V. Item 17 had the second highest correlation with the total score, taking into account all the remaining items of Groups V and VII. In actual fact, the nine highest item correlations with total scores were all represented because Group 2 contained items 31, 15 and 35; these three items held rank positions of first, second and sixth respectively when correlated with total scores, as can be seen in Table 2.

The seven group representative items shown in Table 6 became the new motor Scale A. Table 7 shows the item numbers and the description of each item contained in the scale. The correlation between the composite scores obtained in Scale A and the total scores obtained in the Lincoln-Oseretsky Motor Development Scale was found to be 0.86, which can be regarded as a high correlation.

Individual composite scores obtained in Scale A (and also Scales B, C, and D) and total scores obtained in the Lincoln-Oseretsky Motor Development Scale appear in the appendix.

It is apparent that a highly useable and reliable assessment of an individual's motor ability can be determined by administering the seven items contained in Scale A. It should be noted that items 5, 13, 14 and 17

TABLE 7

ITEM NUMBERS AND DESCRIPTION OF ITEMS CONTAINED IN NEW MOTOR SCALE A.

Item Number.	Description of Item.
16	Describing circles in air.
31	Tap feet & describe circles.
13	Making a ball.
18	Placing coins & matchsticks.
5	Touching fingertips.
14	Winding thread.
17	Tapping for 15 seconds.

TABLE 8

ITEM NUMBERS AND DESCRIPTION OF ITEMS CONTAINED IN NEW MOTOR SCALE B.

Item Number.	Description of Item.
14	Winding thread.
31	Tap feet & describe circles.
13	Making a ball.
18	Placing coins & matchsticks.
5	Touching fingertips.
16	Describing circles in air.

require performances with both the preferred and non-preferred limbs of the body, therefore, eleven sub-tests would need to be administered, giving a maximum score of thirty-three points.

Tables 8, 9 and 10 show the item numbers and the descriptions of the items contained in new motor Scales B, C and D. An explanation of why and how these three additional scales were constructed would be appropriate at this stage.

Scale B contained only the first six items included in Scale A because item 17 was not the true representative of Group VII. No purpose would have been served by including item 5, twice, in Scale A. Scale B included items 16, 18, 31, 5, 13, and 14, the latter three items being dual limb performance items. Therefore, nine sub-tests would need to be administered, giving a maximum score of twenty-seven points.

Scale C was a combination of six items, one item having been extracted from each of the seven original groups shown in Table 5. The representative items for Scale C were selected on the basis that no item requiring performances with both the preferred and non-preferred limbs of the body would be selected. Only six representative items could be extracted because Group 3 contained three items, all of which required dual limb performances. Again, the item with the highest rank position when corre-

TABLE 9

ITEM NUMBERS AND DESCRIPTIONS OF ITEMS CONTAINED IN NEW MOTOR SCALE C.

Item Number	Description of Item.
8	Finger movement.
11	Making dots.
16	Describing circles in air.
18	Placing coins & matchsticks.
20	Putting matchsticks in box.
31	Tap feet & describe circles.

TABLE 10

ITEM NUMBERS AND DESCRIPTION OF ITEMS CONTAINED IN NEW MOTOR SCALE D.

Item Number.	Description of Item.
16	Describing circles in air.
18	Placing coins & matchsticks.
31	Tap feet & describe circles.
5 (preferred)	Touching fingertips.
13 (non-preferred)	Making a ball.
14 (preferred)	Winding thread.
17 (non-preferred)	Tapping for 15 seconds.

lated with total scores obtained in the Lincoln-Oseretsky Motor Development Scale was chosen to represent the group in Scale C. (See Table 2) Scale C included items 8, 11, 16, 18, 20 and 31 with a maximum score of eighteen points.

Finally, the seven items listed in Scale D were the same seven as used in Scale A. However, only the score of the limb which had the higher correlation with the total score was chosen. Table 11 shows these correlations. Scale D included items 16, 18, 31, 5 (preferred limb only), 13 (non-preferred limb only), 14 (preferred limb only), and 17 (non-preferred limb only. Only seven tests need to be administered in this scale, giving a maximum score of twenty-one points.

Correlations between the composite scores of the respective items contained in Scales B, C, and D and total scores obtained in the Lincoln-Oseretsky Motor Development Scale were as follows: Scale B, 0.85; Scale C, 0.83; Scale D, 0.88.

Dual Limb Items

The correlations shown in Table 11 prompted this researcher to make a comment on dual limb performance tasks. As can be seen, in ten out of the seventeen items, the non-preferred limb showed a higher correlation with the total score. A possible explanation for this occurance was that as no practice time was given for any of the test items, the first attempt with the preferred limb served as a

TABLE 11

CORRELATIONS BETWEEN PREFERRED AND NON-PREFERRED LIMB PERFORMANCES AND TOTAL SCORES.

Item No.	Correlation with Total Score Preferred Limb/Non-Preferred Limb.		Limb with Highest Correlation.
3	.05	.28	Non-preferred.
5	.51	.36	Preferred.
12	.33	.38	Non-preferred.
13	.51	.53	Non-preferred.
14	.57	.44	Preferred.
15	.52	.59	Non-preferred.
17	.51	.59	Non-preferred.
21	.22	.32	Non-preferred.
22	.20	.26	Non-preferred.
23	.27	.48	Non-preferred.
24	.24	.52	Non-preferred.
25	.39	.02	Preferred.
26	.40	.25	Preferred.
27	.42	.23	Preferred.
32	.24	.25	Non-preferred.
34	.30	.19	Preferred.
36	.24	.21	Preferred.

learning process. It can be argued that where motor educability was almost instant, the attempt with the non-preferred limb was superior to the performance with the preferred limb. Thus, the motor educability of the individual more than adequately compensated when using the non-preferred limb. It would be of interest to see how scores resulted if, firstly, a short practice session be allowed with the preferred limb and secondly, if the non-preferred limb were required to be performed first. Further research involving rotations of the preferred and non-preferred limb performances might solve this particular problem.

Conclusions

The following conclusions were formed as a result of the analysis of the collected data.

1. Intercorrelations between items were generally low, but positive. In arbitrary figure of 0.40 was selected as an indication of a reasonably high correlation.

2. Seven groups, each containing three test items, were found to exist on the basis of the above mentioned arbitrary figure.

3. One item from each of the seven groups was selected to represent the group. This item was selected on the basis of highest correlation with the total test score obtained in the Lincoln-Oseretsky Motor Development Scale.

The seven selected test items placed in the highest nine correlations when each item was correlated with total scores.

4. Ten of the seventeen test items requiring separate limb performances showed a higher correlation with total scores when the non-preferred was used. Discussion concerning the use of the preferred and non-preferred limbs was given.

5. Four newly devised motor scales were presented. The composite scores of the various tasks contained in each of these scales were correlated with the total scores obtained in the Lincoln-Oseretsky Motor Development Scale. The scale with the highest correlation was Scale D, with a correlation of 0.88. The composite scores of the items contained in the other three scales all had an above 0.80 correlation with total score.

6. However, it is recommended that the newly devised Scale A be used to obtain an expedited assessment of an individual's motor ability. Scale A contains exactly the same test items as does Scale D, except that dual limb performances were required in items 5, 13, 14 and 17. A correlation of 0.86 was found to exist between the composite scores obtained in this scale and the Lincoln-Oseretsky Scale scores. The results obtained from administering Scale A should be more reliable as the items included in it were actually administered to the subjects,

whereas Scale D is a hypothetical scale based on correlations between preferred and non-preferred limb performance scores and total scores obtained in the Lincoln-Oseretsky Scale.

7. As only eleven sub-tests are necessary in administering Scale A, no more than a total of ten minutes would be required to administer the tests in order to obtain an assessment of an individual's motor ability, based on the Lincoln-Oseretsky Motor Development Scale.

Summary

The primary approach in this study was to score the individual performances of fifty-five boys and girls, whose ages ranged from nine years six months to eleven years five months, on a large variety of especially designed psycho-motor tests, known collectively as the Lincoln-Oseretsky Motor Development Scale.

The general approach used in the analysis of this collected data was by correlation, the Pearson-Product Moment method being used.

Items which had two or more intercorrelating items with a 0.40 or above correlation were recorded and the various groups were checked for "common items" within the groups. Seven groups, each containing three items, were found to be in existence. These seven groups were assumed to measure the same factors since all had intercorrelations

of above 0.40 with each other. One item per group was chosen as the group representative based on the highest rank position held when correlated with total scores. A near perfect relationship was found to exist between the seven selected group representatives and those that held highest rank position when correlated with total scores.

Four new motor scales, A, B, C, and D were devised and the composite scores of the items contained in each of the four scales were correlated with total scores obtained in the Lincoln-Oseretsky Scale. All four scales showed a correlation of above 0.80 and it was proposed that Scale A, with a correlation of 0.86, be used to obtain an expedited, yet reliable assessment of an individual's motor ability and development based on the Lincoln-Oseretsky Motor Development Scale.

Discussion was given concerning the test items that involved the use of both the preferred and non-preferred limbs.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The Problem

The Lincoln-Oseretsky Motor Development Scale is considered to be the best available test of its kind in the field of motor development. However, the time required to individually administer the complete test is not conducive to general usage and acceptability of the Scale. It was the main purpose of this study to attempt to reduce the number of tests in the Scale, thereby lowering the overall testing administration time, so that more practical, but still reliable, method of determining an individual's motor ability could be used, based on the Lincoln-Oseretsky Motor Development Scale.

Experimental Equipment

In 1954, William Sloan revised the original Oseretsky tests, of which there were eighty-five, to a more reasonable thirty-six items. The tests used throughout this present study were those referred to in Sloan's "Manual for Lincoln-Oseretsky Motor Development Scale, #37018."

Experimental Procedures

Subjects used in this study were fifty-five boys and girls, whose ages ranged from nine years six months to eleven years five months, selected from the fourth, fifth, and sixth grade classes at The Training School, Western Kentucky University, Bowling Green. The Lincoln-Oseretsky Motor Development Scale was administered individually to each of the fifty-five subjects. As seventeen of the thirty-six items required performances with the preferred and non-preferred limbs, fifty-three scores, each with a maximum of three points, were recorded. The data processing cards were mailed to the University of Massachusetts for the appropriate analysis.

Analysis of Data

All items which showed an intercorrelation of 0.40 or higher with two or more items were recorded. Seven groups, each containing three test items, were found to exist. Of the three items within the group, the one that held the highest rank position when correlated with total scores obtained in the Lincoln-Oseretsky Motor Development Scale was chosen to be the group representative. Four new motor scales were devised, the composite scores of items contained in each of the four scales being correlated with the total scores obtained in the Lincoln-Oseretsky Scale. All four scales showed a correlation of above 0.80.

Conclusions

1. It was recommended that Scale A be used to obtain an expedited, yet reliable and useable assessment of an individual's motor ability. Scale A consisted of items 16, 18, 31, 5, 13, 14 and 17. The last four mentioned tests required dual limb performances.

2. A correlation of 0.86 was found to exist between the composite scores of the items contained in Scale A and the total scores obtained in the Lincoln-Oseretsky Motor Development Scale. A total time of no more than ten minutes would be necessary to administer the test items contained in Scale A.

Recommendations

The results of this present study might serve as a basis for further research along the lines utilized in this study.

1. Further testing with subjects in the same age-range as used in this study will be of considerable value in order to verify the conclusions reached in this study. If the work of this study is substantiated by future research, tentative norms for the new Scale A could be established.

2. The testing of younger and older subjects would be beneficial to determine if the new Scale A is valid for other age groups.

3. Results of test obtained in the Lincoln-

Oseretsky Motor Development Scale by such people as Sloan, Malpass, Thams and Vandenberg might be compared.

4. More research could be done on the seventeen items in the Lincoln-Oseretsky Scale that require dual limb performances.

5. As a result of tests, individuals with detected weaknesses in certain aspects of motor ability could be directed into adaptive activities and exercises designed specifically to improve the particular phase or phases of motor ability in which an individual needs assistance.

APPENDIX

INDIVIDUAL TOTAL SCORES OBTAINED IN THE LINCOLN-OSERETSKY MOTOR DEVELOPMENT SCALE AND THE COMPOSITE SCORES OF THE ITEMS CONTAINED IN THE NEW MOTOR SCALES A, B, C, AND D.

Subject No.	Scale A Max. 33 Points.	Scale B Max. 27 Points.	Scale C Max. 18 Points.	Scale D Max. 21 Points.	Total Score Max. 159 Points.
1	30	24	18	19	117
2	26	21	15	19	115
3	30	24	16	19	115
4	28	22	18	18	114
5	28	22	17	18	112
6	27	21	14	17	110
7	25	19	16	16	102
8	21	17	14	13	99
9	19	15	14	12	98
10	14	10	11	8	90
11	17	12	14	10	75
12	1	1	4	1	46
13	25	29	17	16	116
14	29	23	17	20	111
15	27	21	17	17	110
16	28	23	16	17	109
17	20	17	17	13	101
18	23	18	14	12	100
19	20	16	14	14	96

Subject No.	Scale A Max. 33 Points.	Scale B Max. 27 Points.	Scale C Max. 18 Points.	Scale D Max. 21 Points.	Total Score Max. 159 Points.
20	26	21	16	17	95
21	22	17	13	12	89
22	20	15	13	11	88
23	22	17	13	13	85
24	15	10	12	9	81
25	25	22	16	16	123
26	28	22	17	19	117
27	25	21	18	18	116
28	32	26	17	20	113
29	26	20	17	17	111
30	28	22	17	18	109
31	28	22	18	18	109
32	27	21	16	18	107
33	25	20	17	16	106
34	17	12	14	10	96
35	21	15	14	14	95
36	28	23	17	17	95
37	20	15	17	13	94
38	20	14	11	13	94
39	22	17	14	13	90
40	20	16	13	14	88
41	16	14	14	10	82
42	18	13	11	11	77
43	14	11	9	9	71

Subject No.	Scale A Max. 33 Points.	Scale B Max. 27 Points.	Scale C Max. 18 Points.	Scale D Max. 21 Points.	Total Score Max. 159 Points.
44	16	12	13	10	67
45	24	18	17	16	107
46	25	19	15	16	104
47	24	18	17	17	103
48	28	23	17	17	102
49	24	19	14	14	94
50	19	13	14	12	92
51	21	18	14	12	87
52	16	12	14	11	84
53	18	14	13	10	84
54	18	15	14	10	73
55	13	8	8	7	61
Mean Scores.	22.3	17.5	14.7	14.1	96.8

RECORD BOOKLET

THE LINCOLN-OSERETSKY MOTOR DEVELOPMENT SCALE
Catalog #37018-R

Name _____ Birth Date _____ Age _____

Education _____ Physical Defects _____ Score ____ P

Examined at _____ Examiner _____ Date ____

ITEM	DESCRIPTION	R - L	Trs.	Pts.
1	Walking backwards, 6 ft.		2	
2	Crouching on tiptoe		2	
3	Standing on one foot (1)	R/L	2/2	/
4	Touching nose		1	
5	Touching fingertips	R/L	2/2	/
6	Tapping rhythmically with feet and fingers		1	
7	Jumping over a rope		1	
8	Finger movement		3	
9	Standing Heel to toe		2	
10	Close and open hands alternately (1)		3	
11	Making dots		2	
12	Catching a ball	R/L	5/5	/
13	Making a ball	R/L	2/2	/
14	Winding thread	R/L	1/1	/
15	Balancing a rod crosswise	R/L	3/3	/
16	Describing circles in the air		1	
17	Tapping (15")	R/L	2/2	/
18	Placing coins and matchsticks		1	

ITEM
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

DESCRIPTION	R - L	Trs.	Pts.	Notes
ump and turn about		1		
utting matchsticks in a box		1		
inding thread while walking	R/L	1/1	/	
hrowing a ball	R/L	5/5	/	
orting matchsticks	R/L	1/1	/	
rawing Lines	R/L	2/2	/	
utting a circle	R/L	1/1	/	
utting coins in box (15")	R/L	1/1	/	
racing mazes	R/L	1/1	/	
lancing on tiptoe (2)		1		
pping with feet and fingers		1		
mp, touch heels		1		
p feet and describe circles		1		
and on one foot (2)	R/L	1/1	/	
mping and clapping		1		
lancing on tiptoe (1)	R/L	1/1	/	
ening and closing hands (2)		1		
lancing a rod vertically	R/L	3/3	/	

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