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A COMPARISON OF SEX DIFFERENCES IN NORMAL AND RETARDED CHILDREN IN THE ABILITY TO EMPLOY A SERIES OF SELECTED CATEGORIES

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CHAPTER I

INTRODUCTION

During the past few years there have been many innovations in the field of mental deficiency. This situation has resulted in a growing number of immediate practical problems. In order to solve many of these problems, psychologists and educators have often been required by the pressures of a concerned society to look for solutions rather than being given the opportunity to reflect on basic theoretical aspects of subnormality. Consequently, it is not surprising to find not only a lack of sufficient experimental research in the area of mental deficiency, but also a tendency for many workers in the field to deceive themselves into believing that they know more about subnormality than they actually do.

Confronted with this situation, professional people who work with mentally retarded children have had to rely principally upon evidence derived from clinical observations and educational practices. One of the results of this practice has been the creation and perpetuation of many assumptions regarding the nature of mental deficiency which unfortunately have often been accepted as if they were actually valid, rather than being subjected to proper empirical investigation. Thus, many of these assumptions have become the traditional guiding principles of educational practices and policies underlying the treatment and care of subnormal children.

Fortunately, a review of the recent literature in mental deficiency reveals a tendency to be more critical of those traditional ideas and practices now used in special education which have not been properly evaluated by acceptable empirical methods.[1] Furthermore, according to Zigler, there is an emerging recognition that two important goals of workers in the field of subnormality--the need for a theory of subnormality and the need for solutions to problems posed by practical demands--can both be best achieved by greater emphasis on the experimental investigation of the problems associated with subnormality

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[1]William C. Kvaraceus, "Research in Special Education: Its Status and Function," Journal of Exceptional Children, XXIV, (1958), 249-254.

rather than by continued attempts to justify beliefs based largely on tradition.[2]

Prior to her survey of experimental studies of learning in retarded children, McPherson noted that,

> It has been commonly asserted that subnormal individuals are unable to acquire information and skills as rapidly and to such a degree of complexity as normal people.[3]

This assumption that the patterns of thinking in subnormal individuals are simpler than those of normal individuals seems to be a claim unworthy of unquestioned acceptance without adequate empirical support. Although this assumption has not received sufficient experimental confirmation to justify or warrant its continued application in educational planning and instructional practices, simplicity of thinking, nevertheless, has been one of the most widely accepted characterizations of the mentally deficient individual.[4]

Interest in finding out how normal and retarded children think is emerging in current research. One area

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[2]Edward Zigler, "An Overview of Research in Learning, Motivation, and Perception," Journal of Exceptional Children, XXVIII, (1962), 445-448.

[3]Marion White McPherson, "A Survey of Experimental Studies of Learning in Individuals Who Achieve Subnormal Ratings on Standardized Psychometric Measures," American Journal of Mental Deficiency, LII, (1948), 232.

[4]For a good example, see: Malinda Dean Garton, Teaching the Educable Mentally Retarded (Springfield, Illinois: Charles C. Thomas, 1961), 8-11.

of special focus has been the process of categorization. Bruner described categorization as the vital process through which the individual is enabled to give structure and, thus, meaning to his experiential world.[5] A review of the research literature indicates that, with the exception of Stephens, relatively little attention has been given to the important part played by categories in the intellective process. Certainly, research into the part played by categories in the intellective process should help make it possible to determine the reliability of the traditionally accepted assumption that patterns of thought in normal children are more complex than those of retarded children.

In view of the acknowledged need for further research in the area of mental deficiency and recognizing the importance of categorization in the intellective process, an examination of the professional literature should help to clarify areas of agreement and determine the nature and direction of this study.

Review of the Literature

Unfortunately, there have been relatively few studies involving the use of selected categories in normal

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[5]Jerome S. Bruner, Jacqueline J. Goodnow, and George A. Austin, A Study of Thinking (New York: John Wiley and Sons, Inc., 1956), 1-24.

and retarded children, although several psychologists and educators have expressed interest in this area of study and have acknowledged the basic importance of the categorization process in intellective functions. Brown, for example, proposed that categories are extremely important in conceptual thinking because they provide ways of:

> . . . grouping an array of objects or events in terms of those characteristics that distinguish this array from other objects and events in the universe.[6]

Church, in the section of his book dealing with developmental psychology of cognition, stated that ". . . the end of all learning--whether by insight or accretion or classical or operant conditioning--is schematization."[7] Schematization is accomplished by the formation of ". . . implicit principle(s) by which we order experience."[8] These schemata, essentially similar to categories as acknowledged in this present study are ". . . the most fundamental form of knowledge," according to Church. "Our more specific schemata," he continued, "are of classes of objects--sometimes called concepts or categories."[9]

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[6] Roger Brown, Words and Things (Glencoe, Illinois: Free Press, 1958), 221.

[7] Joseph Church, Language and the Discovery of Reality (New York: Random House, 1961), p. 31.

[8] *Ibid.*, 36.

[9] *Ibid.*

Although Carroll referred to his linguistic classification of categories as "form classes," he also emphasized the importance of conceptual categories as schema which serve to organize experiential stimuli into meaningful psychological patterns.[10] Similarly Bruner was one of the first to recognize the importance of categories of thought in the intellective process. In his book A Study of Thinking, Bruner noted:

> The learning and utilization of categories is one of the most elementary and general forms of cognition by which man adjusts to his environment.[11]

Furthermore, Bruner observed that the utility of categories is a result of the following observations:

1. Categorization reduces the complexity of the environment.
2. Categorization is the means by which the objects of the world about us are identified.
3. Categorization reduces the necessity of constant learning.
4. Categorization permits the ordering and relating of classes of events.[12]

One of the pioneers in the use of categories was Stephens, who, in order to study the process of categorization in normal and retarded children, created and developed the line of reasoning which follows.[13]

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[10] J. B. Carroll, Language and Thought (Englewood Cliffs, N. J.: Prentice-Hall, 1964).

[11] Bruner, op. cit., p. 2. [12] Ibid., p. 13.

[13] Wyatt Stephens, "A Comparison of Normal and Subnormal Boys on Tasks Requiring the Use of Selected Categories, Unpublished Doctoral Dissertation (University of Oklahoma, 1963).

1. It appears that one important aspect of everyday intellective activity is that of making discriminations among similar experiential data in order to determine their meaning. This is not a simple sensory task. To be able to accomplish this task, the individual must possess a variety of conceptual categories of meaning, which he uses as a framework for classification of his experiences.

2. The process of categorization is possible for the individual because he has accumulated a number of similar experiences into meaningful aggregates during the course of his development. He then employs these, in the form of categories, as an interpretative framework. The meaning of new experience for the individual is derived from the manner in which he is able to relate that new experience to his previously established categories.

3. Further, it can be seen that normal intellective function requires that an individual be able to employ approximately the same categories as do his peers, and that the individual must attain roughly the same meaning from his experiences as do others in the same surroundings, or risk classification as a deviant.

4. Since subnormal individuals are observed to have actual difficulty in functioning successfully in numerous situations, it seems legitimate to suggest that this low level of function may be caused by the subnormal person's inability to incorporate adequately the set of categories which is predominant for his particular culture.

5. An inability to employ categorization as an intellective tool might take several forms in subnormal persons. They might possess relatively fewer categories, in which case they would likely be unable to find items representing as great a number of categories as would normal individuals. They might possess a stock of categories which were less well delineated or understood by them, in which case their verbal

> descriptions of their category use. Or their use of categories might require more time, which would cause them to use categories with more apparent difficulty.[14]

Although the foregoing observations suggest the growing interest of many writers in the importance of categorization as a foundation of intellective processes, research in this area is notably far from complete. Investigation of the experimental literature, conducted in the following section reveals this incompleteness.

Experimental Studies

Except for Stephens, no investigators have published research which compares normal and subnormal children with respect to their repertory and use of categories, and few studies have been published which yield even indirect information on this topic. Most of the research which does provide information, both direct and indirect, concerning the categorization process can be organized under one of four headings:

1. Studies of concept formation.
2. Studies analyzing the results of standardized ability tests.
3. Psychological studies of normal and subnormal children.
4. Studies in the use of selected categories.

The studies considered below will be grouped in the above sequence.

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[14] *Ibid.*, pp. 5-6.

Studies of Concept Formation

Although there are many studies in the area of concept formation, in general, they tend to yield only minimal information regarding the nature of categories possessed by children. According to Vinacke, two important reasons account for the general shortcomings of research in concept formation:

> First, the evolution of psychology has not gone far enough to free the treatment of concept formation from its past associations with epistemology and formal logic. Thus, terms like "abstraction" and "generalization" are still utilized--and still influence the nature of experiments--without sufficient analysis of the behavioral and genetic processes involved. Second, the data utilized in discussions of the subject are much too narrow, since they are usually drawn from limited experimental situations. . . .[15]

Vinacke also suggested that one fault evident in previous studies of concept formation is the fact that investigators have unwittingly included three related but somewhat different fundamental problems in their studies.[16] These problems which have been dealt with were: (1) Ability to conceptualize, which is concerned with a general effort to ". . . trace, with age, the unfolding and elaboration

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[15] W. Edgar Vinacke, "The Investigation of Concept Formation," Psychological Bulletin, XL (1951), p. 1.

[16] *Ibid.*, pp. 7-8.

of a general function in the behavior of the individual together with conditions which influence that development;"[17] (2) Repertory of concepts, which is more concerned with ". . . the particular concepts which the child possesses, and with the way he utilized them;"[18] (3) Achieving specific concepts, in which the question is posed: "How does the individual go about attaining a particular concept?"[19]

The second of these problems seems to be the most closely related to this study. Of the studies which have been conducted in these areas, however, the following appear especially pertinent.

Reichard, Schneider, and Rapaport administered the Color-Form and Sorting tests described by Goldstein and Scheerer to 234 normal children who ranged in age from 4 through 14 years.[20] Their results revealed a steady increase in the ability to group together objects which belong together, and in the ability to give conceptual explanations of the groupings. On the basis of their findings, they postulated that development of conceptual abilities progresses from a concretistic level through

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[17] *Ibid.*

[18] *Ibid.*

[19] *Ibid.*

[20] Suzanne Reichard, Marion Schneider, and David Rapaport, "The Development of Concept Formation in Children," *American Journal of Orthopsychiatry*, XIV (1944), 156-162.

a functional level to a conceptual level.[21] They found that this development appeared to take place throughout the whole age range studied.[22]

Welch attempted to measure the gradual development of finer concepts of large, small, middlesize, wide, and narrow, in a group of 24 children from 12 to 40 months in age.[23] During a period of several months of observation, he noted the emerging development of these concepts. A series of similarly related studies conducted by Welch and his associate Long indicated that the development of conceptual abilities in children generally proceeds from simple to complex. Their studies also revealed that at a childhood level of conceptual development, chronological age seemed to be as important as mental age in the determination of conceptual ability.[24]

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[21] Ibid., pp. 156-160.

[22] Ibid.

[23] Livingston Welch, "The Development of Size Discrimination Between the Ages of 12 and 40 Months," Journal of Genetic Psychology, LV (1939), pp. 243-268; "The Span of Generalization Below the Two Year Level," Journal of Genetic Psychology, LV (1939), pp. 269-297; "The Development of Discrimination of Form and Area," Journal of Psychology, VII (1939), pp. 37-54; Livingston Welch and Louis Long, "A Further Investigation of the Higher Structural Phases of Concept Formation," Journal of Psychology, X (1940), pp. 211-220.

[24] Louis Long and Livingston Welch, "Influence of Levels of Abstraction on Reasoning Ability," Journal of Psychology, XII (1942), pp. 41-59.

A few other relevant studies attempted to establish the typical age at which specific concepts occur in children. Friedman, for example, studied 697 children who ranged in school placement from kindergarten through the sixth grade, and who were within the normal range of intelligence.[25] He found that conventional concepts of time were usually established by the time the children reached the sixth grade, and that younger children tended to display less comprehension of time unless the time period was of special importance to them. Friedman felt that the progression of concept development appeared to be characterized by long and continuous progress, during which the child first developed gross discriminations which were followed by increasingly fine discriminations.

Thrum studied concepts dealing with magnitude by investigating the concept of middlesizeness in children from two to five years of age.[26] Many of her subjects demonstrated great difficulty in utilizing this particular concept, and she noted that there appeared to be a high correlation between general intelligence and the ability to discriminate middlesizeness. Hicks and Stewart also

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[25] Kopple C. Friedman, "Time Concepts of Elementary School Children," <u>Elementary School Journal</u>, XLIV (1944), pp. 337-342.

[26] Martha E. Thrum, "The Development of Concepts of Magnitude," <u>Child Development</u>, VI (1935), pp. 120-140.

investigated the concept of middlesizeness in two to five year old children, and reported that gross discriminations of size appeared to be followed by increasingly finer ones as the child grew and developed.[27]

The literature of concept formation also reveals an interest in concepts of form. Gellerman, for example, investigated two children and two chimpanzees in order to determine their relative rate of development of form concepts.[28] As a result of his investigations, he concluded that the two year old children could discriminate forms and that symbolic behavior was generally exhibited in connection with form discrimination. Colby and Robertson also investigated form and shape discrimination, and the results of their investigations enabled them to conclude that form, as a concept, is established as early as three years of age, and appears to be dominant over color as a concept at that stage.[29]

Although there are numerous other studies in the area of concept formation, not to mention the nonexperimental

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[27]Allen Hicks and Florence D. Stewart, "The Learning of Abstract Concepts of Size," Child Development, I (1930), pp. 195-203.

[28]Louis W. Gellerman, "Form Discrimination in Chimpanzees and Two-year Old Children," I. Form (Triangularity) Per. Se. Journal of Genetic Psychology, XLIII, (1933), pp. 23-50.

[29]Manual G. Colby and Janis G. Robertson, "Genetic Studies in Abstraction," Journal of Comparative Psychology XXXIII (1942), pp. 385-401.

treatment of concept formation espoused by the great Piaget and his colleagues,[30] they have not been included in this review because they were either directed primarily toward adult concept formation processes or did not test children's repertory of concepts or categories. Unfortunately, the experimental studies in this area have, in general, yielded very little information regarding the process of categorization because they seem primarily concerned with investigating specific concepts generally related to perceptual abilities instead of intellective processes.

Studies Analyzing the Results of General Ability Tests

Investigations of various intellective characteristics of children displayed on different tests of general mental ability have also revealed information related to the process of categorization. Two of the most relevant instruments, whose results have been thoroughly investigated and are especially pertinent to this study, are the Stanford-Binet Intelligence Test[31] and the different Wechsler Intelligence Scales.[32]

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[30]Jean Piaget, The Child's Conception of the World (New York: Harcourt, Brace, and Co., 1959).

[31]Revised Stanford-Binet Scale (New York: Houghton Mifflin Company, 1937).

[32]David Wechsler, The Measurement of Adult Intelligence (3rd edition; Baltimore: Williams and Wilkins, 1944); The Wechsler-Bellvue Intelligence Scale (New York: Psychological Corporation, 1946); Wechsler Intelligence Scales for Children (New York: Psychological Corporation, 1949)

The Stanford-Binet was originally designed to measure general intelligence and, consequently, includes items which show high correlation with general ability.[33] However, some investigators have attempted to determine whether or not certain patterns of responses to the test are characteristic of various modes of thinking. Myers and Gifford, for example, investigated this line of thought, and reported that schizophrenics were superior in vocabulary, abstract words, and dissected sentences, when compared as a group with normals of the same mental age.[34] Another researcher, Feifel, found that patients in a mental institution when compared to normal subjects responded to vocabulary items in different ways, in that normals tended to use synonyms, while mental patients defined by description, illustration, and explanation.[35]

Particularly relevant was a study conducted by Thomson and Magaret, who compared the performance of normal and retarded subjects with similar mental ages on

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Wechsler Adult Intelligence Scale (New York: Psychological Corporation, 1955); Wechsler Pre-School Intelligence Scale (New York: Psychological Corporation, 1966).

[33]Lewis M. Terman and Maud A. Merrill, Stanford-Binet Intelligence Scale, Manual for the Third Revision Form L-M, (Boston: Houghton Mifflin Company, 1960), pp. 1-3.

[34]C. R. Myers and Elizabeth Gifford, "Rescoring the Stanford-Binet," Bulletin of the Canadian Psychological Association, I (April, 1941, Number 29).

[35]Harold Feifel, "Qualitative Differences in the Vocabulary Responses of Normals and Abnormals," Genetic Psychology Monographs, XXXIX (1949), pp. 151-204.

the Binet.[36] In their study, 73 of the Binet items were subjected to statistical analysis, and of these 43 did not differentiate between the normal and subnormal subjects. Although these results appear to cast doubt on many of the items, McNemar suggested from his statistical analysis of Binet items that performance was largely determined in terms of a single common factor, which for lack of a better name was referred to as "brightness."[37] In the Thomson and Magaret study, subnormal subjects might have been more deficient in those items which were more heavily saturated with this general factor first described and analyzed by McNemar.[38]

Other investigators have been concerned with exploring specific aspects of the thinking process and have attempted to find them reflected in the scatter of scores on the Binet. Regarding their efforts, Anastasi noted that:

> Attempts have repeatedly been made to determine whether the extent and nature of scatter bore any relation to the individual's intellectual. . . characteristics. The results of such investigations have generally been negative or inconclusive.[39]

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[36] Claire V. Thomson and Ann Magaret, "Differential Test Responses of Normal and Mental Defectives," _Journal of Abnormal and Social Psychology_, XLII (1947), pp. 285-23.

[37] Quinn McNemar, _The Revision of the Stanford-Binet Scale_ (Boston: Houghton Mifflin Company, 1942), Ch. IX.

[38] Thomson and Magaret, _loc. cit._

[39] Anne Anastasi, _Psychological Testing_ (New York: The MacMillan Company, 1954), p. 189.

A number of investigators have studied the patterning of responses on the subtests of the different Wechsler scales and have reported that they reveal variations and patterns of thinking. Studies conducted by Wechsler[40] and Rapaport[41] have been prominent in this area of investigation. Both of these psychologists, however, have been concerned with abnormal thought processes and have suggested that patterning of scores on subtests of the Wechsler intelligence scales indicate differences in thinking. Although Rapaport's intensive study of the Bellevue scale resulted in his initial findings regarding the relation of scatter and patterning of test results to disturbed thought processes, Anastasi and others have offered several critical observations of scatter analysis similar to those criticisms leveled at the analysis of scatter on the Binet.[42]

Thus, although both the Stanford-Binet and the Wechsler have had wide acceptance since their introduction and are considered reliable estimators of general ability repeated studies have apparently failed to find any significant patterning of responses to either test which provides

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[40]David Wechsler, _The Measurement of Adult Intelligence_, (3rd Edition; Baltimore: William and Wilkins, 1944).

[41]David Rapaport, _et. al._, _Diagnostic Psychological Testing_, I (Chicago: Year Book Publishers, 1945), pp. 37-379.

[42]Anastasi, _op._ _cit._, pp. 333-334.

reliable information concerning specific aspects of thinking or which reveals information regarding the stock of categories which a subject possesses.

Psychological Studies of Normal and Subnormal Children

Some of the indirect observations that are related to the study of conceptual categories have been provided by only a few psychological investigations of normal and retarded individuals. The relevant studies are found in one of two main areas: (1) studies comparing endogenous and exogenous types, and (2) studies of abstract versus concrete behavior.[43]

Werner, Strauss, Lehtinen, and their colleagues conducted a number of studies designed to reveal differences between so-called "garden variety" subnormals and brain injured subnormals.[44] Their investigations found that a garden variety group approached a marble patterning task "globally," with uni-directional line arrangements, while the exogenous or brain injured group was characterized by incoherent, unrelated lines of arrangement. They also discovered in an experiment which required children to sing back melodic patterns played on a piano that endogenous

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[43]Stephens, *op. cit.*, p. 18.

[44]Heinz Werner and Alfred A. Strauss, "Pathology of Figure-ground Relation in the Child," *Journal of Abnormal and Social Psychology*, XXXVI (1941), pp. 236-248.

children's responses were similar to those of normal children since both tended to simplify patterns which were too difficult for them.[45] The exogenous sample, however, tended to respond with more bizarre and unrelated patterns. In this same experiment, exogenous children seemed more confused by distracting backgrounds when trying to reproduce figures presented in complicated backgrounds.

Interest has also been revealed in the area of concrete and abstract thinking. Goldstein and his associates conducted some investigations utilizing specially constructed sorting tests in order to find out more about the patterns of concrete and abstract thinking.[46] However, most of their studies are not directly relevant to this study because they used adult subjects and relied upon testing instruments that were designed for the purpose of measuring abnormal thinking patterns instead of assessing the use of categories. Rapaport expressed their primary concern in his statement that the aim of testing of concept formation is "to discover and diagnose _in statu nascendi_ the encroachment of maladjustment upon conscious thinking."[47] If this is valid, the usefulness of these

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[45]Heinz Werner and Alfred A. Strauss, "Casual Factors in Low Performance," _American Journal of Mental Deficiency_, XLV (1940-1941), pp. 213-218.

[46]Kurt Goldstein and Martin Scheerer, "Abstract and Concrete Behavior: An Experimental Study with Special Tests," _Psychological Monographs_ (1941), No. 239.

[47]David Rapaport _et. al._, _op. cit._, p. 389.

types of sorting tests would appear to be seriously limited in studies dealing exclusively with the categorization process.

Bolles, however, studied the ". . . qualitative differences in certain of the thinking processes of aments, dements, and normal children . . ." *specifically*.[48] In one of her most relevant studies she administered the Holmgren Wools Test, Weigl Object Sorting Test, and the Kohs Block Test to 10 normal adults and 10 retarded adults.[49] According to Bolles, her subjects classified the test items in four distinct ways:

> 1. Identity. The subject brings together only those objects which are exact sensory equivalents. If there are any discrepancies between them, the objects are not brought together.
>
> 2. Partial Identity. The subject brings objects together that are similar in some ways. The similarity seems still to be on a sensory level. The objects seem to be equivalent in terms of some sensory attribute.
>
> 3. Co-functionality. The subject brings the objects together because they seem to belong together in a concrete situation. The relationship between them seems to depend upon their being used together in a specific set of circumstances.
>
> 4. Categorical Similarity. The subject brings together objects that belong to the same general category. The objects are taken as a representative of a class and not in terms of some specific attribute or function each possesses.[50]

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[48] Mary M. Bolles, "The Basis of Pertinence," Archives of Psychology, XII (1937).

[49] Goldstein and Scheerer, *loc. cit.*

[50] Bolles, *op. cit.*, p. 46.

Bolles reported that these groupings appeared to form a progression form concrete to abstract, and she noted that "aments" tended to respond concretely and seemed less able to shift voluntarily from one aspect of the situation to another. Although these findings contribute needed information on the thinking process, they are difficult to accept uncritically in terms of the abstract-concrete continuum[51] because of the small number of subjects used and the omission of subnormal children.[52]

Studies in the Use of Selected Categories

Relatively few investigators have ventured into the area of study involving the use of categories in the thinking processes. And, except for Stephens, no research has been done studying the process of categorization in normal and retarded children.

Recently, however, Sigel, Jarman, and Hanesian reported an investigation involving a group of 4 and 5 year old children who were given the Stanford-Binet Intelligence Test (Form L), teacher's ratings of personal-social behaviors, and a test of categorization consisting of 20 sets of items containing human, animal, and object content.[53]

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[51]Brown, op. cit., Chapter 8.

[52]Bolles, op. cit., p. 48.

[53]Irving Sigel, P. Jarman, and Helen Hanesian, "Styles of Categorization and their Intellectual and Personality Correlation in Young Children, Human Development, 1967, 10(1), pp. 1-7.

They found no statistically significant relationship between categorization and IQ. However, they reported a relationship between styles of categorization and personal-social behaviors and suggested that particular styles of categorization may be relatively well-established in the personality structure at an early age.

In a recent study by Cofer, clustering in free recall was interpreted as resulting from the use of the category name as a coding response.[54] Relevant data was presented and interpreted with regard to three free-recall situations in which clustering was empirically studied. It was concluded that category names do not play roles in clustering in the category clustering situation or in differences in clustering found for sets of words comprising all the items of a category as compared with word sets which did not exhaust a category. However, Cofer cited evidence that the greater clustering found for categorized rather than non-categorized pair members with equal associative overlap could have been due to the greater codability of the categorized pairs.

One investigator who deserves special attention is Stephens. His pioneering investigations into the process

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[54]Charles N. Cofer, "Some Evidence for Coding Processes Derived from Clustering in Free Recall," Journal of Verbal Learning and Verbal Recall, 1966, 5(2), pp. 188-192.

of categorization are particularly relevant because he used normal and subnormal children as subjects and devised a special list of selected categories. In his unpublished dissertation, Stephens tested 30 normal boys and 30 subnormal boys between the ages of 7½ and 10½ years of age.[55] Within the obvious limitations posed by the sample and by the age, sex, and intellective characteristics of his subjects, Stephens found that subnormal boys appear to possess relatively fewer conceptual categories and seem to have less success than comparable normal subjects in the independent utilization of categories.

In a similar study, Stephens measured the conceptual categorization abilities of 30 mentally subnormal subjects. The results indicated that the subnormal group could be expected to be able to give meaning to a comparatively narrower range of life experiences than could normal children.[56]

Recently, Stephens has investigated the category usage of normal and subnormal children on three types of categories.[57] This study compared the categorization

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[55] Wyatt E. Stephens, "A Comparison of Normal and Subnormal Boys on Tasks Requiring the Use of Selected Categories," An Unpublished Doctoral Dissertation, University of Oklahoma, 1963.

[56] Wyatt E. Stephens, "A Comparison of the Performance of Normal and Subnormal Boys of Structured Categorization Tasks," Exceptional Children, 1964, 30(7), pp. 311-315.

[57] Wyatt E. Stephens, "Category Usage of Normal and Subnormal Children on Three Types of Categories," American Journal of Mental Deficiency, 1966, 71, 2, pp. 266-273.

performance of a group of subnormal subjects with that of an equal chronological age, higher mental age group, and with that of an equal mental age, lower chronological group. The most striking result was the finding that, while subnormal subjects resembled equal mental age counterparts in responses to perceptual and human categories, they showed significantly lower levels of performance in the use of categories than had been expected either on the basis of their mental age, or their performance on categories of the other two types.

Summary

A review of the professional literature in the field of subnormality reveals very little systematic comparison of mental processes in normal and subnormal children. Specifically, there is a lack of adequate investigation and knowledge regarding the nature of conceptual categories and the part they play in the thinking process. The results of the investigations referred to in this study seem to provide tentatively useful information about these processes. But unfortunately, this information seems generally sparse and often difficult to evaluate because of limitations in objectives and design.

Stephens, for example, expressed the view that:

> . . . the basic ability underlying a large part of intellective function is the ability of

> the individual to utilize conceptual categories to give meaning to his experiences.[58]

He studied the ability of normal and subnormal children in using a variety of specially designed categories which were observed to be an important part of everyday intellective function and thus opened up a very valuable area of investigation. His study investigated the comparative number of categories used by normal and subnormal subjects, the ability of normal and subnormal subjects to use these categories independently, their ability to specify a name for the category they used for their grouping, their ability to find examples of a category when they were given the name of the category, and the relative speed with which they could carry out all of these tasks.

However, Stephens neglected to include an adequate experimental sample in his study. His original investigation was limited to a comparison of normal and subnormal boys in the use of selected categories. Consequently, his results and conclusions did not account for the possibility of sex differences in performance. Stephens was apparently aware of this when he noted in his conclusions that "Several major areas merit further investigation. . ."[59] before the results of his study could be fully evaluated.

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[58]Wyatt E. Stephens, unpublished doctoral dissertation, op. cit., p. 22.

[59]Ibid., p. 95.

Among those mentioned as most important was the need for ". . . normative data which will describe age and sex differences in categorization ability."[60]

It has been assumed by most investigators that no sex differences exist. This is an unwarranted assumption in view of the evidence which, although contradictory, suggests the possibility that sex differences may be a variable influencing the scores and performance of normal and retarded children.

Other writers have also indicated a need to evaluate the possibility of sex differences. Indeed, there seems to be some conflict in the literature regarding the influence of sex differences on behavior and mental activity. The studies done by McNemar and Terman, for example, have reviewed investigations in which sex differences in performance have been revealed.[61] They found that on standardized verbal intelligence test batteries there was a rather significant trend in favor of greater male variation in intelligence as defined by these tests.

Certainly, these investigations by McNemar and Terman and the studies done by Stephens suggest the importance of sex differences as an uncontrolled variable

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[60] Ibid., p. 96.

[61] Quinn McNemar and Lewis M. Terman, "Sex Differences in Variational Tendency," Genetical Psychological Monographs, 1936, 18, pp. 1-65.

which has perhaps all too often been assumed to be non-existent.

All these facts, when taken together, suggest the value of a study which investigates and described the differences in the stock and use of categories in both normal and subnormal males and females. Such a study should help to clarify whether or not there are sex differences in the categorization process and possibly reveal how they are related to the intellectual process.

Additional experimental data concerning these questions should also help to provide more information regarding the mental processes and intellective characteristics of normal and subnormal children. Hopefully, this information could provide professional workers in education and psychology with an experimental basis on which to develop instructional practices and theory.

CHAPTER II

STATEMENT OF THE PROBLEM

In view of the importance of sex differences in the professional literature and the need for a study to determine whether or not sex differences are a variable which influences the performance and use of conceptual categories in the intellectual processes of normal and subnormal children, McNemar noted that:

> Whether or not such differences as have been demonstrated [in the past] have social significance may be open to question, but as regards their import for experimental control, there can be no question, for when sex differences are not present, conclusions from an experiment become more general and less subject to qualifications.[1]

If this is true, then it seems appropriate to investigate the categorization process in normal and subnormal children as Stephens did, but this time with the purpose of finding out whether or not sex differences exist in performance and, if so, how they influence it.

Thus, it is specifically desired to determine

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[1] Quinn McNemar, The Revision of the Stanford-Binet Scale, Houghton Mifflin Co., 1942, p. 42.

whether or not there are significant sex differences in normal and subnormal children in the ability to employ a series of selected categories. In order to determine whether or not sex differences exist, it is necessary to study the abilities of normal and subnormal children of each sex to use selected categories appropriately; to correctly specify the names of the categories which were employed; and to correctly identify members of the categories, the names of which the experimenter had specified, Data resulting from the study of these tasks would make it possible to compare the performances of the children in order to determine whether or not sex differences exist, and, if so, whether or not they are influential.

In his investigation, Stephens was primarily interested in determining whether or not normal male children possessed a relatively greater number of categories and whether or not they were able to utilize these categories more effectively than subnormal male children. The present experiment will employ basically the same experimental design that Stephens used, but with some modifications that were necessary to include in order to find out whether or not sex differences had any influence on performance.

The following null hypotheses were formulated in order to determine whether or not sex differences would account for differences in performance when normal and subnormal groups of children of each sex were presented with unstructured and structured categorization tasks:

1. The number of correct responses attained by the male subjects is not significantly greater than the number of correct responses attained by the female subjects in normal and subnormal groups of children when the responses of both groups to each of 24 unstructured categorization tasks are compared.

2. The number of correct category names specified by the male subjects is not significantly greater than the number of correct category names specified by the female subjects in normal and subnormal groups of children when members of each group are required to name the categories they have employed in the unstructured categorization tasks.

3. The number of correct responses attained by the male subjects is not significantly greater than the number of correct responses attained by the female subjects in normal and subnormal groups of children when the responses of the groups to each of 24 structured categorization tasks are compared.

4. The mean time for correct responses attained by male subjects is not significantly greater than the mean time for correct responses attained by the female subjects in normal and subnormal groups of children when the responses of the groups to each of 24 unstructured categorization tasks are compared.

5. The mean time for correct responses attained by the male subjects is not significantly greater than the mean time for correct responses attained by the female subjects when the responses of the groups to each of 24 structured categorization tasks are compared.

Since the design of this experiment was generated by Stephens' investigations and the sampling techniques were similar, it is possible for this study to also provide additional evidence regarding the hypotheses which he proposed and the results which he obtained.

CHAPTER III

METHOD

This study was designed in order to compare normal and subnormal groups of children in terms of sex differences with respect to their abilities to utilize a variety of specially selected conceptual categories. Hypotheses were formed regarding whether or not there would be significant differences in performance on categorization tasks between male and female subjects in normal and subnormal groups of children.

The Subjects

The subjects used in this experiment were 80 boys and girls[1] randomly selected from six elementary schools in the Oklahoma City Public School System. The subjects ranged in chronological age from 90 to 126 months. Forty were enrolled in regular classrooms, and 40 were from classes

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[1]The sample size was determined by the specially devised statistic, $n = [x^2 \; N\pi(1-\pi)] \div [d^2(N-1)+x^2\pi(1-\pi)]$. This formula was created for experiments dealing with small sample techniques by the NEA Research Division and appeared in the NEA Research Bulletin, May 1964, pp. 99-104.

for the educable mentally retarded. The subjects were selected from schools located in predominantly upper-lower class neighborhoods as described by an Oklahoma City School Board Official. They represented families of lower-middle to middle-middle socio-economic levels. Each subject was screened prior to the actual experiment for evidence of difficulty in hearing, visual acuity problems, or any physical handicap which would possibly interfere with test performance.

The subjects were separated into four groups. The first group was comprised of 20 normal males between 7½ and 10½ years of age. They were classified within the normal range of intelligence, each possessing an Intelligence Quotient between 90-110 as measured by the <u>California Test of Mental Maturity</u>.

The second group was comprised of 20 normal females between 7½ and 10½ years of age. They were classified within the normal range of intelligence, each possessing an Intelligence Quotient between 90-110 as measured by the <u>California Test of Mental Maturity</u>.

The third group was comprised of 20 subnormal males between 7½ and 10½ years of age. They were classified within the educably retarded range of intelligence, each possessing an Intelligence Quotient between 51-78 as measured by the <u>Stanford-Binet Intelligence Scale (Form L-M)</u>.

The fourth group was comprised of 20 subnormal females between 7½ and 10½ years of age. They were classified within the educably retarded range of intelligence, each possessing an Intelligence Quotient between 51-78 as measured by the *Stanford-Binet Intelligence Scale (Form L-M)*. Except for the equating of sex, the subjects were randomly selected within each of the experimental groups.

The Test Instrument

In order to subject the formulated hypotheses to proper experimental test, it was necessary to find a suitable instrument which was capable of determining the presence or absence of a range of categories in normal and subnormal groups of children, and which was able to assess the children's use of these categories in different situations. Since this study was designed to further explore the work begun by Stephens, it was decided to utilize the same type of procedure and test materials which he used.

Initially, Stephens was confronted with the possibility of using several published tests. Two of the most potentially useful tests which Stephens originally considered for his study were the *Goldstein and Scheerer Tests*[2] and the Columbia Mental Maturity Scale.[3] None of the

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[2]Goldstein and Scheerer, *loc. cit.*

[3]Bessie B. Buregemeister, Lucille H. Blum, and Irving Larrage, *Columbia Mental Maturity Scale* (New York: World Book Company, 1954-1959.

Goldstein and Scheerer tests were judged suitable. According to Stephens, some of these tests dealt with one one, or at most a few categories, and thus would have lacked the range of categories necessary for his study.[4] The other tests covered a broader range of categories, but Stephens noted that they were made up of relatively unwieldy materials and lacked a clear-cut basis for judging passes and failures.[5] A further disadvantage of using the *Goldstein and Scheerer Tests* was that they were designed so that their results would be interpreted on the basis of the abstract-concrete continuum rahter than in terms of categories.

The *Columbia Mental Maturity Scale* was also considered for use by Stephens. However, he decided against its use because, as Canter pointed out, the items of this test were too factorially complex, and although ability to categorize was required of the subject for successful completion of each item, the factorial complexity obscured the nature of the category named by the subject.[6] Stephens noted that the Columbia Test also had a very high chance score (20%-25%, depending upon the item), which would also

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[4]Stephens, *loc. cit.*, p. 28.

[5]*Ibid.*, p. 28.

[6]Arthur Canter, "The Use of the Columbia Mental Maturity Scale with Cerebral Palsied Children," *American Journal of Mental Deficiency*, LX (April, 1956), pp. 843-851.

most likely contaminate the obtained results.[7]

As a result of his inability to locate a reliable test for his study, Stephens constructed a test. Stephens' Test of Categorization consisted of a series of 27 cards, each 8 inches by 18 inches. There was one test card for each of the following 27 categories:

Sample: Size
Sample: Form
1. Color
2. Number
3. Detail
4. Orientation in space
5. Heat
6. Clothing
7. Fruits versus vegetables
8. Flying versus non-flying objects
9. Containers versus non-containers
10. Tools versus non-tools
11. Cutting versus non-cutting equipment
12. Sex differences in children
13. Age differences in men
14. Sex differences in adults
15. Happy versus sad children
16. Ugly versus pretty women
17. Land vehicles versus airborne or amphibious vehicles
18. Land animals versus airborne or amphibious animals
19. Young boys versus other living things
20. Clothing made from animal products versus other wearing apparel
21. Footwear versus other clothing
22. Furniture versus other household objects
23. Cooking equipment versus other household objects
24. Male versus female wearing apparel
25. Even numbers of dots versus odd numbers of dots

On each test card there were seven randomly ordered figures or pictures, four of which represented the category,

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[7] Stephens, loc. cit., p. 28.

and three of which were incorrect responses in terms of the category which was being tested.

In the present study, 24 categories of *Stephens' Categorization Test* were used. The subject was required to perform three kinds of tasks employing these categories. First, he was required to independently decide upon the appropriate category for each card. Second, he was required to provide a name for each of the categories he had used as a basis for arriving at his responses. Third, he was required to find the items on each card which represented the correct category, after the name of that category had been revealed by the examiner.

Some delimitations should be noted regarding the categories used by Stephens. First, Stephens pointed out that his categories were:

> . . . not intended to include the whole range of intellective experience, but rather were believed to be representative of classification tasks necessary for adequate everyday intellective function on the part of children.[8]

A second delimitation, according to Stephens, had to do with the relative difficulty of the categories. Although it appeared impossible to establish the absolute difficulty of any given category, it was suggested, in view of strong experimental support found in the literature,

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[8] *Ibid.*, p. 30.

that the difficulty of a category was dependent upon the number and type of cues which the individual must consider before the decision of inclusion or exclusion was made. Stephens was apparently aware of this when he noted that even though:

> . . . there was no way of establishing conclusively that a test item for a particular category is the simplest form possible, a recognition of the necessity for simplicity at least serves to draw the attention of the test constructor toward this problem.[9]

A third delimitation also should be disclosed at this point. Stephens did not apparently create this test for popular usage, but rather as a special experimental instrument for studying the categorization process. The sole value of his test, therefore, depends not upon its resemblance to existing tests, but upon whether or not it differentiated normal from subnormal subjects along the dimension of behavior being studied.[10]

The Pilot Study

A pilot study duplicating the procedure used in the present experiment was done in order to determine: (a) whether or not the test items discriminated between normal and subnormal children, and (b) whether or not any mechanical problems might occur which would be associated

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[9] *Ibid.*, pp. 30-31.

[10] *Ibid.*, p. 31.

with administration procedure, recording of scores, and with timing the tasks in the structured and unstructured testing situations.

Four groups were tested in the pilot study. The first group was composed of 5 normal boys between 7½ and 10½ years of age, with IQ scores ranging from 90 to 110. The second group was composed of 5 normal girls between 7½ and 10½ years of age, with IQ scores ranging from 90 to 110. The third group was composed of 5 subnormal boys between 7½ and 10½ years of age, with IQ scores ranging from 51 to 78. The fourth group was composed of 5 subnormal girls between 7½ and 10½ years of age, with IQ scores ranging from 51 to 78.

All responses made by each subject and the number of seconds required for him to make the response were recorded on a specially constructed form (Appendix 1). Inspection of the results obtained in the pilot study indicated that many of the items discriminated between normal and subnormal subjects, generally in favor of the normal subjects. No substantial sex differences in performance were obvious, although there appeared to be some items in which responses could have been accounted for in terms of sex differences. In addition the technical procedure, instructions, and scoring used during the pilot seemed adequate and easily adaptable to the experimental design of the study.

Administration of the Test

The testing was conducted in a quiet, well lit room. Each subject was accompanied to the room by the experimenter and seated at a small table. When rapport was sufficiently established for testing purposes, the experimenter carried out the following procedure:

> 1. Subjects were seated facing the experimenter. The experimenter then placed four pennies, heads up, in a row before the subject, and said: "You've probably noticed how different things can be like each other. See, these pennies are all alike. They look alike."
>
> The pennies were then removed, and a row of coins composed of one penny, one dime, one nickel, and one quarter were arranged before the subject. The experimenter then asked: "Are these alike? They don't look alike, but they <u>are</u> alike in some ways, aren't they? For example, we could buy something with any of them, couldn't we? They are alike then because they all do something alike."
>
> The pennies were then replaced before the subject, and the experimenter said: "Now, I have some pictures on these cards of lots of things. On each card some of the things go together because they are most alike. We're going to look at each card, and put the pennies on the things which are most alike. I'll show you what I mean with the first two cards."
>
> 2. The experimenter presented each sample card, and aided the subject, when necessary, in the correct solution, each time verbalizing the correct category following the correct placement of the pennies.
>
> 3. The experimenter then presented the first test card with these instructions: "Let's do this one. Which of

these are most alike?" The subject's response and the time required to reach it were recorded.[11] Then the subject was asked: "How or why are these most alike?" The subject's responses and the time he required to reach them were recorded on the specially constructed forms (Appendix 1).

4. The same instructions as presented in item 3 were presented for each of the subsequent items.

5. After completion of the unstructured administration, each card was once again presented to the subject in a structured condition, in which the experimenter structured the situation by specifying the category which the subject should employ. The experimenter placed each card before the subject and asked: "Which ones are the same color?", etc., naming the category for each card, until all of the cards had been attempted by the subject.

Following completion of the unstructured tasks, the naming tasks, and the structured tasks in that order, each child was complimented on his effort and taken back to his classroom by the experimenter.

Data Obtained

The subjects were randomly selected and randomly tested in order to control for sets and to avoid serial placement. Information regarding each of the 80 subjects were collected prior to the testing. The preliminary data included the subjects name, code number,[12] sex, age, date

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[11]A stop watch divided into minutes, seconds, and tenths of seconds was used to determine the amount of time between the stimulus and response.

[12]Each of the 80 subjects was given a code number in order to protect their right to anonymity.

of birth, school, teacher, intelligence test scores, and information concerning the adequacy of vision and hearing or any physical disability which would interfere with proper control and sampling procedure. The data collected during the test included the subject's responses to the unstructured tasks, which were his own independent, self-determined responses to each of the 24 categories tested; his naming responses, which were the names given by each child for each of their completed efforts regardless of whether they were correct or incorrect; and the subject's responses to the structured tasks, which were his responses to the same 24 test cards but with the experimenter specifying the correct category name in advance of each successive card in which the subject was to select the correct pictures or objects.

Using the methods and procedures that were described in this chapter, the normal and subnormal samples of boys and girls were tested in order to determine whether or not there were significant differences in performance which could be attributed to sex differences on tasks requiring the use of selected conceptual categories. The results of this evaluation are presented in the following chapter.

CHAPTER IV

THE RESULTS

Eighty children from the Oklahoma City Public School System were tested on a series of 24 specially devised selected categories in order to determine whether or not there were significant sex differences in performance.[1] The subjects were separated into four groups: (1) Normal Males; (2) Normal Females; (3) Retarded Males; and, (4) Retarded Females. The 40 normal subjects ranged in IQ from 90 to 110, and the retarded subjects fell within the IQ range of 51 to 78. All of the subjects tested were between 7½ and 10½ years of age and were randomly selected from predominantly middle and lower class neighborhoods.

Treatment of Data

The present study was designed for a three-way analysis of variance.[2] Since the assumption of homogeneity was satisfied by the experimental design, a 2 x 2 x 2 analysis

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[1]Wyatt E. Stephens, *loc. cit.*

[2]Allen L. Edwards, *Experimental Design in Psychological Research* (New York: Holt, Rinehart and Winston, 1960).

of variance with sex, intelligence, and set as the factors was employed in the statistical analysis of the data.[3] For the present study, the level of significance was set at the .05 level.

The nature of the design was such that the data gathered was analyzed in two sections: (1) performance on the three major stages; and, (2) mean times for latency of response. The responses of each group on the three major tasks was analyzed in terms of performance on the unstructured and structured tasks (set), the naming tasks, and total performance on all three tasks (unstructured, structured, and naming).

Analysis of Unstructured and Structured Tasks

Each subject in each of the four experimental groups was given a series of 24 selected test categories in order to determine how many he could complete successfully through a process of inspecting each test card and then independently selecting the items on that card which were most alike. Successful completion in terms of choosing the correct items on each of the test cards was assumed to be a result of a subject's ability to utilize the appropriate category for selecting the items. As far as could be determined, only one logical solution was possible for the subject in

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[3] B. J. Winer. Statistical Principles in Experimental Design (New York: McGraw Hill Book Co., 1962).

each category. Stephens so constructed his test of categorization to specifically minimize the number of reasonable groupings which a subject could employ.

The four experimental groups investigated in this study were also administered 24 structured categorization tasks. The tasks were structured in that the experimenter specified the name for each of the categories prior to requesting the subject to locate the items on each card which represented the category named. It was assumed that the structured tasks would be relatively less difficult for both normal and subnormal subjedts of each sex because the category was specified.

The number of correct responses out of the 24 unstructured tasks and the 24 structured tasks for each of the four experimental groups of subjects is presented in Table 1.

As shown in Table 1, the total number of correct responses for the four experimental groups on the unstructured tasks reveals that the Normal Female Group of subjects scored higher than the Normal Male Group of subjects, while the Retarded Male Group of subjects scored higher than the Retarded Female Group of subjects. This comparison is also present in the performance on the structured tasks. The Male Retarded Group, however, scored higher than the Retarded Female Group on both the unstructured and structured tasks.

TABLE 1

TOTAL NUMBER OF CORRECT RESPONSES FOR STRUCTURED AND UNSTRUCTURED TASKS

(N=80)

	Unstructured Tasks[a]	Structured Tasks[b]	Total[c]
Normal Males (N=20)	289	375	664
Normal Females (N=20)	303	392	695
Retarded Males (N=20)	207	311	518
Retarded Females (N=20)	179	300	479

[a]Highest possible score = 480.

[b]Highest possible score = 480.

[c]Highest possible score = 960.

The total number of subjects in each group who had attained correct responses on the unstructured categorization tasks and on the structured categorization tasks were compared to find out whether or not there were any significant differences in performance. The results of these comparisons are summarized in Table 2.

As seen in Table 2, a computation and comparison of the test scores fails to indicate that the sex effect was significant. However, both the main effects of intelligence ($\underline{F}$=60.40; $\underline{P} < .001$) and set ($\underline{F}$=327.87; $\underline{P} < .001$) were significant. These significant differences indicate

TABLE 2

ANALYSIS OF VARIANCE FOR SEX, INTELLIGENCE AND TASK STRUCTURE ON THE UNSTRUCTURED AND STRUCTURED TASKS

(N=80, Scores=160)

Source of Variation	df	MS	F	P
Sex (Male vs. Female)	1	.40	.03	*
I.Q. (Normal vs. Subnormal)	1	819.025	60.40	.001
Sex x I.Q.	1	30.625	2.26	*
error (a)	76	13.56		
Set (Unstructured tasks vs. Structured tasks)	1	1000.0	327.87	.001
Sex x Set	1	2.5	.82	*
I.Q. x Set	1	15.62	5.12	.05
I.Q. x Sex x Set	1	1.22	.40	*
error (b)	76	3.05		
Total	159			

*Not Significant.

that, although there are no apparent differences in performances which can be attributed to sex, there are great differences in the performances on the unstructured tasks and the structured tasks, (in favor of the structured tasks) which appears to be a function of differences in intelligence between the normal and subnormal groups of subjects.

Further evidence of this is revealed by the significant second order interaction ($\underline{F}$=5.12; $\underline{P} < .05$) between the factors of intelligence (Normal vs. Subnormal) and set (unstructured vs. structured tasks).

Figure 1 illustrates the differences mentioned above in terms of mean scores for each of the four experimental groups of children on the 24 unstructured tasks and the 24 structured tasks. From this graph it can be seen that there is relatively little difference between normal male and normal female subjects in the performance of the unstructured and the structured tasks, while there is apparently a significant difference between normal and subnormal subjects in the performance of the two tasks.

Thus, on the basis of the data presented, the first and third null hypotheses cannot be rejected. In other words the number of correct responses attained by the male subjects is not significantly greater than the number of correct responses attained by the female subjects in groups of normal and subnormal children of each sex when the responses of the members of each group to each of 24 unstructured categorization tasks are compared, and the number of correct responses attained by the male subjects is not significantly greater than the number of correct responses attained by the female subjects in groups of normal and subnormal children of each sex when the responses of the members of each group to each of 24 structured categorization tasks are compared.

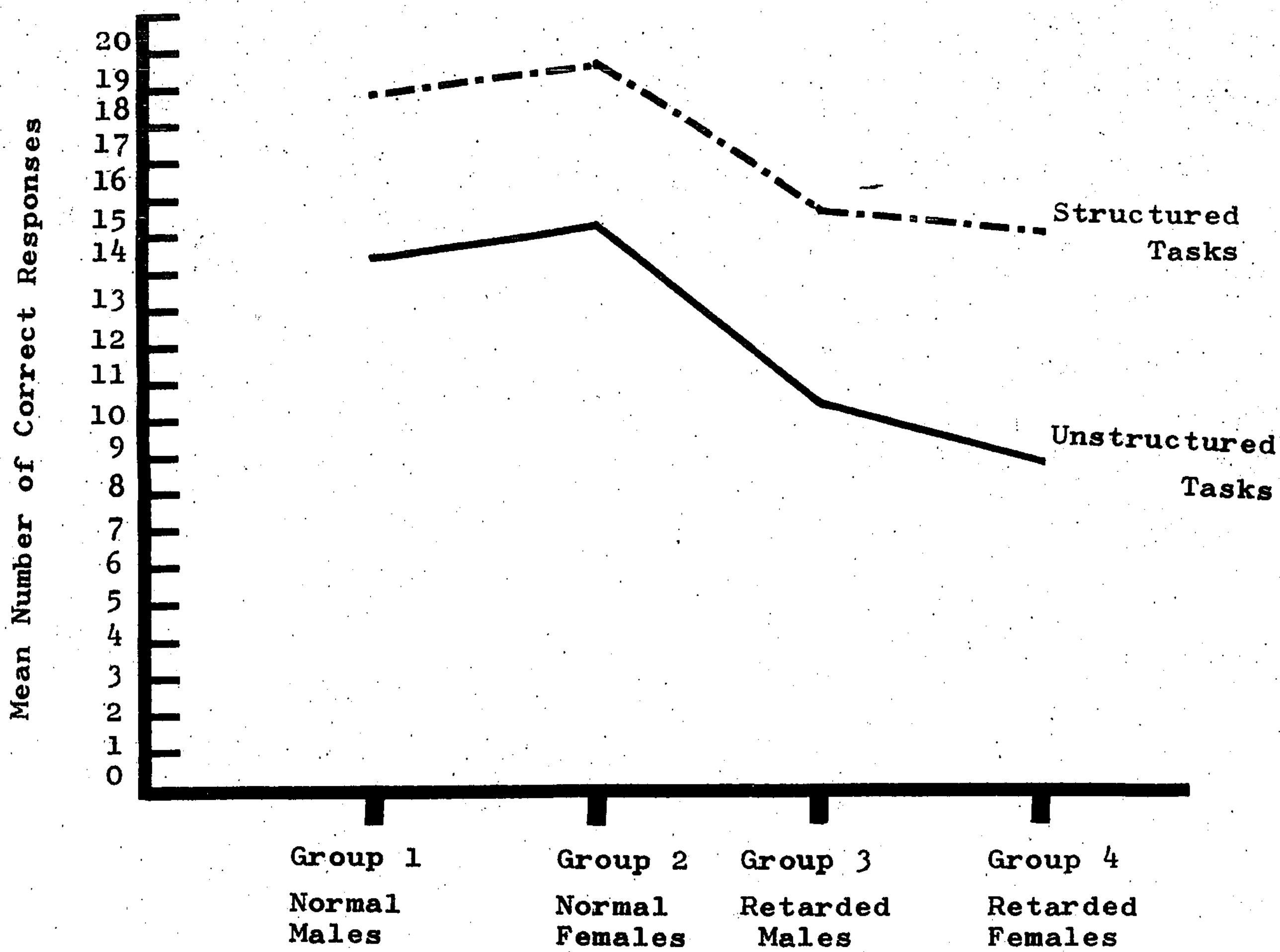

Figure 1: Task Performance as a Function of Task Structure, Sex, and Intelligence.

Analysis of the Naming Tasks

The four experimental groups of subjects in the present study were also compared on the basis of their performance on the naming tasks. The main interest in this comparison was the relative efficiency with which the subjects in each group could specify the correct names for categories which they had been able to correctly employ. The responses of each subject to the naming tasks were recorded in the appropriate space on the data form. Table 3 represents a summary of the number of correct responses and means for each group of subjects.

TABLE 3

NUMBER OF CORRECT RESPONSES ON THE NAMING TASKS

(N=80)

	Mean[a] X/N
Normal Males (N=20)	13.65
Normal Females (N=20)	13.75
Retarded Males (N=20)	10.85
Retarded Females (N=20)	9.15

[a]Highest possible mean score = 24.00

Although there are not significant differences, the data appears to be similar to Table 1 in that, here also, the Normal Female Group scored higher than the Normal Male Group while the Retarded Male Group scored higher than the Retarded Female Group. However, referral to Table 4, which presents the analysis of variance of the number of correct responses in the naming tasks indicates that the only statistically significant factor, in terms of performance, was due to the factor of intelligence which differed significantly in favor of the normal subjects (F=31.54; P < .001).

TABLE 4

ANALYSIS OF VARIANCE FOR SEX, INTELLIGENCE AND TASK STRUCTURE ON THE NAMING TASKS

(N=80)

Source of Variation	df	MS	F	P
Sex	1	12.8	1.47	*
I.Q.	1	273.8	31.54	.001
Sex x I.Q.	1	16.2	1.87	*
error	76	8.68		
Total	79			

*Not Significant.

Thus, on the basis of the data obtained from the statistical analysis of the results, it is concluded that the second null hypothesis cannot be rejected. The number of correct category names specified by the male subjects is not significantly greater than the number of correct category names specified by the female subjects in normal and subnormal groups of children of each sex when members of each group are required to name the categories they have employed in the unstructured categorization tasks.

Analysis of Total Number of Correct Responses

The four experimental groups of subjects in the present study were also compared on the basis of their total number of correct responses to all three tasks. Thus, the total number of correct scores for all subjects in each group for their performances on the unstructured tasks, the structured tasks, and the naming tasks were added together and computed, using a two-way analysis of variance in order to determine whether or not there were significant differences in performance. The results of this analysis are presented in Table 5.

As seen in Table 5, a computation and comparison of the test scores reveals that sex differences in performance of the four experimental groups on naming tasks are not significant (F=1.47). Again, however, a significant difference, attributed to the intelligence variant, was in the analysis of the variance (F=31.54; $P < .001$).

Time Comparisons

The data gathered on the four experimental groups of subjects in the present study also permitted comparisons

TABLE 5

ANALYSIS OF VARIANCE FOR SEX, INTELLIGENCE, AND TASK STRUCTURE ON THE UNSTRUCTURED, STRUCTURED, AND NAMING TASKS

Source of Variation	df	MS	*F*	*P*
Sex	1	20.0	.35	*
I.Q.	1	3251.25	56.25	.001
Sex x I.Q.	1	140.45	2.43	*
error	76	57.8		
Total	79			

*Not Significant.

of the mean number of seconds required by each group of subjects to complete their responses to the unstructured and structured tasks. It should be noted that the time necessary to respond correctly, incorrectly, and both together were dealt with separately in the analysis of time differences on both the unstructured and structured tasks.

These data were analyzed by stages in the following manner. First, for each of the four groups of experimental subjects, the mean number of seconds required to complete each of the tasks was computed. Then the variance for each mean was found. It was then necessary to compare the variances of each of the groups of subjects. This was accomplished by the F test, in which the larger variance was divided by the smaller variance to yield a value which indicated the likelihood of the two variances being significant.[4]

Differences in Mean Number of Seconds Required for Correct Responses in Unstructured and Structured Tasks

The length of time required by each of the four experimental groups to respond correctly to the unstructured and structured tasks are presented in Figure 2. The mean scores reveal the Normal Male responded faster than the Normal Female Group while Retarded Female Group responded faster than the Retarded Male Group on both the unstructured tasks and the structured tasks.

The analysis of variance revealed in Table 6 indicated that sex is not a significant primary factor (F=.98), although there is a significant second order interaction between sex and intelligence (F=10.92; $P < .001$). Intelligence also exhibits a significant primary effect (F=4.88; $P < .05$) differing in favor of the normal subjects. All four groups of subjects responded significantly faster on the structured tasks than on the unstructured tasks (F=64.17; $P < .001$). However, normal subjects appeared to respond faster than subnormal subjects. This

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[4] Bryan Wilkinson, "A Statistical Consideration in Psychological Research," Psychological Bulletin, XLVIII (1951), pp. 156-158.

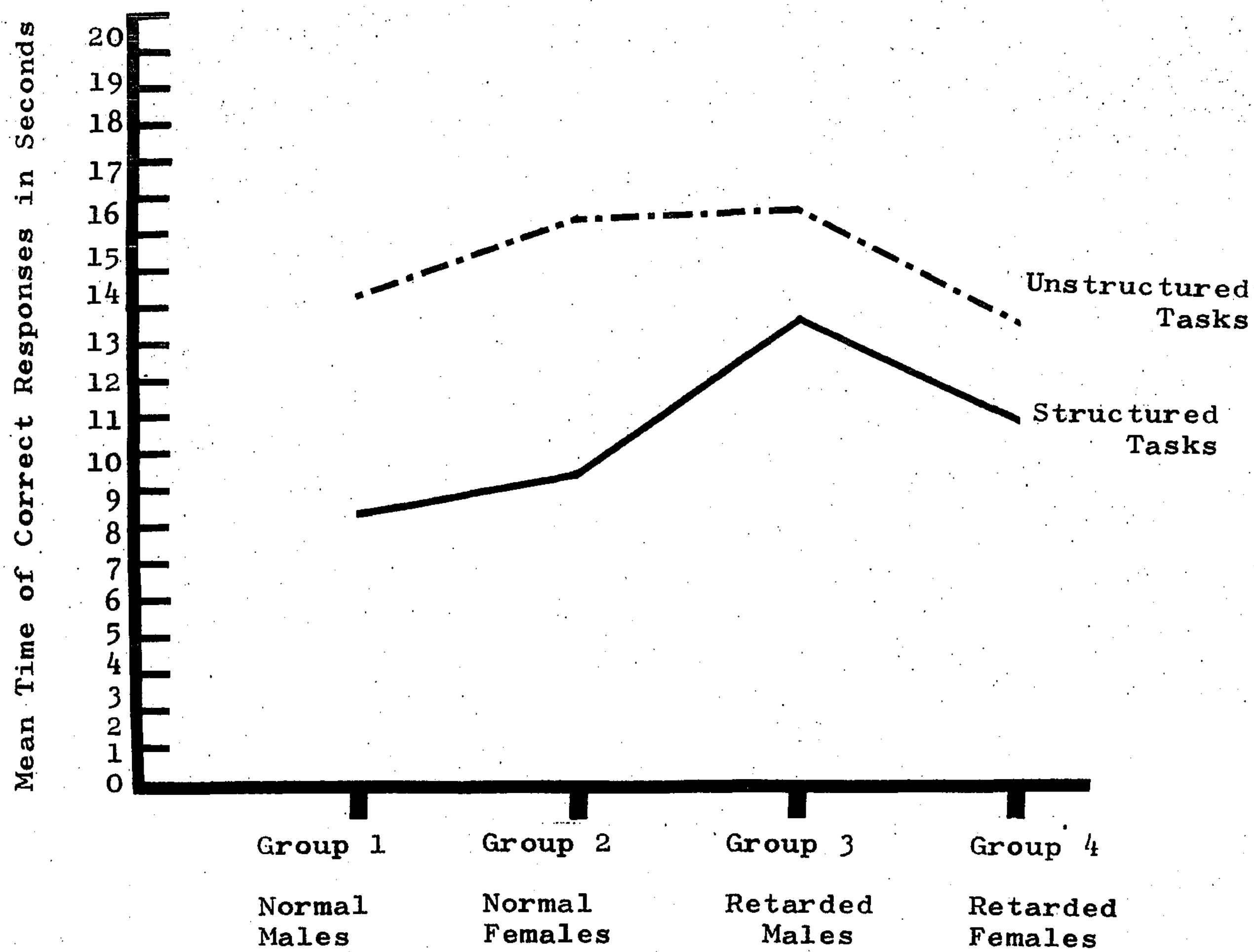

Figure 2: Mean Times for the Correct Responses on the Unstructured and Structured Tasks

observation is supported by the significant second order interaction between set and intelligence (*F*=9.13; *P* < .001).

TABLE 6

ANALYSIS OF VARIANCE FOR SEX, INTELLIGENCE, AND TASK STRUCTURE MEAN TIKES FOR CORRECT RESPONSES ON THE UNSTRUCTURED AND STRUCTURED TASKS

(N=80, Scores=160)

Source of Variation	df	MS	*F*	*P*
Sex	1	18.54	.98	*
I.Q.	1	91.92	4.88	.05
Sex x I.Q.	1	205.85	10.92	.001
error (a)	76	18.84		
Set	1	868.41	64.17	.001
Sex x Set	1	1.88	.14	*
I.Q. x Set	1	123.54	9.13	.001
I.Q. x Sex x Set	1	8.29	.61	*
error (b)	76	13.53		
Total	159			

*Not Significant.

In view of the evidence presented, it is concluded that neither hypotheses 4 or 5 can be rejected. The mean time for correct responses attained by the male subjects in each group is not significantly greater than the mean time for correct responses attained by the female subjects in each group of normal and subnormal groups when the response of the groups to each of the 24 unstructured and the 24 structured tasks are compared.

Analysis of the Mean Times for Incorrect Responses on the Unstructured and Structured Tasks

In order to find out whether or not there were any significant mean time differences in responding to the unstructured and structured tasks between the four experimental groups, it was felt that attention should also be given to the incorrect performances as well as the correct and total performances of the subjects. The results of the analysis of variance for the incorrect responses are displayed on Table 7.

Table 7 indicated significant differences in the primary factor effects of intelligence (F=15.03; $P < .001$). and set (F=7.96; $P < .001$) on the incorrect responses. These results are not significantly different from the results obtained on the correct responses. However, of considerable importance is the interesting second order interaction of sex and intelligence factors (F=16.87; $P < .001$). Figure 3 illustrates this interaction graphically and reveals the hasty response of the Normal Female Group to the unstructured tasks which were incorrect.

TABLE 7

SUMMARY OF THE ANALYSIS OF VARIANCE FOR SEX, INTELLIGENCE, AND TASK STRUCTURE MEAN TIMES FOR INCORRECT RESPONSES ON THE UNSTRUCTURED AND STRUCTURED TASKS

(N=80, Scores=160)

Source of Variation	df	MS	F	P
Sex	1	40.10	.70	*
I.Q.	1	859.79	15.03	.001
Sex x I.Q.	1	964.82	16.87	.001
error (a)	76	57.19		
Set	1	632.42	7.96	.001
Sex x Set	1	8.06	.10	*
I.Q. x Set	1	143.08	1.80	*
I.Q. x Sex x Set	1	20.94	.26	*
error (b)	76	79.46		
Total	159			

*Not Significant.

Analysis of the Mean Times for Both Correct and Incorrect Responses on the Unstructured and Structured Tasks

Table 8 presents a summary of the analysis of variance for the total response mean times on the unstructured and structured tasks. Table 8 demonstrates a significant second order interaction between sex and intelligence

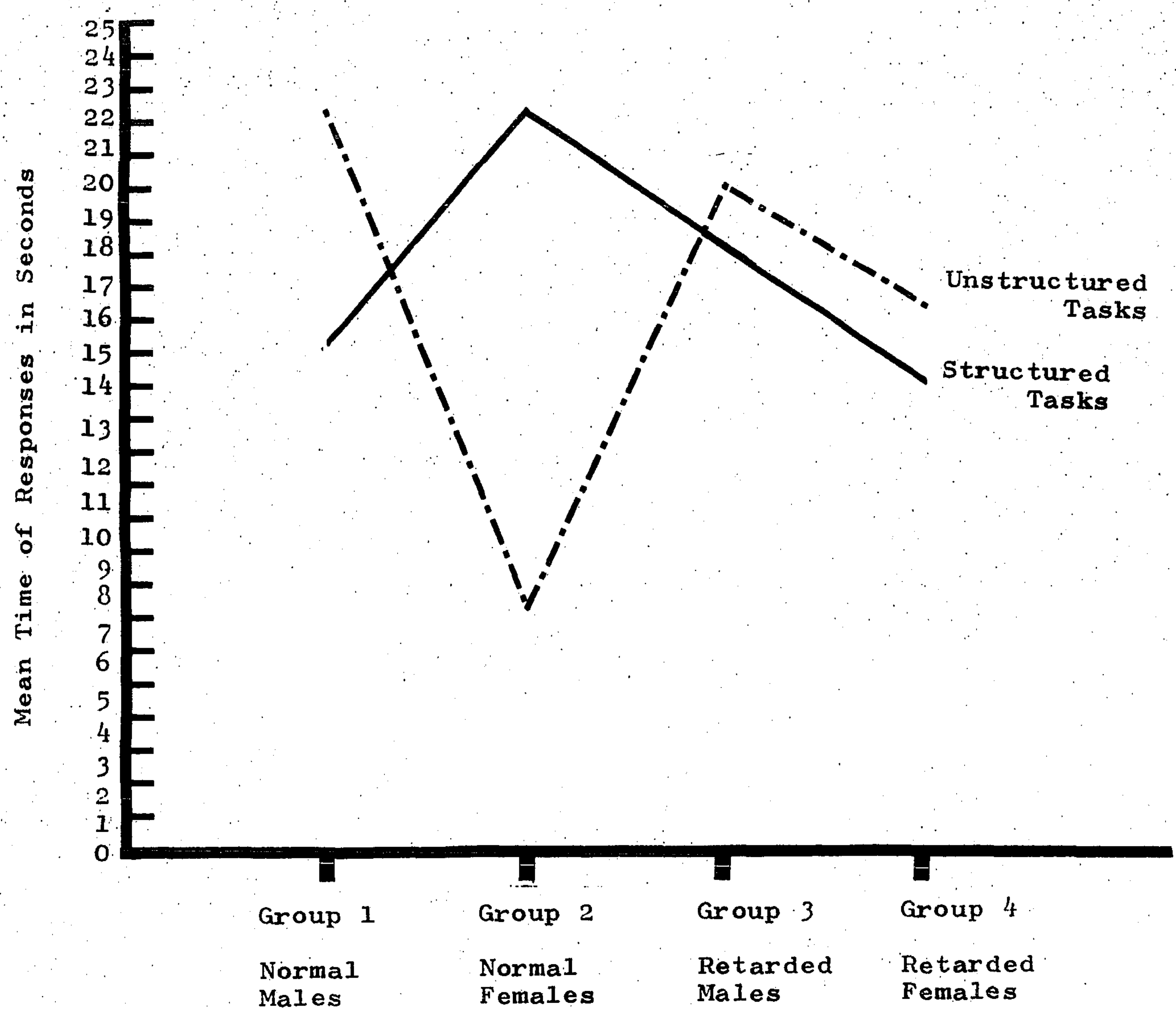

Figure 3: Mean Times for the Incorrect Responses on the Unstructured and Structured Tasks.

TABLE 8

SUMMARY OF THE ANALYSIS OF VARIANCE FOR SEX, INTELLIGENCE, AND TASK STRUCTURE MEAN TIMES FOR BOTH CORRECT AND INCORRECT RESPONSES ON THE UNSTRUCTURED AND STRUCTURED TASKS

Source of Variation	df	MS	F	P
Sex	1	.09	.003	*
I.Q.	1	16.84	.54	*
Sex x I.Q.	1	233.52	7.21	.001
error (a)	76	32.38		
Set	1	1,251.60	48.91	.001
Sex x Set	1	.33	.013	*
I.Q. x Set	1	106.11	4.15	.05
I.Q. x Sex x Set	1	.44	.017	*
error (b)	76	25.59		
Total	159			

*Not Significant.

(F=7.21; $P < .001$). Significant differences in the primary effect of set (F=48.91; $P < .001$) is also apparent with the difference in favor of the structured tasks and a second order interaction with intelligence (F=4.15; $P < .05$). These differences have been graphically reproduced in Figure 4.

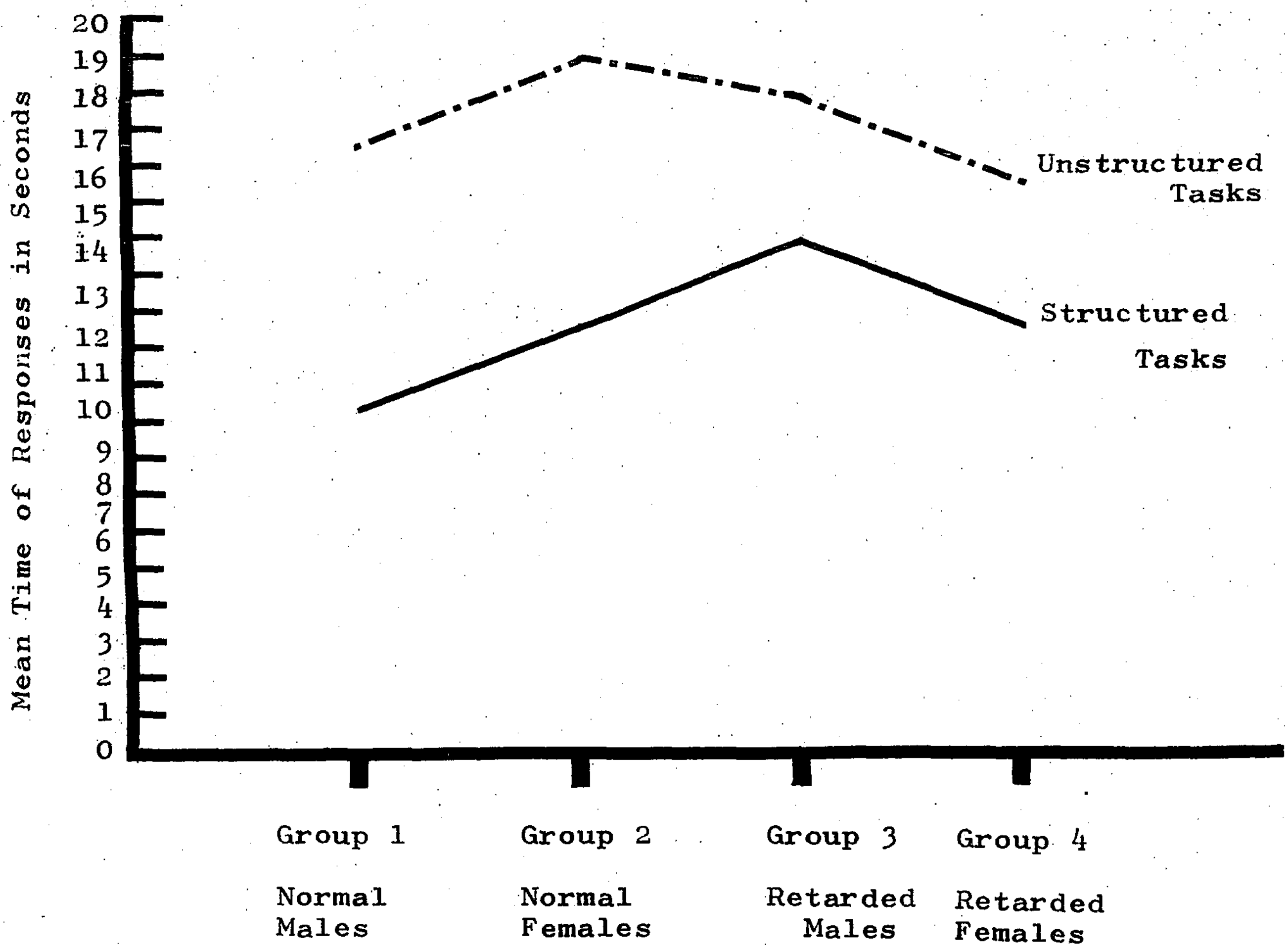

Figure 4: Mean Times for Both Correct and Incorrect Responses On the Unstructured and Structured Tasks.

The present chapter has presented the data that was gathered and analyzed from the experimental investigation of the categorization process in normal and subnormal males and females. The following chapter discusses the conclusions based upon these results, and some of the implications for educational consideration.

CHAPTER V

DISCUSSION

Recent interest has emerged regarding the characteristics of the categorization process in normal and subnormal children. It was suggested earlier that the common assumption that subnormal children possess simpler patterns of thought than normal children was of little value to educators and those concerned with the field of mental retardation without adequate experimental confirmation which would hopefully specify the dimensions of this simplicity if it did, in fact, exist. It was also suggested that investigations dealing with the characteristics of the categorization process and the ability of normal and subnormal children to use conceptual categories could provide an experimental basis for future educational practices.

Studies were presented which have requested further research on the categorization process with particular attention to providing normative data such as, sex and age differences in the performance of normal and subnormal children. Stephens noted the specific need for a study dealing with sex differences between normal and subnormal children in view of the apparent lack of agreement among researchers regarding the effect of sex differences on the categorization process.[1] It was noted that whether or not such differences would be of utility to education was open to some question, but with regards to their import for experimental control there could be no question, for when sex differences are not demonstrated to be influential, conclusions from an experiment become more general and, therefore, less subject to qualifications.[2]

The present study was undertaken in order to provide more information regarding the categorization process and to find out whether or not there were significant sex differences in the performance of normal and subnormal children. It was proposed that there would be no significant sex differences between normal and subnormal children in their performance on three kinds of categorization tasks. It was also proposed that there would be no significant sex differences between the mean time to respond on two of the categorization tasks.

The results presented in the preceeding chapter indicated that there were no significant main effect sex differences in the performance of the four experimental groups on any of the three categorization tasks. Nor were there any significant main effect sex differences in terms

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[1] Wyatt E. Stephens, loc. cit.

[2] Ibid.

of the mean time required for response to the various tasks analyzed.

Although there were some significant second order interactions in which sex differences in performance were demonstrated, the data generally indicated a negligible main sex factor effect. The primary factors which appeared to best account for differences in performance were the degree of task structure (set) and intelligence.

These results appear to provide further support for many of the observations made by Stephens.[3] The comparison of each group in terms of independently deciding upon an appropriate category on the unstructured tasks indicated that subnormal subjects were generally less able than normal subjects to successfully perform these tasks. This observation implies that subnormal children appear to have relatively more difficulty in perceiving meaning independently from their experiential environment. Experiences which do not fit readily into already organized categories may be less meaningful to subnormal children. If this is true, then, according to Stephens:

> It might be expected that the content of the intellective operations in subnormal persons would be relatively limited, and that subnormal persons would be less well equipped than normals to interpret the wide range of newexperiential stimuli which occur in everyday activity.[4]

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[3] Ibid.

[4] Ibid., p. 78.

The data resulting from the naming tasks suggested that normal subjects were better able to specify the correct category name for the categories they were able to use. Although relatively fewer subnormal subjects were able to perform unstructured tasks successfully, it is interesting to note that those who did score correctly also apparently had some degree of efficiency in the naming tasks. Future research may reveal a sequence of category development in which general ability to organize experiences into meaningful categories is followed by the ability to name them.

The assumption that the structured tasks would be relatively less difficult for both normal and subnormal subjects was also demonstrated in the results. Subnormal subjects in the present study, however, apparently possessed fewer usable categories. Consequently, it might be expected to find that subnormal children are able to give meaning to a comparatively narrower range of experiences than normal children.

Comparisons of mean time required to successfully complete the unstructured and structured tasks revealed significant differences in favor of the normal subjects. Not only did the subnormal subjects seem to have relatively fewer functional categories at their disposal, less well delineated ability to specify these categories, and more difficulty in using these categories voluntarily, but they also seemed to require more time to perform both unstructured and structured tasks. Subnormal children may also exhibit these latent effects in responding to other kinds of tasks as well. Perhaps future investigations will provide further evidence regarding the exact nature of these findings.

Implications

Since no significant sex differences were found in the performance of unstructured, structured, and naming tasks, perhaps future investigations on the categorization process in normal and subnormal children will be relatively less subject to strict control of the sex factor. If it is true, as the present study indicates, that response to new experiential material is to some degree dependent upon the possession by the child of functional categories, then many of the current practices in education which emphasize repetitive drill need to be re-evaluated. The creation and development of useful categories appear to depend more on meaningful associations than on repetitive ability. Consequently, repetition seems of little value without the prior existence of the associations necessary to create the category.

An instrument which would give teachers more complete information regarding the extent to which normals and subnormals possess the categories related to areas of specific subject matter would be of great value in education. Creation of such an instrument would perhaps follow a more thorough understanding of the nature of the intellective processes and the extent and nature of the repertory of categories employed by normal and subnormal children.

Inasmuch as several specific differences in the use of selected categories were revealed by this study, there seems to be sufficient need and justification for further exploration and investigation of the categorization process in normal and subnormal children. Indeed, much more experimental research is needed before a truly comprehensive theory of mental deficiency can be formulated to serve as a foundation for educational practices.

CHAPTER VI

SUMMARY

The broad purpose of the present study was to provide further experimental evidence concerning the intellective characteristics of normal and subnormal children. Specifically, it was desired to determine whether or not there are sex differences in normal and subnormal children in the ability to use conceptual categories.

A special test devised by Stephens[1] was administered to four groups of normal and subnormal children in order to measure several aspects of their performance on tasks requiring the use of conceptual categories which had been observed to be essential in everyday intellective activity. In particular, information was gathered to enable comparisons between groups of normal and subnormal children of each sex with respect to how successfully each group of 20 subjects could perform three main types of tasks, all of which were dependent upon the subject's ability to utilize conceptual categories. In these three tasks the subjects

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[1] *Ibid.*

were required: (1) to determine the appropriate category for organizing pictures of items without help from the experimenter; (2) to give names for the categories which the subject had just employed in the unstructured situation; and, (3) to find pictures which represented the category being tested after the experimenter had specified the category name in advance of each task. The tasks were respectively labeled: (1) the unstructured tasks; (2) the naming tasks; and (3) the structured tasks. The time in seconds required by each subject to complete the unstructured and structured tasks was also recorded for later comparison. It was proposed that knowledge of how males and females performed on these categorization tasks would help explain the relative simplicity or complexity of thinking patterns in normal and subnormal children and reveal areas of potential educational concern.

It was hypothesized that there would be no significant sex differences in groups of normal and subnormal children of each sex in their performance on unstructured, structured, and naming tasks. It was also hypothesized that there would be no significant sex differences in the mean time to respond correctly on the unstructured and structured categorization tasks.

The results of this study supported each of the 5 hypotheses proposed. There were no significant main effect sex differences in the performance of the four experimental groups on any of the three categorization tasks. Nor were there any significant main effect sex differences in terms of the mean time required for response to the various tasks analyzed. However, there were some significant second order interaction effects on many of the tasks which suggested the presence of possible factors which could not be clearly specified, but which, nevertheless, seemed to influence performance.

On the basis of these findings it was proposed that the use of categories by normal and retarded children merited further research and investigation. Implications for future study were also proposed, and it was noted that more experimental evidence is needed before an adequate theory of mental deficiency can be created, which would provide a model for formulating more valuable educational practices.

BIBLIOGRAPHY

Books

Anastasi, Anne. *Psychological Testing*. New York: The MacMillan Co., 1954.

Brown, Roger. *Words and Things*. Glencoe, Illinois: The Free Press, 1958.

Bruner, Jerome S., Goodnow, Jacqueline J., and Austin, George A. *A Study of Thinking*. New York: John Wiley and Sons, Inc., 1956.

Church, Joseph. *Language and the Discovery of Reality*. New York: Random House, 1961.

Dixon, Wilfrid J., and Massey, Frank J. *Introduction to Statistical Analysis*. New York: McGraw-Hill Co., 1957.

Edwards, Allen L. *Experimental Design in Psychological Research*. New York: Holt, Rinehart and Winston (Rev. Ed.), 1960.

Games, Paul A., Klare, George R. *Elementary Statistics*, McGraw-Hill Co., 1967.

Garrett, Henry E. *Statistics in Psychology and Education*. New York: Longmans, Green and Co., 1960.

Garton, Malinda Dean. *Teaching the Educable Mentally Retarded*. Springfield, Illinois: Charles C. Thomas, 1961.

McNemar, Quinn. *The Revision of the Stanford-Binet Scale*. Boston: Houghton Mifflin Co., 1942.

Piaget, Jean. *The Child's Conception of the World*. New York: Harcourt, Brace and Co., 1929.

________. *Language and Thought of the Child*. New York: Meridian Press, 1955.

Rapaport, David, et. al. Diagnostic Psychological Testing. Chicago: Year Book Publishers, 1945, Volume I.

Sarason, Seymour B. Psychological Problems in Mental Deficiency. New York: Harper and Brothers, 1958.

Seigel, Sidney. Non-parametric Statistics. New York: McGraw-Hill Book Bo., 1956.

Terman, Lewis M., and Merrill, Maud A. The Stanford-Binet Intelligence Scale, Manual for the Third Revision Form L-M. Boston: Houghton Mifflin Co., 1960.

Winacke, W. Edgar. The Psychology of Thinking. New York: McGraw-Hill Book Co., 1952.

Wechsler, David. The Measurement of Adult Intelligence. 3rd ed. Baltimore: Williams and Wilkins, 1944.

Whorf, Benjamin Lee. Language, Thought, and Reality. New York: John Wiley and Sons, Inc., 1956.

Winer, B. J. Statistical Principles in Experimental Design. McGraw-Hill Co., 1962.

Articles and Periodicals

Bolles, Mary M. "The Basis of Pertinence," Archives of Psychology, (1937, Number 12).

Canter, Arthur. "The Use of the Columbia Mental Maturity Scale with Cerebral Palsied Children," American Journal of Mental Deficiency, LX (1956), 843-851.

Cofer, Charles N. "Some Evidence for Coding Processes Derived from Clustering in Free Recall," Journal of Verbal Learning and Verbal Recall, 1966, 5(2), 188-192.

Dolby, M. G., and Robertson, Janis G. "Genetic Studies in Abstraction," Journal of Comparative Psychology, XXXIII (1942), 385-401.

Doll, Edgar A. "The Essentials of an Inclusive Concept of Mental Deficiency," American Journal of Mental Deficiency, XLVI (1941), 214-219.

________. "Feeblemindedness versus Intellectual Retardation," American Journal of Mental Deficiency, LI (1947), 456-459.

________. "Is Mental Deficiency Curable?", American Journal of Mental Deficiency, LI (1947), 420-428.

Feifel, Harold. "Qualitative Differences in the Vocabulary Responses of Normals and Subnormals," Genetic Psychology Monographs, XXXLX (1949), 151-204.

Friedman, Kopple C., "Time Concepts of Elementary School Children," Elementary School Journal, LXIV (1944), 337-342.

Goldstein, Kurt, and Scheerer, Martin. "Abstract and Concrete Behavior: An Experimental Study with Special Tests," Psychological Monographs, (1941, Number 239).

Hicks, Allen, and Stewart, Florence D. "The Learning of Abstract Concepts of Size," Child Development, I (1930), 195-203.

Kvaraceua, William C. "Research in Special Education: Its Status and Function," Journal of Exceptional Children, XXIV (1958), 249-254.

Long, Louis, and Welch, Livingston. "Influence of Levels of Abstraction on Reasoning Ability," Journal of Psychology, XIII (1942), 41-59.

McNemar, Quinn, and Terman, Lewis M. "Sex Differences in Variational Tendency," Genetical Psychological Monographs, 1936, 18, 1-65.

McPherson, Marion White. "A Survey of Experimental Studies of Learning in Individuals who Achieve Subnormal Ratings on Standardized Psychometric Measures," American Journal of Mental Deficiency, LII (1948), 232-267.

Meyers, C. R., and Gifford, Elizabeth. "Rescoring the Stanford-Binet," Bulletin of the Canadian Psychological Association, I (April, 1941, Number 29).

NEA Research Division. "Small-Sample Techniques," NEA Research Bulletin, May, 1964, 99-104.

Reichard, Suzanne, Schneider, Marion, and Rapaport, David. "The Development of Concept Formation in Children," American Journal of Orthopsychiatry, XIV (1944), 156-162.

Sigel, Irving, Jarman, P., and Hanesian, Helen. "Styles of Categorization and their Intellectual and Personality Correlation in Young Children," Human Development, 1967, 10(1), 1-7.

Stephens, Wyatt E. "A Comparison of Normal and Subnormal Boys on Tasks Requiring the Use of Selected Categories," An unpublished Doctoral Dissertation, University of Oklahoma, 1963.

_________. "A Comparison of the Performance of Normal and Subnormal Boys on Structured Categorization Tasks," Exceptional Children, 1964, 30 (7), 311-315.

_________. "Category Usage of Normal and Subnormal Children on Three Types of Categories," American Journal of Mental Deficiency, 1966, 71, 2, 266-273.

Thomson, Claire W., and Magaret, Ann. "Differential Test Responses of Normals and Mental Defectives," Journal of Abnormal and Social Psychology, XLII (1947), 285-293.

Thrum, Martha E. "The Development of Concepts of Magnitude," Child Development, VI (1935), 120-140.

Winacke, W. Edgar. "The Investigation of Concept Formation," Psychological Bulletin, XL (1951), 1-21.

Welch, Livingston. "The Development of Discrimination of Form and Area," Journal of Psychology, VII (1939), 37-54.

_________. "The Development of Size Discrimination Between the Ages of 12 and 40 Months," Journal of Genetic Psychology, LV (1939), 243-268.

_________. "The Span of Generalization Below the Two Year Level," Journal of Genetic Psychology, LV (1939), 269-297.

Werner, Heinz, and Strauss, Alfred A. "Causal Factors in Low Performance," American Journal of Mental Deficiency, XLV (1940-1941), 213-218.

_________. "Pathology of Figure-ground Relation in the Child," Journal of Abnormal and Social Psychology, XXXVI (1941), 236-248.

Wilkinson, Bryan. "A Statistical Consideration in Psychological Research," Psychological Bulletin, XLVII (1951), 156-158.

Zigler, Edward. "An Overview of Research in Learning, Motivation, and Perception," Journal of Exceptional Children, XXVIII (1962), 445-448.

Tests

Burgemeister, Bessis B., Blum, Lucille, and Lorge, Irving. Columbia Mental Maturity Scale. New York: World Book Co., 1954-1959.

Goldstein, Kurt, and Scheerer, Martin. Goldstein-Scheerer Tests of Abstract and Concrete Thinking. New York: Psychological Corporation, 1941-1951.

Terman, Lewis M., and Merrill, Maud A. Revised Stanford-Binet Scale. New York: Houghton Mifflin Co., 1937.

Wechsler, David. Wechsler Adult Intelligence Scale, New York: Psychological Corporation, 1955.

________. Wechsler-Bellevue Intelligence Scale. New York: Psychological Corporation, 1946.

________. Wechsler Intelligence Scales for Children. New York: Psychological Corporation, 1949.

________. Wechsler Pre-School Intelligence Scale. New York: Psychological Corporation, 1964.

APPENDIX I

DATA SUMMARY FORM

DATA SUMMARY FORM

Name ______________________ Date ______________________

Code No. __________ NM NF RM RF Birth Date ________________

School ______________________ CA __________

Teacher ______________________ MA __________

Vision ________ Hearing ________ IQ Score __________

ITEM	Position of Response	TIME	GENERALIZATION	ITEM	Position of Response	TIME
1.				1.		
2.				2.		
3.				3.		
4.				4.		
5.				5.		
6.				6.		
7.				7.		
8.				8.		
9.				9.		
10.				10.		
11.				11.		
12.				12.		
13.				13.		
14.				14.		
15.				15.		
16.				16.		
17.				17.		
18.				18.		
19.				19.		
20.				20.		
21.				21.		
22.				22.		
23.				23.		
24.				24.		

TEST RESULTS

Number Correct

UNSTRUCTURED TASK ____________________

GENERALIZATION ______________________

STRUCTURED TASK ______________________

MEAN TIMES

UNSTRUCTURED TASK ______________

STRUCTURED TASK ______________

CORRECT RESPONSES ON UNSTRUCTURED TASK _________

INCORRECT RESPONSES ON UNSTRUCTURED TASK _______

CORRECT RESPONSES ON STRUCTURED TASK __________

INCORRECT RESPONSES ON STRUCTURED TASK _________

APPENDIX II

RAW SCORES

NUMBER OF CORRECT RESPONSES FOR
NORMAL MALE GROUP

Subject No.	Unstructured Task	Structured Task	Subject No.	Naming Tasks	Total
1	16	20	36	15	51
2	16	18	34	16	50
3	15	18	33	14	47
4	15	19	34	14	48
5	18	18	36	18	54
6	16	18	34	14	48
7	14	18	32	12	44
8	13	21	34	11	45
9	13	19	32	13	45
10	9	19	28	12	40
11	13	20	33	13	46
12	14	16	30	13	43
13	12	19	31	11	42
14	16	16	32	13	45
15	18	21	39	15	54
16	12	18	30	12	42
17	15	19	34	15	49
18	15	19	34	15	49
19	17	22	39	15	54
20	12	17	29	12	41
N	20	20		20	20
ΣX^2	4273	7077		3787	44253
ΣX	289	375		273	937
$(\Sigma X)^2$	83521	140625		74529	877969
$(\Sigma X)^2/N$	4176.05	7031.25		3726.45	43898.45
$\Sigma X/N$	14.45	18.75		13.65	46.85

NUMBER OF CORRECT RESPONSES FOR
NORMAL FEMALE GROUP

Subject No.	Unstructured Task	Structured Task	Subject No.	Naming Tasks	Total
1	20	22	42	18	60
2	14	20	34	14	48
3	11	18	29	12	41
4	16	19	35	14	49
5	15	19	34	14	48
6	14	20	34	14	48
7	18	20	38	7	45
8	20	23	43	20	63
9	15	19	34	15	49
10	18	19	37	15	52
11	13	18	31	11	42
12	14	19	33	14	47
13	16	19	35	15	50
14	12	18	30	10	40
15	17	21	38	13	51
16	16	18	34	15	49
17	14	19	33	15	48
18	12	20	32	11	43
19	12	19	31	13	44
20	16	22	38	15	53
N	20	20		20	20
ΣX^2	4717	7722		3927	47666
ΣX	303	392		275	970
$(\Sigma X)^2$	91809	153664		75625	9409001
$(\Sigma X)^2/N$	4690.45	7682.3		3781.25	47045
$\Sigma X/N$	15.15	19.6		13.75	48.5

NUMBER OF CORRECT RESPONSES FOR
RETARDED MALE GROUP

Subject No.	Unstructured Task	Structured Task	Subject No.	Naming Tasks	Total
1	12	16	28	11	39
2	11	17	28	19	47
3	15	17	32	14	46
4	18	19	37	15	52
5	15	16	31	14	45
6	15	17	32	14	46
7	14	16	30	14	44
8	10	16	26	11	37
9	10	18	28	9	37
10	2	9	11	7	18
11	8	17	25	8	33
12	14	17	31	10	41
13	10	16	26	10	36
14	7	12	19	5	24
15	2	12	14	6	20
16	12	19	31	13	44
17	4	12	16	7	23
18	13	19	32	14	46
19	4	9	13	5	18
20	11	17	28	11	39
N	20	20		20	20
ΣX^2	2543	5015		2627	29157
ΣX	207	311		217	735
$(\Sigma X)^2$	42849	96721		47089	540225
$(\Sigma X)^2/N$	2142.45	4836.05		2354.45	27011.25
$\Sigma X/N$	10.35	15.55		10.85	36.75

NUMBER OF CORRECT RESPONSES FOR
RETARDED FEMALE GROUP

Subject No.	Unstructured Task	Structured Task	Subject No.	Naming Tasks	Total
1	15	15	30	14	44
2	4	10	14	2	16
3	10	16	26	12	38
4	9	15	24	9	33
5	11	16	27	12	39
6	11	14	25	11	36
7	11	14	25	12	37
8	8	17	25	8	33
9	12	18	30	13	43
10	10	14	24	8	32
11	11	19	30	7	37
12	15	18	33	11	44
13	7	14	21	9	30
14	10	17	27	13	40
15	7	18	25	7	32
16	5	14	19	8	27
17	8	16	24	6	30
18	8	17	25	9	34
19	4	10	14	7	21
20	3	8	11	5	16
N	20	20		20	20
ΣX^2	1815	4662		1855	23184
ΣX	179	300		183	662
$(\Sigma X)^2$	32041	90000		33489	438244
$(\Sigma X)^2/N$	1602.05	4500		1674.45	21912.2
$\Sigma X/N$(mean)	8.95	15.00		9.15	33.1

MEAN TIMES FOR CORRECT RESPONSES FOR NORMAL MALE GROUP

Subject No.	Unstructured Task	Structured Task	Total
1	12.8	6.6	19.4
2	9.0	5.4	14.4
3	14.0	6.1	20.1
4	13.6	8.4	22.0
5	21.8	11.2	33.0
6	10.9	4.7	15.6
7	9.6	7.4	17.0
8	11.0	8.7	19.7
9	16.6	8.3	24.9
10	14.0	7.5	21.5
11	9.5	7.5	17.0
12	15.67	8.4	24.07
13	11.4	9.8	21.2
14	17.5	6.7	24.2
15	13.2	5.8	19.0
16	14.0	6.1	20.1
17	13.9	6.8	20.7
18	12.3	5.7	18.0
19	13.8	11.2	25.0
20	9.8	7.5	17.3
N	20	20	
ΣX^2	3677.7989	1182.62	8908.67
ΣX	264.37	149.8	141.17
$(\Sigma X)^2$	69891.4969	22440.04	
$(\Sigma N)^2/N$	3494.57484	1122.002	
$\Sigma X/N$	13.2185	7.49	

MEAN TIMES FOR CORRECT RESPONSES FOR NORMAL FEMALE GROUP

Subject No.	Unstructured Task	Structured Task	Total
1	26.6	8.9	35.5
2	16.4	12.0	27.4
3	7.7	5.0	12.7
4	12.7	7.1	19.8
5	11.1	6.3	17.4
6	13.7	10.6	24.3
7	24.7	7.6	32.3
8	16.2	7.5	23.7
9	9.3	5.2	14.5
10	20.5	11.7	32.2
11	10.3	5.5	15.8
12	10.6	6.7	17.3
13	10.0	7.1	17.1
14	13.0	7.1	20.1
15	13.6	9.0	22.6
16	16.0	9.8	25.8
17	17.0	13.8	30.8
18	13.9	9.6	23.5
19	13.7	6.9	20.6
20	34.3	10.7	45.0
N	20	20	
ΣX^2	5630.27	1526.31	12681.66
ΣX	310.3	168.1	478.4
$(\Sigma X)^2$	96286.09	28257.61	
$(\Sigma X)^2/N$	4814.3045	1412.8805	
$\Sigma X/N$	15.515	8.405	

MEAN TIMES FOR CORRECT RESPONSES FOR
RETARDED MALE GROUP

Subject No.	Unstructured Task	Structured Task	Total
1	23.6	14.5	38.1
2	16.4	10.7	27.1
3	16.2	11.3	27.5
4	14.2	8.7	22.9
5	16.9	14.6	31.5
6	13.9	7.3	21.2
7	11.7	7.8	19.5
8	19.4	16.9	36.3
9	23.6	6.3	29.9
10	7.6	18.0	25.6
11	17.6	26.4	44.0
12	20.6	5.6	26.2
13	18.2	8.0	26.2
14	17.3	9.9	27.2
15	13.6	20.4	24.0
16	11.2	7.3	18.5
17	12.4	23.8	36.2
18	16.2	12.0	28.2
19	12.9	14.5	27.4
20	10.0	8.0	18.0
N	20	20	
ΣX^2	5254.45	3849.18	16883.09
ΣX	313.5	252.0	565.5
$(\Sigma X)^2$	98282.25	62504.0	
$(\Sigma X)^2/N$	4914.1125	3175.2	
$\Sigma X/N$	15.675	12.6	

MEAN TIMES FOR CORRECT RESPONSES FOR RETARDED FEMALE GROUP

Subject No.	Unstructured Task	Structured Task	Total
1	13.7	12.0	25.7
2	15.7	15.0	30.7
3	10.1	6.4	16.5
4	11.6	10.9	22.5
5	8.5	5.9	14.4
6	12.2	8.5	20.7
7	13.7	10.6	24.3
8	11.8	10.8	22.6
9	11.3	7.1	18.4
10	9.4	6.2	15.6
11	11.7	8.5	20.2
12	17.9	10.4	28.3
13	8.4	12.1	20.5
14	17.0	9.8	26.8
15	10.8	11.1	21.9
16	9.2	8.7	17.9
17	17.6	9.6	27.2
18	11.2	9.0	20.2
19	14.4	10.7	25.1
20	14.9	13.5	28.4
N	20	20	
ΣX^2	3317.53	2045.34	10432.39
ΣX	251.1	196.8	447.9
$(\Sigma X)^2$	63051.21	38730.24	
$(\Sigma X)^2/N$	3152.5605	1936.512	
$\Sigma X/N$	12.555	9.84	

MEAN TIMES FOR INCORRECT RESPONSES FOR
NORMAL MALE GROUP

Subject No.	Unstructured Task	Structured Task	Total
1	18.8	17.7	36.5
2	12.9	19.0	31.9
3	19.6	26.2	45.8
4	26.1	14.3	40.4
5	38.2	17.05	55.25
6	11.45	10.8	22.25
7	18.5	14.8	33.3
8	20.2	13.8	34.0
9	24.0	21.8	45.8
10	28.1	13.2	41.3
11	21.5	22.7	44.2
12	18.0	14.1	32.1
13	14.2	16.8	31.0
14	29.4	9.1	38.5
15	57.2	15.8	73.0
16	13.5	8.9	22.4
17	24.8	20.2	45.0
18	20.0	13.0	33.0
19	19.9	8.5	28.4
20	11.4	9.3	20.7
N	20	20	
ΣX^2	12139.96	5177.01	31302.615
ΣX	447.8	307.0	754.8
$(\Sigma X)^2$	200524.84	94310.41	
$(\Sigma X)^2/N$	10026.242	4715.5205	
$\Sigma X/N$	22.39	15.355	

MEAN TIMES FOR INCORRECT RESPONSES FOR NORMAL FEMALE GROUP

Subject No.	Unstructured Task	Structured Task	Total
1	60.7	30.9	91.6
2	23.0	22.0	45.0
3	7.1	6.0	13.1
4	17.4	22.8	40.2
5	18.4	7.2	25.6
6	24.0	37.9	61.9
7	48.0	47.3	95.3
8	27.2	7.3	34.5
9	19.1	17.7	36.8
10	40.4	20.3	60.7
11	15.2	8.9	24.1
12	23.6	42.2	65.8
13	17.2	16.0	33.2
14	13.0	27.7	40.7
15	31.3	24.3	55.6
16	23.5	39.5	63.0
17	24.4	19.6	44.0
18	19.5	20.2	39.7
19	22.1	8.8	30.9
20	67.5	22.1	89.6
N	20	20	
ΣX^2	19327.08	12890.99	59225.85
ΣX	201542.6	448.7	991.3
$(\Sigma X)^2$	294414.76	201331.69	
$(\Sigma X)^2/N$	14720.738	10066.5845	
$\Sigma X/N$	7.13	22.435	

MEAN TIMES FOR INCORRECT RESPONSES FOR RETARDED MALE GROUP

Subject No.	Unstructured Task	Structured Task	Total
1	16.8	9.95	26.75
2	15.9	11.6	27.5
3	14.0	40.8	54.8
4	27.3	21.5	48.8
5	16.5	36.5	53.0
6	13.2	12.0	25.2
7	14.5	11.1	25.6
8	21.2	24.5	45.7
9	18.4	13.6	32.0
10	9.0	8.4	17.4
11	26.6	35.7	62.3
12	52.9	12.6	65.5
13	14.0	27.0	41.0
14	36.5	11.7	48.2
15	18.1	26.0	44.1
16	30.5	6.9	37.4
17	11.9	15.2	27.1
18	16.7	13.9	30.6
19	13.7	13.8	27.5
N	20	20	
ΣX^2	10079.24	8579.1225	32957.4025
ΣX	401.0	364.75	765.75
$(\Sigma X)^2$	160801.0	133042.5625	
$(\Sigma X)^2/N$	8040.05	52.1281	
$\Sigma X/N$	20.05	18.2375	

MEAN TIMES FOR INCORRECT RESPONSES FOR
RETARDED FEMALE GROUP

Subject No.	Unstructured Task	Structured Task	Total
1	24.5	22.0	46.5
2	18.4	16.5	34.9
3	12.7	12.6	25.3
4	17.3	13.4	30.7
5	12.3	7.1	19.4
6	14.3	17.5	31.8
7	10.5	14.2	24.7
8	13.3	11.1	24.4
9	11.6	9.6	21.2
10	9.9	9.8	19.7
11	21.0	22.9	43.9
12	37.8	15.0	52.8
13	17.9	11.9	29.8
14	15.8	13.5	29.3
15	27.9	20.7	48.6
16	11.0	11.5	22.5
17	18.8	13.0	31.8
18	10.6	14.2	24.8
19	13.1	13.6	26.7
20	9.6	11.0	20.6
N	20	20	
ΣX^2	6343.75	4274.89	20486.74
ΣX	328.3	281.1	609.4
$(\Sigma X)^2$	107780.89	79017.21	
$(\Sigma X)^2/N$	5389.0445	3950.8605	
$\Sigma X/N$	16.415	14.055	

TOTAL MEAN TIME SCORES FOR INCORRECT AND CORRECT RESPONSES FOR NORMAL MALE GROUP

Subject No.	Unstructured Task	Structured Task	Total
1	14.8	$\bar{x}$=8.5	23.3
2	9.9	9.6	19.5
3	16.1	11.1	27.2
4	18.3	9.6	27.9
5	25.9	12.7	38.6
6	11.1	6.2	17.3
7	13.3	9.3	22.6
8	15.2	9.4	24.6
9	20.0	11.1	31.1
10	22.8	8.7	31.5
11	15.0	10.0	25.0
12	16.6	9.9	26.5
13	12.8	11.3	24.1
14	21.6	7.5	29.1
15	21.8	7.1	28.9
16	13.8	6.8	20.6
17	18.0	9.6	27.6
18	15.2	7.2	22.4
19	15.6	11.0	26.6
20	11.0	8.0	19.0
N	20	20	
ΣX^2	5748.98	1760.86	13642.54
ΣX	328.8	184.6	513.4
$(\Sigma X)^2$	108109.44	34077.16	
$(\Sigma X)^2/N$	5405.47	1703.86	
$\Sigma X/N$	16.44	9.23	

TOTAL MEAN TIME SCORES FOR INCORRECT AND CORRECT RESPONSES FOR NORMAL FEMALE GROUP

Subject No.	Unstructured Task	Structured Task	Total
1	32.2	11.0	43.2
2	18.5	13.6	32.1
3	7.4	5.2	12.6
4	14.2	10.6	24.8
5	13.9	6.5	20.4
6	18.0	15.2	33.2
7	23.2	14.3	37.5
8	18.7	7.5	26.2
9	13.0	7.8	20.8
10	25.5	13.5	39.0
11	11.6	6.4	18.0
12	16.0	14.1	30.1
13	12.4	17.5	29.9
14	13.0	12.3	25.3
15	18.7	11.7	30.4
16	22.0	17.0	39.0
17	20.0	15.0	35.0
18	16.7	11.4	28.1
19	17.9	11.4	29.3
20	45.4	11.6	57.0
N	20	20	
ΣX^2	8467.35	2965.16	20566.55
ΣX	378.3	233.6	611.9
$(\Sigma X)^2$	143110.89	54568.96	
$(\Sigma X)^2/N$	7155.54	2728.45	
$\Sigma X/N$	18.92	11.68	

TOTAL MEAN TIME SCORES FOR INCORRECT AND CORRECT RESPONSES FOR RETARDED MALE GROUP

Subject No.	Unstructured Task	Structured Task	Total
1	20.2	8.9	29.1
2	16.1	11.0	27.1
3	15.4	19.9	35.3
4	18.6	11.4	30.0
5	16.8	22.8	39.6
6	13.5	9.2	22.7
7	12.9	9.6	22.5
8	20.3	19.4	39.7
9	20.5	8.1	28.6
10	9.0	9.1	18.1
11	23.6	29.1	52.7
12	33.9	7.7	41.6
13	15.7	14.3	30.0
14	30.9	10.8	41.7
15	17.8	23.3	41.1
16	20.8	7.2	28.0
17	12.0	19.5	31.5
18	16.4	12.4	28.8
19	13.2	13.0	26.2
20	12.0	9.7	21.7

N	20	20	
ΣX^2	7182.76	4566.66	21637.64
ΣX	359.6	276.4	636
$(\Sigma X)^2$	129312.16	76396.96	
$(\Sigma X)^2/N$	6465.61	3819.85	
$\Sigma X/N$	17.98	13.82	

TOTAL MEAN TIME SCORES FOR INCORRECT AND CORRECT RESPONSES FOR RETARDED FEMALE GROUP

Subject No.	Unstructured Task	Structured Task	Total
1	17.8	15.8	33.6
2	18.0	15.9	33.9
3	11.6	8.8	20.4
4	15.1	11.8	26.9
5	10.5	10.0	20.5
6	13.3	12.3	25.6
7	16.3	11.7	28.0
8	12.8	12.1	24.9
9	11.5	7.7	19.2
10	9.7	7.7	17.4
11	16.8	10.7	27.5
12	40.6	11.6	52.2
13	12.9	12.0	24.9
14	16.3	16.3	32.6
15	21.9	13.5	35.4
16	10.5	9.9	20.4
17	18.4	10.7	29.1
18	10.8	10.5	21.3
19	13.3	12.4	25.7
20	10.2	11.5	21.7
N	20	20	
ΣX^2	5635.11	2822.05	15834.02
ΣX	308.3	232.9	541.2
$(\Sigma X)^2$	95048.89	54242.41	
$(\Sigma X)^2/N$	4752.45	2712.12	
$\Sigma X/N$	15.4	11.65	