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THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

A COMPARISON OF PERFORMANCES OF NORMAL AND SUBNORMAL SUBJECTS USING VISUAL AND AUDITORY STRUCTURED CATEGORIZATION TASKS

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WILLIAM R. VAN OSDOL

Norman, Oklahoma

1964

A COMPARISON OF PERFORMANCES OF NORMAL AND SUBNORMAL SUBJECTS USING VISUAL AND AUDITORY STRUCTURED CATEGORIZATION TASKS

APPROVED BY

DISSERTATION COMMITTEE

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A COMPARISON OF PERFORMANCES OF NORMAL AND SUBNORMAL SUBJECTS USING VISUAL AND AUDITORY STRUCTURED CATEGORIZATION TASKS

CHAPTER I

Introduction

The late President of the United States, John F. Kennedy, initiated a progressive movement of study in the field of mental retardation. This movement must be kept alive through education and through experimental study with subnormal persons by workers in the field of subnormality. Experimentation will help to shed light upon assumptions concerning subnormality. These assumptions may become factually theorized through experimentation, which in turn will help reduce educational practices that have been established dogmatically. The lack of experimental data has allowed the workers in the field of subnormality to accept and use these many practices which have been based upon pure assumption.

The workers in the field of subnormality have been forced by society to accept presuppositions because society has not been ready to accept the responsibility that lies with the administration, education, and institutionalization

of subnormal people. Society has been demanding refuge from subnormality only because it has been somewhat stigmatic to identify oneself as an ally with subnormality. Parents have not wanted their "normal" children placed into a learning situation with "subnormal" children. Our social hierarchy could not be identified with subnormality. The wealthy may isolate their problems in private schools. The middle class may let their children struggle along in school and blame non-qualified teachers for the child's subnormality. And the lower class may possibly operate within a society that supports the children with minimal jobs and public welfare.

In recent years, study in the field of mental retardation has established a foothold. President Kennedy's sincere attention to the study of subnormality has indicated to the American people that subnormality is not confined to the poor and the less intelligent families. He, also, positively indicated that subnormality is not a situation of which one should feel ashamed, and it is not a situation that should be forgotten and isolated into institutions and schools for mental retardation. Consequently the need has been shown that traditional assumptions of conceptual issues should not be defended as all-inclusive, and should not be accepted as totally-valid principles until so indicated by experimental data. Therefore, the need for experimental studies does exist, because only through experimentation can the pseudo-assumptions be invalidated. Fortunately, recent literature reveals an increasing unwillingness to accept

traditional ideas and practices which have not been evaluated critically.[1]

Zigler has also offered support for the need of experimentation in the following statement:

> "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 emphases on the experimental investigation of the problems associated with subnormality, rather than by continued attempts to justify beliefs based largely on tradition."[2]

Clinical observation, which is the sole basis for many assumptions concerning the practices used with subnormal persons, has not established sufficient evidence for relying wholely upon these commonly accepted ideas. Therefore, an established experimental plan is most important in order to enable authority of evaluation of these commonly accepted and practiced assumptions.

There are two assumptions, which need additional investigation, with which this experiment was concerned. First, is the assumption that patterns of thinking in subnormal individuals are simpler than those of normal individuals.[3] Secondly, is a principle, somewhat tested by Beck,

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

[2]Edward Zigler. "An Overview of Research in Learning, Motivation, and Preceptions," Journal of Exceptional Children, XXVIII, (1962), pp. 445-48.

[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), pp. 232.

that there is no difference in inhibitive qualities of normal and subnormal individuals. Beck indicated that healthy adults, children, schizophrenics, and most feeble-minded subjects all react with about the same speed. The central tendency for all Rorschach cards is around twenty seconds. Some of the fastest first responses are regularly given by young children -- instantly in most cases, and within five seconds in others. Hypomanics likewise respond with great speed. Lack of inhibition would thus then seem to be the critical factor.[4]

These assumptions have despotically controlled the educational practices as used with subnormal students. Our instructional materials and methods have been determined by these assumptions. Doll reflects views upon the allegation that subnormal children possess patterns of simple thinking. "This allegation underlies current social planning for subnormal persons, such as the practice of institutionalization, which hinges on the justification that intellective deficit in subnormals is of such a nature that those persons can never be expected to maintain themselves independently."[5]

Our structure becomes stereotyped when one tries to be practical without valid experimentation that will indicate

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[4]Samuel J. Beck, Rorschach's Test, A Variety of Personality Pictures, Vol. II, (New York, Grune and Stratton, 1947), p. 52.

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

whether the structure is constructive or destructive. Ostensible simplicity of thinking seems to be one of the most widely accepted characterizations of subnormal children, both among lay people and among workers in the field of subnormality.[6]

When research reveals valid concepts concerning patterns of thinking, and qualities of inhibition of subnormal people, the structure of education for the subnormal student should become somewhat more compatible with the needs of the subnormal student. English and English define inhibition and impulse in the following manner:

> Inhibition is restraining or stopping a process from continuing, or preventing a process from starting although the usual stimulus is present. Impulse is an act performed without delay, reflection, voluntary direction, or obvious control by the stimulus. Although the act is triggered by the stimulus, the determining factor is the person's state of condition.[7]

The term response delay as used in this study will refer to the acts which are triggered by both visual and oral clues to categorization tasks and determined by the person's state or condition.

The very young child is socially maladroit. His frustration tolerance is negligible, his needs are immediate, and his perceptual response abilities for harmonious social interaction are minimal (when judged by adult standards).[8]

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[6]Marion White McPherson, Op. cit., p. 232.

[7]Horace B. English and Ava. Champney English, A Comprehensive Dictionary of Psychology and Psychoanalytical Terms, (New York: Longmans, Green and Company, 1958), p.262.

[8]George G. Thompson, Child Psychology, (New York: Houghton Mifflin Company, 1952), pp. 482.

An error in perception will result in an erroneous concept that emerges from that perception. Similarly, since memories also go into the building of concepts, distortions of memory and inadequate or inaccurate recall may affect the resultant concept.[9]

There have been few studies made which have given attention to employment of categorization tasks by subnormal children. Although there has been a suggestion of need for such studies by Brown,[10] Church,[11] and Bruner.[12] Therefore a definite need appears to exist for research which will deal effectively with conceptual categories.

Vinacke (1952) states that one of the most difficult aspects of the psychology of thinking is that which concerns concepts. One reason is that the information and use of concepts bear important relationships to the nature and development and functions of perception and to the phenomena of social interaction. Another obstacle to the understanding of concepts is the kind of information we have from experimental investigations on the problem. The situations and tasks that

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[9]Joseph Rosenstein, "Concept Development and Language Instruction," Exceptional Children, 1964, Vol. 30, p. 338.

[10]Roger Brown, Words and Things, (Gleucoe, Illinois: Free Press, 1958), pp. 1-21.

[11]Josephy Church, Language and the Discovery of Reality, (New York: Random House, 1961), pp. 147-59.

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

have been studied have been very narrow and have elicited very simple observable response behaviors.[13]

The present experiment intends to indicate, by use of categorization tasks, whether effective handling of impulses plays an important role in the process of categorization by which means the individual is enabled to give structure and meaning to his experiential world.[14] This study also intends to afford additional experimental data which will either support or deny the assumptions concerning the patterns of thinking of subnormal individuals. Intelligence, previous training and experience, and vocabulary are factors other than age that have been found to be related to concept development. Welch and Long (1940) have shown that the conceptualizing ability of children seems to develop from simple to more complex levels. A preabstract period leads gradually to an ability to grasp first hierarchy concepts, such as the fact that "men" and "women" are "people". This period which starts near the 26th month is followed in hierarchy concepts, such as that "potatoes" are vegetables" and "apples" are "fruit", and both "vegetables" and "fruit" are "food".[15] If then, indeed, this experiment indicates that the patterns of thinking of subnormal individuals are simpler than those employed by normal persons, educators may stand somewhat on fact rather than on dogmatism.

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[13]Rosenstein, loc. cit., p. 339.

[14]Bruner, op. cit., p. 21.

[15]Rosenstein, op. cit., p. 337.

Rationale for the Study

The rationale by which this study was initiated is as follows:

1. The ability to inhibit plays an important part in the social and educational adjustment of an individual. The effective handling of impulses and the inhibition of impulsive behavior may be fundamental in order to discriminate similar experiential data in order to determine their meaning.

2. Lack of response delay may direct the individual to respond quickly and with no regard for a meaningful process of categorization. Consequently the individual cannot accumulate meaningful interpretative categories with which he can relate new experiences.

3. To function adequately in his society an individual must be able to respond with the same restraint and with equal accuracy as demonstrated by the norms in his environment. Any deviation from the experiential meaning employed by his milieu will place the individual into a nonfunctioning category.

4. If a subnormal person is unable to adequately construct categories which are predominant for his milieu, he would not have the proper framework which is needed for successful functioning.

5. There are many avenues of employment of categories which may cause the individual's inability to construct categories as intellective frameworks. The individual may not possess adequate use of visual or audio stimuli in his use of categories; in which case his response delay may be significantly

different and his total employment time may be significantly longer than that required by normal individuals, which should indicate the apparent difficulty that subnormals encounter in using categories.

6. Subnormal individuals may employ significantly fewer categories regardless of the external stimuli, which should indicate their inabilities to function without a broad intellective framework.

Review of the Literature

The first step taken in this study involved extensive reading concerning the contributions made by previous studies. Research of the literature has indicated that very little information is available that pertains to subnormal individuals and their patterns of thinking in relation to conceptual categorization; and, also, very little information is available concerning subnormal individuals and response delay in relation to conceptual categorization.

Psychologically speaking, a concept may be regarded as a selective system in the mental organization of a person which links previous experience and current states with stimulus. In children, who are confronted with an entirely new realm of experience, the sequence of psychological events in concept formation is regarded as a progression from perception to abstraction to generalization (Vinacke, 1952). That is, a child must first see and experience an item so that he may distinguish it from others, then he must abstract some

feature of the item and retain it so that he may then be able to relate that feature in some meaningful manner to other objects which display the same feature as the one abstracted.[16]

The literature has revealed that some contemporary educators and researchers are interested in the categorization process and its relationship with intellective functioning. Emmett A. Betts, one of the foremost reading authorities, has stated that teachers do not sufficiently understand the dynamics of human relationships, and that they need to know and understand how pupils think and make concepts.[17]

Jerome Bruner has indicated the importance of the utilization of categories to enable intellective functioning. He has stated, "The learning and utilization of categories is one of the most elementary; and general forms of cognition by which man adjusts to his environment."[18] Bruner has listed the importance of one's ability to utilize categories as follows:

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.[19]

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[16]Rosenstein, op. cit., p. 341.

[17]Emmett A. Betts, "Reading Abilities, Averages, and Deviations," Education, (1954), Vol. 74, pp. 323-26.

[18]Jerome Bruner, op. cit., p. 2.

[19]Ibid., p. 13.

The ability to categorize is inherent in the development of concepts. Categorizing at both the perceptual and conceptual level, consists of the process of identification, involving the "fit" between the properties of a given object and the specification of a category. Categorizing is necessary for the reduction of the complexity of the environment since it gives a means for identifying objects in the environment. With this ability, there is a reduction of the necessity for constant learning. A direction for instrumental activity is available. Categorizing, in other words, aids in the ordering and relating of classes of events.[20]

Studies concerned with concept formation have dealt within a proximity of the process of categorization. Vinacke has indicated that studies of concept formation have included problems which are related but have been treated separately. One phase has dealt with the ability to conceptualize. These studies have made an effort to trace, with age, the unfolding and elaboration of the general function in the behavior of the individual together with conditions which influence that development.[21] A study made by Ruzskaya supports Vinacke's statement. In his study he used children 3-7 years old. They were taught to discriminate between various geometrical figures by means of visual presentation and verbal designation of the figures. It was found that the verbal factor

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[20]Rosenstein, op. cit., p. 341.

[21]W. Edgar Vinacke, "The Investigation of Concept Formation," Psychological Bulletin, XL, (1951), pp. 7-8.

was very important particularly with older children. The formation of verbal connections with the objects depended upon the orienting-investigatory activity of the subjects (some proceeded by trial and error, some used secondary clues, some the whole outline of the figure). It was concluded that the most important factor in the concept formation is the verbal signal.[22]

The second area of concept study as indicated by Vinacke was the repertory of concepts, which are regarded as the particular concepts that the child possesses and the way he utilizes them.[23] A study made by Hoffman on concept formation supports this particular area of concept study. Hoffman used ninety boys and girls between twelve and seventeen years old. They were selected so that there were thirty subjects each of the following ranges of the Wechsler Bellevue Intelligence Scale: 50-85, 86-115, and 115-up. These subjects were presented with several series of drawings designed to test their ability to form concepts from perceptual material. The concepts studied were size, symmetry, thickness, acuteness, and solidity. The subjects' scores on the conceptual tests correlated higher with verbal than

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[22]A. G. Ruzskaya, "Rol'neposredstuennogo opyta i slova obrazovanii obobshcheniya u detei doshkolnogo vozrasta," (The Role of Direct Experience and of Speech in the Concept Formation of Pre-school Children," Dokl, Akad, Pedag, Nauk, RSFSR 1958, No. 3, p. 77-80.

[23]W. Edgar Vinacke, op. cit., p. 8.

non-verbal Wechsler scores in spite of the non-verbal nature of the conceptual problems.[24]

The third area of concept study dealt with specific concepts. Studies have been made which sought to find how the individual goes about attaining a particular concept.[25] Rommetveit's study gave supporting evidence to this area of concept study. He indicated a procedure that the defining property must first acquire perceptual dominance. After that, the functional concept is achieved. Finally, the verbal concept is developed as an insight into a symbolic representation of an already established intuitive discriminatory mechanism.[26]

Concepts are among the most important materials of children's thinking. They often develop slowly out of percepts, memories, and images and as a result of the child's reorganization of experience in a problem solving or creative way. Children's concepts change with increasing age. The change does not occur at the same rate for all children. No child of a particular age gives consistent responses of one type of another but instead may give many different types of responses, depending upon the situation.[27]

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[24]Herbert N. Hoffman, "A Study in an Aspect of Concept Formation, with Subnormal, Average, and Superior Adolescents," Genetical Psychology Monograph, 1955, Vol. 52, pp. 191-239.

[25]W. Edgar Vinacke, op. cit., p. 8.

[26]R. Rommetveit, "Stages in Concept Formation and Levels of Cognitive Functioning," Scandinavian Journal of Psychology, 1960, Vol. I, pp. 115-124.

[27]Rosenstein, op. cit., p. 337.

Cause-effect relations can be grasped by the eighth or ninth year. Social concepts seem to increase steadily from grade to grade. Recognition of social problems is not great before the sixth or seventh grade (Vinacke, 1952). Every study of children's knowledge of any type of concept shows wide gaps and numerous inadequacies. Children may know a concept thoroughly, partially, inaccurately, or not at all.[28]

Osborn suggested in a study concerned with clustering in organic and familial retardates that inability to form concepts may be related to inappropriate learning habits. Osborn used organic, familial, and control subjects who were matched for mental age and compared with respect to their functioning on the associate clustering task. He found no significant difference between organics and familials on this task, and both retardate groups recalled pictures and organized them conceptually as adequately as did the control group. There were qualitative differences, however, in the manner in which the retardates developed their total scores. From this he concluded that inefficiencies in functioning may be related to inappropriate learning habits.[29]

A study by Griffith, Belver, and Spitz made with retarded and normal subjects was concerned with verbal mediation

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[28]Rosenstein, op. cit., p. 337.

[29]W. J. Osborn, "Associative Clustering in Organic and Familial Retardates," American Journal of Mental Deficiency, 1960, Vol. 65, pp. 351-57.

and concept formation. They used an abstraction task in which the subjects had to discover a similarity in three words. In a separate session, the stimulus words were presented to determine the number in each triad, defined in terms of acceptable abstraction. Retardates and normal seven year old subjects were not successful in concept attainment unless they had the opportunity to match words on the basis of their eliciting a common immediate association, that is unless they defined at least two words in terms of an abstraction.[30] This study lends evidence that there is a progressive quality in relation to one's age and his ability to conceptualize.

Relatively little data is available that has been concerned with the control of response delay as involved with the process of categorization; although there have been studies which were indirectly related. Many studies have been conducted that have been concerned with response delay on the Rorschach. A relationship between production of human movement responses and response delay has been recognized by many authorities (Beck, 1962; Piotrowski, 1957; Levine and Meltzoff, 1957). It has frequently been observed that the first occurences of M in children's Rorschach records and the increase in the number of M parallel the development of ability to delay responses.

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[30]Belver C. Griffith, Herman H. Spitz, and Ronald S. Lipman, "Verbal Mediation and Concept Formation in Retarded and Normal Subjects," Journal of Experimental Psychology, 1959, Vol. 58, pp. 247-51.

Since maturity, ego integration, and response delay have been related by theorists and since short reaction times and lack of M have been related to lack of maturity and poor ego integration in psychiatric patients, it seems that a mass of evidence is growing which relates response delay and M production in psychiatric subjects.[31] Consequently one should remain suspect of subnormal students and their response delay when trying to conceptionalize.

Several studies (Blere and Blacker, 1956; Levine, Glass, and Meltzoff, 1957; Meltzoff, Singer, and Korchin, 1953; Shipola and Taylor, 1953; Singer, Meltzoff, and Goldman, 1952; Werner, 1945; and Werner and Thuma, 1942) have found evidence of longer reaction time for M responses than for responses involving other components. These studies have also found more M responses being given by individuals who respond slowly than among individuals who respond quickly.[32] M- represents a fantasy creation in which the subject has at the same time inaccurately perceived the form that he sees in movement. M- reflects an autistic creativity.[33] Therefore the possibility exists that the subnormal child may fall into a pattern of response which leads him into a disguised perception.

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[31]Julia L. Franklin, The Inhibition Process and the Handling of Humans and Humans in Movement of the Kinget, Unpublished Ph.D. Dissertation, 1963, Oklahoma University, p. 4.

[32]Ibid., p. 7

[33]Samuel Beck, op. cit., p. 23.

Beck indicates that a movement response in an animal is a repressed or a heavily disguised M. The individual is seeing a human activity--else it could not be scored M-, but he hangs it onto a nonhuman form.[34] If a child does not have the experiential framework with which he can conceptualize, his responses, whether on a Rorschach or on a categorization task, may indicate an autistic creativity.

In order for either reasoning or planning to take place the individual must first be able to inhibit or delay the direct instrumental response to the drive stimulus and cue. It is this inhibition that offers the cue-producing responses an opportunity to operate and this response of "not - responding" must be learned just as any other new response. It is also necessary that the cue-producing responses be efficient and realistic and finally that they lead to appropriate instrumental or overt acts.[35] Hall and Lindzey appear to imply that one must have learned to respond and to non-respond if he is to function efficiently and realistically.

Shipola and Taylor (1953) have studies which indicate that reaction times for M responses are longer than for other types of responses given. These investigators concluded that M responses are delayed responses, that they reflect control of immediate, impulsive reactions; and that

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[34]Beck, op. cit., p. 24-25.

[35]Calvin Hall and Gardner Lindzey, Theories of Personality, New York: John Wiley and Sons, Inc., 1963, p. 439.

the slow, deliberate person will produce more M responses than will the fast, impulsive person.[36]

Quickly given responses and those which involve an extreme length of delay are predominantly poorly integrated responses and usually reveal a great degree of emotionality. Evidence is available which indicates that people who do not inhibit well are likely to respond quickly or to respond very slowly (Levine, Glass, and Meltzoff, 1957). It apparently takes time to inhibit responses, but effective inhibitors will inhibit relatively more rapidly than will less effective-inhibitors. Either too long or too short reaction times seem to indicate inadequate handling of impulses.[37]

Klopfer (1956) states that children, immature adults, and deteriorated adults tend to respond quickly, impulsively, and less effectively than do mature adults. The threat of impulses aroused by a specific stimulus or stimulating situation seems to determine the length of time needed by the individual for adequate handling of the threat. Inhibition is not an instantaneous process since complex ego controls are involved.[38]

Bennett and Doppelt made a study which sheds some light upon the speed of response when they studied response and item difficulty of slow and fast students. Their study indicated that a substantial relationship was observed

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[36]Franklin, op. cit., p. 8.

[37]Franklin, op. cit., p. 9.

[38]Ibid., p. 10.

between vocabulary ability and rate of responding. Slow people were inclined to work at about the same rate with easy and difficult materials, but faster students tend to vary their response rate with the difficulty level of items.[39]

Deterline in a study concerned with responses and concept formation has indicated that a decrease in frequency of agreement of stimulus and response concept classes from object, to form, to number is consistent with the decreasing ease of rote concept learning. Differences are due to previously learned verbal habits in terms of the most probable responses and strengths of competing responses to each stimulus.[40]

Ellis and Sloan have shown a relationship between intelligence and reaction time, which appears conversely to Beck's finding on reaction time with the Rorschach. Ellis and Sloan measure simple reation time to an auditory stimulus in 79 mental defectives who ranged in chronological age from 10.3 to 19.5, and in mental age from 3.7 to 12.2. They discovered that reaction time tended to be more variable for low mental age than for high mental age.[41] This evidence appears to indicate that

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[39]George K. Bennett, and Jerome E. Doppelt, "Item Difficulty and Speed of Response," Educational Psychology Measurement, 1956, Vol. 16, pp. 494-6.

[40]W. A. Deterline, "Verbal Responses and Concept Formation," Psychological Report, 1957, Vol. 3, p. 372.

[41]N. R. Ellis, and W. Sloan, "Relationship between Intelligence and Simple Reaction Time in Mental Defectives," Perception Motor Skills, 1957, Vol. 7, pp. 65-67.

the high mental age subjects had enough impulse control that they could maintain a consistency while doing a task.

Venables and Tizard somewhat support the preceding study with an experiment which shows that in 22 out of 24 chronic, nonparanoid schizophrenics, reaction times to the brighter stimuli were longer than those to weaker stimuli in a first testing session, but no so in a second test. Convalescent, short-stay schizophrenics and normal controls showed no paradoxical effects.[42]

In a study by Grice it has been shown that anxiety and intelligence may both play important roles in discrimination-reaction-time tasks. Two groups of subjects of high and low anxiety as determined by a scale of Manifest Anxiety were given a complex discrimination-reaction-time task involving a high degree of interference. While the low anxiety group was superior in performance on the reaction-time task, it was found that this superiority could be attributed to intellectual differences rather than to differences in level of anxiety.[43]

Hall and Stride somewhat agree with Beck's findings on the Rorschach. They have indicated that depression, as such, may not lengthen response time, as depressives under age forty don't differ, except in variability, from normals. Acute schizophrenics show high degree of response

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[42] P. H. Venables, and J. Tizard, "Paradoxical Effects in the Reaction Time of Schizophrenics," Journal Abnormal Social Psychology, 1956, Vol. 53, pp. 220-24.

[43] Robert Grice, "Discrimination Reaction Time as a Function of Anxiety and Intelligence," Journal Abnormal Social Psychology, 1955, Vol. 50, pp. 71-74.

time deficit.[44]

There also is relatively little data concerned with the conceptual formation of categories and the dependence that the individual has for visual and or audio stimuli. Hennon has reported studies which try to support either visual, or audio, or visual-audio as the most important as a mode of presentation for retention. These studies may be of importance to the process of categorization in that retention has to be dependable if the individual so constructs categories which can be utilized as intellective frameworks.

Finzi presented letters, numbers, and nonsense syllables to subjects by visual means, auditory and articulatory combined, and articulatory alone. The results were that the visual method alone gave the most reliable results.[45]

Kemsies used auditory, visual, and visual-auditory methods. He summarized that auditory presentation was superior in all cases. The combined method proved poorer than the visual or auditory presentations.[46]

Musterberg and Bigham experimented with visual, auditory, and visual-auditory methods of stimuli presentation and concluded as follows: "A series of presentations offered to two senses at the same time is much more easily

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[44]K. R. L. Hall, and E. Stride, "Some Factors Affecting Reaction Times to Auditory Stimuli in Mental Patients," Journal Mental Science, 1954, Vol. 100, pp. 463-77.

[45]V. A. C. Hennon, "The Relation between Mode of Presentation and Retention," The Psychological Review, XXX (1912), p. 80.

[46]Ibid., p. 82.

reproduced than if given only to sight or only to hearing. There is a significant superiority in the combined method. When taken alone visual memory excels strongly the aural.[47]

Pohlmann's study revealed that auditory presentation is better than visual with significant material (words) but that visual presentation is better with nonsense material (numbers and syllables). The value of visual presentation for words increases with age and finally surpasses the auditory or visual alone. The visual-auditory-motor presentation gives poorer results.[48]

Goda and Rigradsky allowed inconsistency of dependence on sensory stimuli in the following summary of their study: "Hearing responses are affected by environment and materials to which they are responding. While the child usually used both vision and hearing in responding to verbal symbols, there are periods where he uses hearing exclusively."[49]

Stagner has indicated that personality may be involved with categorizing attitude with the following explanation:

> Still another perceptual phenomenon seems to be related to leveling-sharpening. This is the kind of

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[47] Ibid., p. 80.

[48] V. A. C. Hennon, op. cit., p. 83.

[49] S. Goda, and S. Rigradsky, "Auditory Training Procedures of Certain Mentally Retarded Children," Training School Bulletin, 1962, Vol. 59, pp. 81-88.

> categorizing shown by the person. Gardner (1953) presented his subjects with a large number of miniature objects and asked each person to classify these into groups that belonged together. Some S's looked for very broad categories and divided the objects into a few groups. Others tended to stick fairly close to the distinctive features of each object, and thus used a large number of groups or categories. Further tests suggested that those using broad categories were levelers and those using rather specific classifications resembled the sharpeners. Here again we find evidence for a broad, general aspect of personality affecting the person's way of dealing with a variety of emotion-arousing, environmental stimuli. And as suggested earlier, we suspect that persons in the leveling group are those who fail to observe differences among individuals, who have a few broad categories into which people fit.[50]

Stagner further indicates that a categorizing attitude may be somewhat affected by the child's milieu, because he learns the limits within which impulse gratification is permitted, and beyond which punishment will result. He learns the kinds of responses which are appropriate to certain contexts and social roles. Essentially this is a process of developing a picture of the world. It may be a rigid picture with everything depicted either black or white; or it may be less clear-cut, with ambiguities and shades of gray blurring much of the picture.[51]

Summary

Many studies, which are directly or indirectly concerned with conceptual categories related to delay of

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[50]Ross Stagner, Psychology of Personality, (New York: McGraw-Hill Book Co., Inc., (1961), p. 140.

[51]Ibid., p. 128.

response and thinking patterns, have not clearly indicated any evidence that will support the assumption that subnormal individuals function inadequately because of prolonged or shorten response delay.

These studies may be evaluated to cover certain areas of concept formation, but they are inconclusive. There have been numerous studies on retroactive and proactive inhibition, but the inhibition studies examined by this writer have indicated no concern for response delay and its relationship with conceptual categories. Therefore studies which are concerned with the abilities of subnormal and normal children to perform with conceptual categorization tasks are needed. These studies may indicate the ability of individuals to utilize conceptual categories and whether the differences in individuals' experiential meaning may be manifested by one's ability to utilize conceptual categories.

This experiment should investigate the comparative number of correct categories used by normal and subnormal subjects when they are given a visual (picture-association) cue to the category and when they are given an auditory (naming the category) cue to the category. The study should also investigate their reaction time (response delay) to each category, and the total time employed to complete all the categorization tasks.

This additional experimental data should help to

modify and or to nullify educational practices and theories that may have been somewhat dogmatically established.

CHAPTER II

STATEMENT OF THE PROBLEM

Introduction

It was the purpose of this study to determine if there is a statistically significant difference in subnormal and normal children's ability to employ conceptual categories. Specifically, the experiment will try to determine whether normal subjects can correctly employ more of a series of test categories than subnormal subjects after the examiner has identified the categories by giving visual (picture-associative) cues, and whether normal subjects can correctly employ more of a series of test categories than subnormal subjects after the examiner has identified the categories by giving an auditory (naming the category) cue; and to determine whether or not response delay indicates a statistically significantly different reaction time to each of the 25 categorization tasks; and whether or not there is a statistically significantly different total time spent on correct responses of each of the 25 categorization tasks.

Hypotheses to be Tested

The experiment was carried out to test the following

null hypotheses:

1. The number of correct responses attained by the normal group will not be significantly different from the number of correct responses attained by the subnormal group when the responses of the groups to each of 25 visual structured categorization tasks are compared.

2. The number of correct responses attained by the normal group will not be significantly different from the number of correct responses attained by the subnormal group when the responses of the groups to each of 25 auditory structured categorization tasks are compared.

3. The correlation between correct responses and mean response delay time attained by the normal group will not be significantly different from the correlation attained by the subnormal group when the correlations of the 25 visual structured categorization tasks are compared.

4. The correlation between correct responses and total mean task time attained by the normal group will not be significantly different from the correlation attained by the subnormal group when the correlations of the 25 visual structured categorization tasks are compared.

5. The correlation between correct responses and mean response delay time attained by the normal group will not be significantly different from the correlation attained by the subnormal group when the correlations of the 25 auditory structured categorization tasks are compared.

6. The correlation between correct responses and

total mean task time attained by the normal group will not be significantly different from the correlation attained by the subnormal group when the correlations of the 25 auditory structured categorization tasks are compared.

Method of Study

This study utilized data from previous studies and was conducted in part by utilizing the same experimental instrument, and modification thereof, used in a previous study, thus giving more continuity and better opportunity for more appropriate comparison of results discovered.

Statistical Treatment

The test results for the normal and subnormal groups were compared by converting them to percentages and applying the formula for the significance of the difference between proportions, which is described by Garrett.[1] This formula provides a standardized deviate score based upon the following operation:

$$Z = \frac{P_1 - P_2}{\sqrt{PQ\left(\frac{1}{N_1} - \frac{1}{N_2}\right)}}$$

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[1]Henry E. Garrett, Statistics in Psychology and Education, (New York: Longmans, Green, and Company, 1960), pp. 235-241.

Time comparisons as stated in the null hypotheses were tested by using the Pearsons Product - Moment Coefficient of Correlation. This formula will indicate the correlation of the correct responses with the response delay time, and the correct responses with the total task time. This procedure was followed for both normal and subnormal subjects on both the visual structured tasks and on the auditory structured tasks. Pearson Product - Moment Coefficient of Correlation was found by using the following formula:

$$r = \frac{\Sigma XY - \frac{(\Sigma X)(\Sigma Y)}{n}}{\sqrt{\left(\Sigma X^2 - \frac{(\Sigma X)^2}{n}\right)\left(\Sigma Y^2 - \frac{(\Sigma Y)^2}{n}\right)}}$$

After the correlations were made the r's were transformed to Z scores by using the Fishers Z table.[2] The following formula was then applied which enabled the examiner to compare the correlations of the normal subjects with the subnormal subjects. Through use of this formula the examiner was able to determine his rejection or acceptance of the hypotheses.[3]

$$CR = \frac{Z_1 - Z_2}{\sqrt{\frac{1}{N_1 - 3} + \frac{1}{N_2 - 3}}}$$

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[2]Garrett, op. cit., pp. 199-201.

[3]Ibid.

Organization of the Study

The organization of this study followed the general plan outlined in Chapter I and Chapter II. Chapter III was devoted to the procedure of the study. Chapter IV was devoted to the presentation and analysis of data. And Chapter V consists of the summary, conclusion, and recommendations.

CHAPTER III

PROCEDURE OF THE STUDY

Introduction

The purpose of this study was to determine if there was a statistically significant difference in performance of normal and subnormal children using visual and auditory structured categorization tasks. "The Handbook of Research Methods in Child Development" (Mussen, 1960) differentiates between two ways by which concepts are learned. When a child is successively told that certain items are red, he is presumably learning the concept "red." When he points to the first fire truck he's ever seen and says, "Red," he is demonstrating some learning of the concept. When reference is to this type of original learning, the term "Concept Learning" is used.[1] Now consider a set of cards consisting of several instances of triangles, circles, and squares with several instances of each form colored red. The subject may sort these cards in terms of color, form, or a combination of both. But the subject can learn through experimentor prompting, the concept the experimentor

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[1]Rosenstein, op. cit., p. 341.

considers relevant. The learning that takes place in this type of situation is called "concept discovery."[2]

Specifically, this study will determine whether or not normal subjects perform more adequately than subnormal subjects with several performance aspects. The study will be concerned with the differences between normal children and subnormal children in their employment of visual-structured categorization tasks (picture-associative cues); in their employment of auditory-structured categorization tasks (naming the category); in their differences of mean time of total responses; and in their mean differences of response delay (reaction time).

The Instrument

The instrument to be used in this study was, in part, an instrument constructed for use in a previous study.[3] This instrument was used with modifications as constructed by the examiner for this study. Specifically, the modification of the original instrument is an additional set of 27 cards, six inches by six inches, which have a single picture on the center of each card. These cards were used in cooperation with the original instrument for the visual-structured categorization task. The original

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[2]Rosenstein, op. cit., p. 342.

[3]Wyatt Stephens, "A Comparison of Normal and Subnormal Boys on Tasks Requiring the Use of Selected Categories," Unpublished Ph.D. Dissertation, University of Oklahoma, 1963, p. 27.

instrument consists of a series of 27 cards, each eight inches by eighteen inches, on which are located seven different pictures. These cards were used singularly for the auditory-structured categorization task. There is one set of test cards 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 are seven randomly ordered figures or pictures, four of which represent the category, and three of which are incorrect responses in terms of the category which is being tested.[4] In the present study, the

[4]Stephens, op. cit., p. 29.

subject was required to perform two types of tasks employing materials. First, he was required to decide upon the appropriate category for each card by picture association. Second, he was required to decide upon the appropriate category for each card by use of auditory cues. His response delay to each card was timed; and finally his total response time was measured. All children were from the same school system, and each of the normal subjects was matched for chronological age to a subnormal subject.

The purpose for constructing a test is that of creating an instrument which will measure what it purports to measure. This means that the value of the test depends not upon its resemblance to existing tests, but upon whether or not it can differentiate normal from subnormal subjects along the dimensions of behavior being studied.[5] Consequently a test was needed that would measure the differences of performance of normal and subnormal subjects using visual-structured and auditory-structured categorization tasks. Evidence has been shown by the pilot study from a previous study that the experimental instrument of 27 cards, eight inches by 18 inches, as described in the preceding paragraph, is adequate for the present study. An additional pilot study was made to determine the adequacy of the modification of the original instrument.

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[5]Seymour B. Sarason, Psychological Problems in Mental Deficiency, (New York: Harper and Brothers, 1959), p. 646.

The Pilot Study[6]

The main purposes of the pilot study were (1) to gain further information concerning the ability of the test items to discriminate between normal and subnormal children, and (2) to reveal any mechanical problems which might be associated with administration procedure, recording of scores, and with timing the items.

Two groups were tested in the pilot study. One was composed of 10 normal boys from regular classrooms, while the other was made up of 10 subnormal boys in the educable range who were enrolled in special classes. All children were from the same school, and each of the normal subjects was matched for chronological age to a subnormal subject, allowing a range of plus or minus three months.

The procedure for testing was as follows:

1. Subjects were seated facing the examiner across a small table. The examiner 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 composed of one penny, one dime, one nickel and one quarter was made before the subject. The examiner then asked: "Are these alike?" They don't look alike, but they do something alike, don't they? We could buy something with any of them. They are alike because they do something alike."

   "So, things can be alike for different reasons. They can be alike because they look alike, like the pennies, or they can be alike because they

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[6]Stephens, op. cit., p. 31.

do something alike, like the others."

The pennies were replaced before the subject, and the examiner 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 examiner presented each sample card, and aided the subject, when necessary, in the correct solution, each time verbalizing the correct category following correct placement of the pennies.

3. The examiner then presented the first test card, saying: "Let's do this one. Which of these are most alike?" The subject's response and the time required to reach it were recorded.

4. The same instructions as presented in item 3 were presented for each of the subsequent items through item 25.

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

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.

The Second Pilot Study

An additional pilot study was conducted for the purpose of gathering further information with which to evaluate the adequacy of the 27 picture-associative cards when used cooperatively with the original 27 cards.

Two groups were tested in this pilot study. One was composed of 8 boys who possessed intelligence quotients within the normal range; and the other group consisted of 8 boys who possessed intelligence quotients within the subnormal range. All children were from the same school system, and each of the normal subjects was matched for chronological age to a subnormal subject, allowing a range not to exceed 6 months.

The procedure for testing was as follows:

1. Subjects were seated facing the examiner across a small table. The examiner 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 removed, and a row composed of one penny, one dime, one nickel, and one quarter were placed before the subject. The examiner asked: "Are these alike? They don't look alike, but they do something alike, don't they? We could buy something with any of them. They are alike because they do something alike."

   "So, things can be alike for different reasons. They can be alike because they look alike, like the pennies, or they can be alike because they do something alike, like the others."

   The pennies were replaced before the subject, and the examiner said:

   "Now, I have some pictures on these cards of lots of things. On each card some of the things go with the pictures on the smaller card because they are most alike. We're going to look at each card and put the pennies on the things which are most like the picture on the small card. I'll show you what I mean with the first two cards."

2. The examiner presented each sample card, and aided the subject, when necessary, in the correct solution, each time verbalizing the correct category following correct placement of the pennies.

3. The examiner presented the first test card, saying: "Let's do this one. Which of these are most alike?" The subject's response, delay of response, and the time required to reach it were recorded.

4. The same instructions as presented in item 3 were presented for each of the subsequent items through item 25.

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

All responses made by each subject, the response delay time, and the number of seconds required for him to make the response, were recorded on a specially constructed form (Appendix 1).

The data obtained in this pilot study were carefully evaluated. The evaluation of the raw scores clearly indicated that there was a difference in performance between normal and subnormal groups. Discrimination was shown in favor of the normal subjects.

The administration and mechanical procedures of the pilot study were the same as shown in the preceding pilot study. Careful evaluation of this procedure resulted in the examiner's decision to modify the instrument by substituting four white plastic chips in place of the four pennies. This change of procedure resulted because of the apparent difficulty of the subjects to handle the pennies. The chips are larger, one inch in diameter, and thicker than the pennies. Consequently, the subjects

were able to physically manipulate the chips with greater ease when placing them over their choices of pictures on the categorization cards.

The examiner also noticed that some of the subjects reacted differently when they were faced with the money which was used at the beginning of the test to illustrate how different things can be alike. Consequently the examiner decided, after conferring with Dr. P. T. Teska, director of this study, that all money should be removed from the administration of this test. This decision was based upon the fact that some students become somewhat threatened by the sight and by the handling of money.

Therefore, the examiner carefully considered many objects which could be used in place of the coins. A decision was made to use seven small, relatively cheap - five cents each - plastic vehicles. The decision was based upon the fact that these vehicles could not be identified as any particular make, model, or year; and consequently it would be very difficult for a subject to associate himself with a particular vehicle. This inability to associate one's self should relieve the threat that was posed by using the coins.

The procedure for introduction of the test will be the same, except that the subject will first be shown four identical, blue vehicles in place of the four pennies. Then three vehicles will be removed and replaced by three different vehicles, which take the place of the previously

used nickel, dime, and quarter.

These two changes were the only modifications as a result of the second pilot study. The data clearly indicated that a differentiation of performance could be obtained by using this instrument.

The Sample

Subjects included in the present study were sixty boys from two public schools in the Oklahoma City public school system. These two schools were located within ten blocks of each other and were within the same socio-economic level. These boys were representative of the lower-middle to the middle-lower socio-economic level. Each subject was screened for evidence of gross physical handicap, visual problems, difficulty in hearing, or emotional disturbance. No child was included who evidenced any of these characteristics.

The examiner determined the presence of defects by observation and testing. Each child was administered the Goodenough Draw-a-Person test to determine if he evidenced any gross emotional disturbance.[7] Hearing difficulties were isolated through observation and conversation with the subject. Visual defects were determined by observation and the child's ability to identify objects, words, and colors.

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[7]Goodenough, Florence L. Measurement of Intelligence by Drawings, Yonkers-on-Hudson, New York: World Book Co., 1926.

A total of 68 boys were tested. From these 68 boys the examiner used the results of 60 boys. The examiner eliminated the test results of eight boys for the following reasons: (1) Two boys were eliminated when they revealed to the examiner that another boy had told them they were to receive a shot with a needle. These boys did not evidence any threat as such, but the examiner decided they should be dropped if the testing were to be free of chance error. (2) Three boys were dropped because their I.Q. scores were only within one point from the dividing line for normal and subnormal subjects. (3) The final three boys were dropped because each was disturbed while taking the test when they were interrupted, respectively, by two janitors' and a teacher's coming into the testing room.

All boys who served as subjects ranged in chronological age from 9 years to 11 years 2 months. Each normal and subnormal boy was equated by chronological age within a range of six months. This age range of 9 years to 11 years was chosen because the review of literature revealed that children develop conceptual abilities more rapidly and better after nine years of age.

The intellectual ranges of the subjects were as follows: Each of the thirty boys of the subnormal group were characterized by having an intelligence quotient in the 54 to 88 I.Q. range as measured by the California Mental Maturity Scale. Each boy in the normal group possessed an intelligence quotient in the 92 to 115 I.Q.

range as measured by the California Mental Maturity Scale. Any child who indicated that he may extremely deviate from his present I.Q. score was rechecked by a score on either the Wechsler Intelligence Scale for Children or by a score on the Stanford-Binet. Any child who manifested an extreme emotional disturbance as indicated by the Goodenough test was not used.

In summary, the sixty boys tested for the present study had the following characteristics:

1. All subjects were attending one of the two schools chosen for this study in the Oklahoma City School System.
2. All subjects represented lower-middle to middle-lower socio-economic level families.
3. No subjects were used who evidenced gross physical handicap, hearing difficulties, visual defects, or severe emotional disturbance.
4. Each normal and subnormal subject was equated within a six months chronological range from age 9 years to 11 years 2 months.
5. Thirty boys, the subnormal group, possessed I.Q. scores ranging from 54 to 88, with a mean I.Q. of 77.96 and a standard deviation of 8.08.
6. Thirty boys, the normal group, possessed I.Q. scores ranging from 92 to 115, with a mean I.Q. of 102.2 and a standard deviation of 7.87.

Administration of the Test

Each subject was taken individually from his classroom and accompanied the examiner to a quiet, well-lighted room. The subject was seated across a table opposite the examiner. The subject was then asked to complete the Goodenough Draw-a-Person Test.

After the subject assured the examiner that he was comfortably seated the following procedure was carried out:

1. The subject was seated facing the examiner across a table. The examiner placed four, small, blue, identical vehicles in a row in front of the subject and said, "I want you to look at these little cars and I will show you what we are going to do. This will help you to understand what I want you to do. These cars are all alike. They are all blue. They are shaped alike. They all have a driver, an engine, and four black wheels. So you can see they are all alike."

   Three blue cars were then removed and three different cars were aligned next to the remaining blue car. The subject was then asked, "Are these all alike?" The subject usually answered by saying no or by shaking his head negatively. Sometimes one would volunteer to point out the differences. The examiner then stated, "No, these are not alike. They are different colors--blue, red, yellow, and green--and they are shaped differently; but even though they don't look alike they still are alike in some ways. They each have an engine, a driver, and four wheels. They can be driven down a street. They burn gasoline. So, you can see that things can be alike in many ways; they may look alike; they may smell alike; they may feel alike; or they may do things alike."

   The cars were removed and the subject was given the four white plastic chips, and the examiner said, "Now, I'll show you what we are going to do. I have some pictures on these cards of lots of things. On this smaller card is one picture. I want you to place the white chips on each picture on this card (pointing to the larger card) that is most like the picture on this card (pointing to the small card). Remember, now, things can be alike in different ways."

2. The examiner presented each sample card and helped the subject to proceed correctly. Then the examiner asked, "Do you understand what we are doing?" The examiner then gave further instructions if the subject so indicated a need.

3. The examiner then presented the first test card, and said, "Let's try this one. Remember, things can be alike for different reasons. Now, which pictures on this card are most like the picture on this card--remember, most alike?" The sub-

ject's response delay time, total task time, and correct or incorrect response were recorded.

4. The same instruction as shown above was presented for each of the tasks until all 25 tasks were completed.

5. After the visual structured administration was completed, each card was again presented without the small picture-association card. The next presentation was an auditory structured condition. Each large card was presented and the subject was told, "This time I will name the card and I want you to place each of the four chips on each of the four pictures that are most alike." Each card was placed before the subject and the examiner then asked, "Which ones are the same color" and, etc. Each card was presented in the same manner, by naming the category, until all 25 cards had been completed by the subject.

After completion of the visual structured tasks and the auditory structured tasks, the child was complimented for his performance and allowed to return to his classroom.

Obtained Data

The examiner was concerned with gathering data for screening purposes and for testing purposes. Therefore, information was obtained which allowed the examiner to meet his objectives. Data gathered before the testing situation, which was used for screening purposes, consisted of the following: subject's name, sex, age, birth date, teacher, school, intelligence quotient, Goodenough Draw-a-Person test, and information concerning physical handicaps. The testing data consisted of the subject's correct responses, response delay time, and total task time on each of the 25 visual structured categorization

tasks; and his correct responses, response delay time, and total task time on each of the 25 auditory structured categorization tasks.

Using the procedure as shown in this chapter the examiner was able to evaluate the results of the data as collected from the normal and subnormal subjects' performances with conceptual categorization tasks. The results of this evaluation are presented in the following chapter.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

The purpose of the present study was to provide additional experimental data which may shed light upon the intellective qualities of normal and subnormal children. Specifically, the examiner hoped to gain information concerning the assumed simplicity of thinking of the subnormal children and to gain information that may indicate whether response delay time and total response time have any relationship between one's ability to correctly form conceptual categories. Therefore, a test which was devised and proven successful in another experiment was used. This test measured several aspects of performance of children on tasks requiring the use of conceptual categories which had been observed to be important in every day intellective activity.[1] A modification of this instrument also was made in order to allow the examiner to have a visual structured category. Specifically, data were collected which enabled the examiner to compare the normal and subnormal subjects' successful employment of the visual structured and auditory structured categoriza-

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[1]Stephens, op. cit.

tion tasks. In these two tasks the subjects were required to do the following: (1) They had to determine the category for organizing the pictures of items on each card by using picture associative cues; (2) They had to determine the category for organizing the pictures of items on each card by using auditory cues (naming of the category by the examiner). These two tasks were respectively referred to as follows: (1) the visual structured tasks, and (2) the auditory structured tasks. The time in seconds and 10th's of a second was recorded for each subject's response delay time (reaction time); and time in seconds and 10th's of a second was recorded for each subject's total task time. These times were recorded for each of the 25 tasks on the auditory structured tasks and for each of the 25 tasks on the visual structured tasks.

It was proposed that data collected from the normal and subnormal subjects' performances on these categorization tasks would lend experimental knowledge which may help to explain the assumption that subnormal subjects possess relatively simpler thinking patterns than normal subjects. It was also proposed that lack of response delay may direct the individual to respond quickly and with no regard for a meaningful process of categorization. Therefore, the assumption must exist that the individual cannot accumulate meaningful interpretative categories with which he can relate new experiences. Lack of significant correlation between the correct responses and the response delay and the

correct responses and the total task time would indicate that effective handling of impulses and the inhibition of impulsive behavior may be fundamental in order to discriminate similar experiential data in order to determine their meaning. Lowered performance on either the visual structured tasks or the auditory structured tasks would indicate lack of category development and delineation, because both sets of these categories are dependent upon one's visual and auditory associative abilities for forming conceptual categories. Therefore, a subject, whose repertory of conceptual categories is relatively limited, and whose ineffective handling of impulses is evident, would have difficulty maintaining himself in a milieu with subjects in whom these abilities are relatively intact.

Two groups of subjects were included in the present study. Each group consisted of 30 boys between the ages of 9 years and 11 years 2 months. Each group was representative of families in the lower-middle to the middle-lower socio-economic levels. The subnormal group was composed of boys whose mean intelligence quotient, as measured by the California Mental Maturity Scale, was 77.96 with a standard deviation of 8.0834. The normal group was composed of boys whose mean intelligence quotient, as measured by the California Mental Maturity Scale, was 102.2 with a standard deviation of 7.878. Therefore these two groups were similar except for measured intellective level.

These two groups were compared to determine their

relative levels of performance on (1) twenty-five visual structured categorization tasks and on (2) twenty-five auditory structured categorization tasks. The normal and subnormal groups were also compared with respect to the mean number of seconds of each subject's total task time and response delay time. This comparison was made possible by running a correlation between the correct responses and the total task time on both the visual structured tasks and the auditory structured tasks. The correlations (r) were converted to a Fishers Z score and compared by using the following formula:

$$CR = \frac{Z_1 - Z_2}{\sqrt{\frac{1}{N_1 - 3} + \frac{1}{N_2 - 3}}}$$

The r's were converted to the Z's by using the table as shown by Garrett.[2]

The correct responses for the normal and subnormal groups were compared by converting them to percentages and applying the formula for the significance of the differences between proportions, which is described by Garrett.[3] This formula provides a standardized deviate score based upon the following operations:

$$Z = \frac{P_1 - P_2}{\sqrt{PQ\left(\frac{1}{N_1} - \frac{1}{N_2}\right)}}$$

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[2]Garrett, op. cit., pp. 199-201.

[3]Ibid, pp. 235-241.

In this formula, P_1 equals the proportion of the first group attaining correct responses and P_2 equals the proportion of the second group whose responses were correct. In the denominator, P equals the total proportion of both groups achieving the correct response, while A equals 1 - P. The total denominator provides an estimate of the standard error of the difference between scores, and when the percentage difference between the two groups is divided by this standard error value, the result is a standard deviate score for which the position on the baseline of a distribution indicates the probability of such a difference occurring by chance alone. For the present study the level of significance was set at the 0.05 level.

In this study the hypotheses were accepted or rejected by reference to a statistical consideration reported by Wilkinson.[4] Through the use of a table provided by Wilkinson (Appendix 2), it is possible to determine the number of differences which may be significant in a given number of comparisons without exceeding certain levels of expectation. In this study, the null hypotheses were tested that normal subjects do not perform at a significantly different level than do subnormals on a series of 25 potential comparisons in two different areas. On each of these areas it was possible to determine the number of comparisons which were required to produce significant differences before the null hypotheses (stating that no differences

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[4]Bryan Wilkinson, "A Statistical Consideration in Psychological Research," Psychological Bulletin, XLVIII (1951), pp. 156-58.

exist) could be rejected.

The data obtained through statistical analysis of the test results are presented in the following sections of this chapter.

Differences in Number of Correct Responses to the Visual Structured Tasks

Each subject in the present study was tested to determine the number of the twenty-five test categories which he could complete successfully through a process of selecting the items on each card which were most like the item on the picture associative card. As far as could be determined, only one logical solution was possible for the subject in each category. The test was constructed to minimize the number of reasonable groupings which a subject could employ. The correct responses of the subnormal subjects were compared as a group with those of the normal group. The comparisons for the visual structured tasks are presented in Table 1.

The data presented in Table 1 indicate that the number of normal subjects attaining correct responses was not significantly greater than the number of subnormal subjects attaining correct responses. In fact the normal subjects did not attain a significant difference on any of the items at or beyond the 0.05 level of confidence. The normal subjects did indicate a greater percentage difference on thirteen of the twenty-five categories, but none of these were significant at the 0.05 level of confidence.

TABLE 1

NUMBER AND PERCENTAGE OF SUBJECTS ATTAINING CORRECT RESPONSES ON VISUAL STRUCTURED TASKS

Category	Normals (n=30) Number	Normals (n=30) Percentage	Subnormals (n=30) Number	Subnormals (n=30) Percentage	Percentage Difference (N SN)	Z Value
1.	27	90.0%	23	76.6%	13.4	1.39
2.	29	96.7	30	100.0	-3.3	-0.99
3.	25	83.4	29	96.7	-13.3	-0.54
4.	29	96.7	29	96.7	0.0	0.00
5.	30	100.0	27	90.0	10.0	1.78
6.	9	30.0	12	40.0	-10.0	-0.81
7.	22	73.3	27	90.0	-16.7	-1.67
8.	14	46.7	7	23.3	23.4	1.90
9.	18	60.0	13	43.3	16.7	1.29
10.	25	83.4	21	70.0	13.4	1.23
11.	10	33.3	14	46.7	-13.4	-1.06
12.	25	83.4	22	73.3	10.1	0.95
13.	17	56.7	12	40.0	16.7	1.30
14.	27	90.0	26	86.7	3.3	0.40
15.	20	66.6	17	56.6	10.0	0.80
16.	12	40.0	11	36.7	3.3	0.26
17.	20	66.6	21	70.0	-3.4	-0.28
18.	8	26.6	7	23.3	3.3	0.30
19.	19	63.3	15	50.0	13.3	1.04
20.	2	6.7	3	10.0	-3.3	----
21.	27	90.0	30	100.0	-10.0	-1.78
22.	23	76.6	19	63.3	13.3	1.13
23.	12	40.0	17	56.7	-16.7	-1.30
24.	7	23.3	13	43.3	-20.0	-1.64
25.	0	0.0	0	0.0	0.0	0.00

Positive percentage differences in favor of normals; minus differences in favor of subnormals.

* Significant at or beyond the 0.05 level.

The normal subjects nearly reached the significant level of 1.96 on two different items (5) Heat at 1.78, and (8) Flying versus non-flying objects at 1.90. Paradoxically, the subnormal subjects indicated a greater percentage difference on nine of the twenty-five categories. Although none of these were significant at the 0.05 level of confidence there were three items that nearly reached the significant level of 1.96. These items were (7) Fruits versus vegetables at -1.67, (21) Footwear versus other clothing at -1.78, and (24) Male versus female wearing apparel at -1.64. Therefore, there was no significant difference at the 0.05 level of confidence on any of the twenty-five categories tested with respect to the number of correct responses achieved by the normal and subnormal groups. No difference existed in the following categories: (1) Color, (2) Number, (3) Detail, (4) Orientation, (5) Heat, (6) Clothing, (7) Fruit, (8) Flying objects, (9) Containers, (10) Tools, (11) Cutting equipment, (12) Sex differences in children, (13) Age differences in men, (14) Sex differences in adults, (15) Sad children, (16) Pretty women, (17) Land vehicles, (18) Land animals, (19) Young boys, (20) Clothing made from animal products, (21) Footwear, (22) Furniture, (23) Cooking equipment, (24) Male wearing apparel, and (25) Even numbers.

It was interesting to note that on two different categories 100 per cent of the subnormal subjects attained correct responses. The normal subjects had 100 per cent correct responses on only one item. The largest percentage

difference on one item was in favor of the normal group. This was a 23.4 percentage difference on item (8) Flying objects. Although the subnormal group had nearly as large a percentage difference, -20.0 per cent, on item (24) Male wearing apparel.

To summarize these data, when the subjects included in the present study were required to find items which represented examples of categories most like the items on the picture associative cards, there were no significant differences on any of the 25 categories tested. Since there were no significant differences, the factor of chance operation had no effect upon these data.

Thus, on the basis of the above data, the first null hypotheses was accepted. The number of correct responses attained by the normal group was not significantly different from the number of correct responses attained by the subnormal group when the responses of the groups to each of the twenty-five visual structured categorization tasks were compared.

Differences in Number of Correct Responses to the Auditory Structured Tasks

The normal and subnormal groups investigated in the present study were also administered twenty-five auditory structured categorization tasks. The tasks were structured to the extent that the examiner specified the name of the category for each of the twenty-five test cards. The picture associative card was removed for this test, and the

subjects were required to locate on each card the items which represented that category named by the examiner. It was expected that the auditory structured tasks would be relatively less difficult for the subjects because the category was identified; therefore, it was assumed that the persons who possessed that category at any functional level could find objects which represented the category if asked specifically to do so.

The total number of subjects in each group who attained correct responses was compared for each of the twenty-five categories. The results of these comparisons are summarized in Table 2.

The data presented in Table 2 indicate that the number of normal subjects attaining correct responses was not significantly greater than the number of subnormal subjects doing so. The normal subjects attained a significant difference in only two items at or beyond 0.05 level of confidence. These two significant differences were noted only in the following categories: (13) Age difference in men, and (25) Even numbers of dots. The normal group indicated a greater percentage difference on 8 of the 25 categories, but only the two above noted categories were significantly different at the 0.05 level of confidence. The subnormal group indicated a greater percentage difference on 7 of the 25 categories, but none of these differences were significant at or beyond the 0.05 level of confidence. Therefore, there was no significant difference at the 0.05 level

of confidence on 23 of the 25 categories tested with respect to the number of correct responses achieved by the normal and subnormal groups. No difference existed in the following categories: (1) Color, (2) Number, (3) Detail, (4) Orientation, (5) Heat, (6) Clothing, (7) Fruit, (8) Flying objects, (9) Containers, (10) Tools, (11) Cutting Equipment, (12) Sex differences in children, (14) Sex differences in adults, (15) Sad children, (16) Pretty women, (17) Land vehicles, (18) Land animals, (19) Young boys, (20) Clothing made from animal products, (21) Footwear, (22) Furniture, (23) Cooking equipment, and (24) Male wearing apparel.

It was interesting to note that on eleven different categories 100 per cent of the subnormal subjects attained correct responses. In contrast, the normal group had 100 per cent correct responses on only eight different categories. Also interesting to note is that even though the widest percentage range between 100 per cent and the other group was only 6.7%, this was in favor of the subnormal group.

To summarize these data, when the subjects included in the present study were required to find items which represented examples of categories named by the examiner, subnormal subjects had performance levels that were significantly lower than those evidenced by the normal subjects in 2 of the 25 categories tested. In a set of 25 comparisons the probability is .3576 that as many as 2 significant differences would occur on the basis of chance

TABLE 2

NUMBER AND PERCENTAGE OF SUCJECTS ATTAINING CORRECT RESPONSES ON AUDITORY STRUCTURED TASKS

Category	Normals (n=30) Number	Normals (n=30) Percentage	Subnormals (n=30) Number	Subnormals (n=30) Percentage	Percentage Difference (N SN)	Z Value
1.	30	100.0%	30	100.0	0.0	0.00
2.	30	100.0	30	100.0	0.0	0.00
3.	30	100.0	30	100.0	0.0	0.00
4.	29	96.7	30	100.0	-3.3	-0.98
5.	30	100.0	30	100.0	0.0	0.00
6.	28	93.3	26	86.7	6.6	0.27
7.	26	86.7	24	80.0	6.6	0.30
8.	30	100.0	30	100.0	0.0	0.00
9.	30	100.0	29	96.7	3.3	0.99
10.	28	93.3	29	96.7	-3.3	-0.59
11.	29	96.7	29	96.7	0.0	0.00
12.	30	100.0	30	100.0	0.0	0.00
13.	26	86.7	18	60.0	26.7	2.40*
14.	30	100.0	30	100.0	0.0	0.00
15.	28	93.3	30	100.0	-6.6	-1.30
16.	21	70.0	24	80.0	-10.0	-0.88
17.	28	93.3	30	100.0	-6.6	-1.30
18.	15	50.0	12	40.0	10.0	0.78
19.	22	73.3	25	83.4	-11.1	-1.09
20.	8	26.6	4	13.3	13.3	1.28
21.	30	100.0	30	100.0	0.0	0.00
22.	25	83.4	25	83.4	0.0	0.00
23.	28	93.3	29	96.7	-3.3	-0.59
24.	28	93.3	26	86.7	6.6	0.27
25.	12	40.0	4	13.3	26.7	2.36*

Positive percentage differences in favor of normals; minus differences in favor of subnormals.

* Significant at or beyond the 0.05 level.

alone.[5] Therefore, the occurrence of 2 significant differences indicates that factors of chance may be operating.

Thus, on the basis of the above data, the second null hypotheses was accepted. The number of correct responses attained by the normal group was not significantly different from the number of correct responses attained by the subnormal group when the responses of the groups to each of 25 auditory structured categorization tasks were compared.

Time Comparisons

The data gathered concerning the normal and subnormal subjects in the present study also permitted comparisons of relationships between the correct responses and response delay mean time on both the visual and auditory structured tasks. Comparisons of relationships between the correct responses and the total mean task time on both the visual and auditory structured tasks were also made.

These data were analyzed in the following manner. First, a correlation was made on the visual structured tasks between the subnormal group's correct responses and the mean response delay time. The same correlation was carried out for the normal group, and then the correlations were changed to z scores and a comparison was possible between the normal and subnormal groups by using the statistics

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[5]Wilkinson, op. cit., p. 158.

as shown on page 49 of this chapter. Secondly, a correlation was made on the visual structured tasks between the subnormal group's correct responses and the mean total task time. The same correlation was carried out for the normal group, and then the correlations were changed to z scores and a comparison was possible between the normal and subnormal groups by using the statistic as shown on page 49 of this chapter. Thirdly, a correlation was made on the auditory structured tasks between the subnormal group's correct responses and the mean response delay time. The same correlation was carried out for the normal group, and then the correlations were changed to z scores and a comparison was possible between the normal and subnormal groups by using the statistic as shown on page 49 of this chapter. Finally, a correlation was made on the auditory structured tasks between the subnormal group's correct responses and the mean total task time. The same correlation was carried out for the normal group, and then the correlations were changed to z scores and a comparison was possible between the normal and subnormal groups by using the statistic as shown on page 49 of this chapter.

Correlation of the Correct Responses and the Mean Response Delay Times on the Visual Structured Tasks

In order to gain information concerning the relative speed with which a subject responds to a task and its relationship to one's correct responses, correlations were made between the correct responses and the mean response delay time for both groups, normal and subnormal. These data for the visual structured tasks are presented in Table 3.

The data in Table 3 reveal that normal subjects have a higher correlation between their correct responses and their mean response delay time than the subnormal subjects. In fact the subnormal subjects indicated that as the correct responses increased the mean response delay time decreased; consequently a negative correlation was indicated at -.114. The normal subjects had a positive correlation at the .375 level.

It is interesting to note the comparisons of the highest and lowest passes on an item by a normal, and a subnormal subject. The highest pass by a normal subject was 21 of a possible 25 with a mean response delay time of 3.5 seconds. The highest pass by a subnormal subject was 20 of a possible 25 with a mean response delay time of 1.4 seconds. This tends to indicate that the subnormal may conceptualize better if he were to inhibit his impulse to act quickly. The lowest pass by a normal subject was 10

TABLE 3

CORRELATION OF THE CORRECT RESPONSES AND THE MEAN RESPONSE DELAY TIMES ON THE VISUAL STRUCTURED TASKS

n=30	Normals		Subnormals	
	Correct Responses	Mean Time (Sec.'s) Response Delay	Correct Responses	Mean Time (sec.'s) Response Delay
	X	Y	X	Y
1.	21	3.5	09	4.5
2.	13	1.7	15	4.0
3.	15	2.0	13	1.1
4.	16	3.3	17	1.7
5.	10	1.4	14	2.8
6.	12	3.3	15	2.5
7.	16	2.5	15	3.0
8.	17	1.9	20	3.4
9.	14	2.0	17	5.1
10.	15	3.0	11	4.1
11.	14	2.1	13	4.5
12.	15	2.0	18	1.3
13.	17	3.6	12	3.1
14.	19	3.7	17	3.0
15.	15	2.1	12	2.6
16.	15	2.4	13	3.0
17.	18	2.8	16	1.5
18.	18	2.9	16	1.8
19.	17	1.5	15	3.5
20.	14	1.8	16	2.2
21.	15	1.7	17	2.7
22.	13	1.3	13	0.8
23.	18	3.1	11	2.5
24.	14	2.2	12	3.8
25.	13	1.8	18	3.3
26.	16	4.1	19	1.6
27.	19	2.2	13	2.5
28.	17	5.3	08	2.3
29.	13	3.3	16	3.7
30.	19	2.8	20	1.4
	468	77.3	441	83.3

ΣY	= 77.3	ΣY	= 83.3
ΣY^2	= 223.45	ΣY^2	= 265.97
ΣXY	= 1235	ΣXY	= 1213.60
ΣX	= 468	ΣX	= 441
ΣX^2	= 7474	ΣX^2	= 6749
r	= .375	r	= -.114

out of 25 with a mean response delay time of 1.4 seconds. The lowest pass by a subnormal subject was 8 out of 25 with a mean response delay time of 2.3 seconds. It is also interesting to note that the normal group attained 468 correct responses out of a possible 750 with a total mean response delay time of 77.3 seconds. The subnormal group attained 441 correct responses out of a possible 750 with a total mean response delay time of 83.3 seconds. This evidence tends to indicate that by inhibition of impulse to act quickly one can respond with more correct conceptual categories. Although, it must be noted as a paradox that the difference in total correct responses was in favor of the normal group by a small margin, 468 - 441 = 27; and the mean response delay time difference was in favor of the normal group also by a small margin, 77.3 - 83.3 = 6 seconds faster for the normal group.

Correlation of the Correst Responses and the Total Mean Task Times on the Visual Structured Tasks

In order to gain information concerning the relative speed with which a subject needs to complete a task and its relationship to his correct responses, correlations were run between the correct responses and the total mean task times for both the normal and subnormal groups. These data for the visual structured tasks are presented in Table 4.

The data in Table 4 reveal that normal subjects have a higher correlation between their correct responses and their total mean task times than the subnormal subjects. Neither correlation was far removed from 0, but the normal group indicated a somewhat higher correlation at .15 than did the subnormal group at .07.

Again it is interesting to note the comparisons of the highest and lowest passes on an item by a normal, and a subnormal subject. The highest pass by a normal subject was 21 of a possible 25 with a total mean task time of 10.8 seconds. The highest pass by a subnormal subject was 20 of a possible 25 with a total mean task time of 6.8 seconds. The lowest pass by a normal subject was 10 of a possible 25 with a total mean task time of 5.0 seconds. The lowest pass by a subnormal subject was 8 of a possible 25 with a total mean task time of 8.4 seconds. The use of these isolated examples does not tend to indicate any pattern of behavior, so far as time is concerned, for completing a task correctly.

It is also interesting to note that the normal subject requiring the longest total mean time, 17.5 seconds, attained 17 correct responses of a possible 25. The subnormal subject requiring the longest total mean time, 19.5 seconds, only attained 13 correct responses of a possible 25. But, again paradoxically, one must note that the normal subject requiring the shortest total mean time, 4.7 seconds, attained 13 correct responses of a possible 25, while the subnormal subject requiring the shortest total

TABLE 4

CORRELATION OF THE CORRECT RESPONSES AND THE MEAN TOTAL TASK TIMES ON THE VISUAL STRUCTURED TASKS

n=30	Normals		Subnormals	
	Correct Responses	Mean Total Task Time (sec.'s)	Correct Responses	Mean Total Task Time (sec.'s)
	X	Y	X	Y
1.	21	10.8	09	15.6
2.	13	4.7	15	10.6
3.	15	8.1	13	5.3
4.	16	9.4	17	12.0
5.	10	5.0	14	6.3
6.	12	9.9	15	10.2
7.	16	8.1	15	8.6
8.	17	9.7	20	12.1
9.	14	7.6	17	9.7
10.	15	13.0	11	14.3
11.	14	9.1	13	13.5
12.	15	7.0	18	18.4
13.	17	13.0	12	5.8
14.	19	14.7	17	9.8
15.	15	8.4	12	9.3
16.	15	7.8	13	19.5
17.	18	12.3	16	8.5
18.	18	8.7	16	6.0
19.	17	6.5	15	13.1
20.	14	8.7	16	9.8
21.	15	6.4	17	9.8
22.	13	4.9	13	3.4
23.	18	8.3	11	9.7
24.	14	8.9	12	17.7
25.	13	6.8	18	16.5
26.	16	12.5	19	5.3
27.	19	10.2	13	11.7
28.	17	17.5	08	8.4
29.	13	13.3	16	11.1
30.	19	11.0	20	6.8
	468	283.1	441	318.8

$\Sigma Y = 283.1$	$\Sigma Y = 318.8$
$\Sigma Y^2 = 2940.57$	$\Sigma Y^2 = 3875.84$
$\Sigma XY = 4519.4$	$\Sigma XY = 4660.5$
$\Sigma X = 468$	$\Sigma X = 441$
$\Sigma X^2 = 7474$	$\Sigma X^2 = 6749$
$r = .15$	$r = .072$

mean time, 3.4 seconds, also attained 13 correct responses of a possible 25.

The normal group attained a mean of 15.6 correct responses with a mean of 9.4 seconds per response. The subnormal group attained a mean of 14.5 correct responses with a mean of 10.6 seconds per response. This information indicates that the subnormal subjects require more time to correctly respond on a comparable level with normal subjects.

Correlation of the Correct Responses and the Mean Response Delay Times on the Auditory Structured Tasks

In order to gain information concerning the relative speed with which a subject reacts to a task and its relationship to his correct responses and the mean response delay times for both groups, normal and subnormal. These data for the auditory structured tasks are presented in Table 5.

The data in Table 5 reveal that the normal and subnormal groups both have a minus correlation between their correct responses and their mean response delay times. This evidence tends to indicate that as the correct responses increased the response delay times decreased. This evidence may be significant, if in fact, one really could achieve more correct responses as he decreased his response delay time, but the evidence appears to be inconclusive at this time. The correlations as presented on Table 5 indicate that the normal group had a correlation

TABLE 5

CORRELATION OF THE CORRECT RESPONSES AND THE MEAN RESPONSE DELAY TIMES ON THE AUDITORY STRUCTURED TASKS

n=30	Normals		Subnormals	
	Correct Responses	Mean Time (sec.'s) Response Delay	Correct Responses	Mean Time (sec.'s) Response Delay
	X	Y	X	Y
1.	24	1.1	19	2.1
2.	24	1.0	20	1.9
3.	23	0.7	20	1.0
4.	24	1.2	19	1.9
5.	16	0.8	22	0.9
6.	21	1.7	23	1.3
7.	22	1.4	19	1.3
8.	18	0.8	23	0.8
9.	21	1.0	22	1.1
10.	22	1.7	22	1.7
11.	22	1.3	23	2.0
12.	24	1.2	23	1.6
13.	25	0.9	21	0.9
14.	22	1.5	23	1.5
15.	24	0.8	20	1.6
16.	24	0.9	23	1.7
17.	23	1.1	22	1.2
18.	22	1.0	23	1.2
19.	20	0.8	20	2.5
20.	24	1.9	19	1.8
21.	19	1.0	19	1.5
22.	19	1.0	20	0.7
23.	22	1.0	18	1.8
24.	24	0.8	22	2.5
25.	21	1.4	22	2.2
26.	20	1.8	22	1.6
27.	20	1.2	21	0.9
28.	19	2.2	20	1.4
29.	19	1.6	20	1.9
30.	22	0.9	23	0.9
	650	35.7	633	45.4
	$\Sigma Y = 35.7$		$\Sigma Y = 45.4$	
	$\Sigma Y^2 = 467.5$		$\Sigma Y^2 = 75.82$	
	$\Sigma XY = 770.6$		$\Sigma XY = 953$	
	$\Sigma X = 650$		$\Sigma X = 633$	
	$\Sigma X^2 = 14226$		$\Sigma X^2 = 13431$	
	$r = -.01$		$r = -.22$	

of -.01. The subnormal group's correlation was -.22, which is substantially further from zero than the -.01 recorded by the normal group.

It is interesting to note the comparisons of the highest and lowest passes on an item by a normal, and a subnormal subject. The highest pass by a normal subject was 25 of a possible 25 with a mean response delay time of 0.9 seconds. The highest pass by a subnormal subject was 23 of a possible 25 with a mean response delay time of 0.8 seconds; conversely this information appears to be misleading because eight subnormal subjects attained passes with mean response delay times ranging from 0.8 seconds to 2.0 seconds. The lowest pass by a normal subject was 16 of a possible 25 with a mean response delay time of 0.8 seconds. The lowest pass by a subnormal subject was 18 of a possible 25 with a mean response delay time of 1.8 seconds. The range of correct responses for the normal subjects was 16 to 25. The range of correct responses for the subnormal subjects was 18 to 23.

The difference in total correct answers between the normal group and the subnormal group is quite small. From a possible 750 correct responses the normal group attained a total of 650 and the subnormal group attained a total of 633; therefore the total difference between the groups is only 17 in favor of the normal group. The normal group required 35.7 seconds total mean response delay time and the subnormal group required 45.4 seconds total mean response

delay time. This difference of 9.7 seconds faster in favor of the normal group appears to be somewhat more significant than does the comparison of the total correct responses. A comparison of the correlations will be made later in this chapter.

The shortest response delay mean time of a normal subject was 0.7 seconds with 23 correct responses of a possible 25. The shortest response delay mean time of a subnormal subject was 0.7 seconds with 20 correct responses of a possible 25. The longest response delay mean time for a normal subject was 2.2 seconds with 19 correct responses of a possible 25. The longest response delay mean time for a subnormal subject was 2.5 seconds with 22 correct responses of a possible 25. This evidence tends to indicate that a longer response delay for the subnormal subjects is conducive for more correct responses, but for the normal subjects the longer response delay appears conversely.

Correlation of the Correct Responses and the Total Mean Task Times on the Auditory Structured Tasks

In order to gain information concerning the relative speed with which a subject needs to complete a task and its relationship to his correct responses, correlations were run between the correct responses and the total mean task times for both the normal and subnormal groups. These data for the auditory structured tasks are presented in Table 6.

TABLE 6

CORRELATION OF THE CORRECT RESPONSES AND THE MEAN TOTAL TASK TIMES ON THE AUDITORY STRUCTURED TASKS

n=30	Normals		Subnormals	
	Correct Responses	Mean Total Task Time (sec.'s)	Correct Responses	Mean Total Task Time (sec.s)
	X	Y	X	Y
1.	24	4.7	19	7.4
2.	24	3.9	20	7.3
3.	23	4.5	20	7.0
4.	24	5.2	19	9.2
5.	16	3.3	22	4.3
6.	21	6.3	23	5.3
7.	22	5.0	19	5.3
8.	18	3.9	23	4.6
9.	21	3.8	22	4.3
10.	22	5.6	22	6.8
11.	22	5.1	23	7.0
12.	24	4.8	23	6.7
13.	25	4.5	21	4.6
14.	22	6.0	23	6.1
15.	24	4.0	20	5.1
16.	24	3.2	23	6.6
17.	23	5.5	22	7.4
18.	22	3.5	23	4.4
19.	20	4.5	20	9.0
20.	24	5.7	19	5.5
21.	19	3.9	19	6.5
22.	19	3.6	20	3.4
23.	22	4.2	18	6.6
24.	24	3.9	22	6.9
25.	21	6.4	22	8.0
26.	20	5.6	22	5.1
27.	20	5.9	21	4.2
28.	19	6.5	20	5.7
29.	19	6.3	20	5.0
30.	22	5.2	23	4.3
	650	144.5	633	179.6
	$\Sigma Y = 144.5$		$\Sigma Y = 179.6$	
	$\Sigma Y^2 = 725.09$		$\Sigma Y^2 = 1138.06$	
	$\Sigma XY = 3128.5$		$\Sigma XY = 3774.30$	
	$\Sigma X = 650$		$\Sigma X = 633$	
	$\Sigma X^2 = 14226$		$\Sigma X^2 = 13431$	
	$r = -.04$		$r = -.22$	

The data in Table 6 reveal that the normal and subnormal groups both have a minus correlation between their correct responses and their total mean task time. The correlations as presented on Table 6 indicate that the normal group had a correlation of -.04. The subnormal group had a correlation of -.22, which is substantially further from zero than the -.04 recorded by the normal group. A comparison of the correlations will be made later in this chapter.

It is interesting to note the comparisons of the highest and lowest passes on an item by a normal, and a subnormal subject. The highest pass by a normal subject was 25 of a possible 25 with a total mean task time of 4.5 seconds. The highest pass by a subnormal subject was 23 of a possible 25 with a total mean task time of 4.3 seconds. This information is again misleading because eight subnormal subjects attained 23 correct responses with a total mean task time ranging from 4.3 seconds to 7.0 seconds. The lowest pass by a normal subject was 16 of a possible 25 with a total mean task time of 3.3 seconds. The lowest pass by a subnormal subject was 18 of a possible 25 with a total mean task time of 6.6 seconds.

It is also interesting to note that the normal subject requiring the longest total mean task time, 6.5 seconds, attained 19 correct responses of a possible 25. The subnormal subject requiring the longest total mean task time, 9.2 seconds, also attained 19 correct responses of a possible 25. This information tends to indicate that the

subnormal subject requires more time to correctly complete a task. The normal subject requiring the shortest total mean task time, 3.2 seconds, attained 24 correct responses of a possible 25. The subnormal subject requiring the shortest total mean task time, 3.4 seconds, attained 20 correct responses of a possible 25. Again this information tends to indicate that the subnormal subject requires more time to correctly complete a task.

In summary, the correct responses correlated with the mean total task times indicate that the normal group attained more correct responses in a shorter total mean task time than the subnormal group. The normal group attained a mean of 21.7 correct responses with a mean of 4.8 seconds per response. The subnormal group attained a mean of 21.1 correct responses with a mean total task time of 6.0 seconds per response. This information indicates that the subnormal subjects require more time to correctly respond comparatively with normal subjects.

Comparison of Correlations of Correct Responses and Response Delay Mean Times on the Visual Structured Tasks

In order to gain information concerning the differences between performances of the normal group and subnormal group it was necessary to compare the correlations by converting them to z scores. These data are presented in Table 7.

The data in Table 7 reveal that there is no significant difference between the correlations of the normal group and the subnormal group. The correlation of the normal group was not significantly different from the correlation of the subnormal group when tested at the 0.05 level of confidence. To be significantly different, the critical ratio (or Z) would have to be at or beyond 1.96. The Z on Table 7 indicates 1.90, which nearly reaches the critical level.

TABLE 7

CORRELATIONS OF CORRECT RESPONSES AND RESPONSE DELAY MEAN TIMES ON THE VISUAL STRUCTURED TASKS TRANSFORMED TO FISHER'S Z

Normals		Subnormals
r = .375		r = -.114
z = .400	CR or Z = 1.90	z = -.110

*Significant at the 0.05 level.

Thus, on the basis of the above data, the third null hypothesis was accepted. The correlation of the normal group was not significantly different from the correlation of the subnormal group when the correlations were compared.

Comparison of Correlations of Correct Responses and Total Mean Task Times on the Visual Structured Tasks

In order to gain information concerning the differences between total task mean times of the normal group and the subnormal group it was necessary to compare the correlations by converting them to z scores. These data are presented in Table 8.

The data in Table 8 reveal that the correlation of the normal group was not significantly different from the correlation of the subnormal group when tested at the .05 level of confidence. The critical ratio was computed at .812 which does not reach the .05 level of confidence at 1.96.

TABLE 8

CORRELATIONS OF CORRECT RESPONSES AND TOTAL MEAN TASK TIMES ON THE VISUAL STRUCTURED TASKS TRANSFORMED TO FISHER'S Z

Normals		Subnormals
r = .15		r = -.072
z = .151	CR or Z = .812	z = -.07

*Significant at the 0.05 level.

Thus, on the basis of the above data, the fourth null hypothesis was accepted. The correlation of the normal group was not significantly different from the correlation

of the subnormal group when the correlations were compared.

Comparison of Correlations of Correct Responses and Response Delay Mean Times on the Auditory Structured Tasks

In order to gain information concerning the differences between the response delay mean times of the normal group and the subnormal group, it was necessary to compare the correlations by converting them to z scores. These data are presented in Table 9.

The data in Table 9 reveal that there is no significant difference between the correlations of the normal group and the subnormal group when tested at the .05 level of confidence. The critical ratio was computed to be .784 which does not reach the .05 level of confidence at 1.96.

TABLE 9

CORRELATIONS OF CORRECT RESPONSES AND RESPONSE DELAY MEAN TIMES ON THE AUDITORY STRUCTURED TASKS TRANSFORMED TO FISHER'S Z

Normals		Subnormals
r = -.01		r = -.22
z = -.01	CR or Z = .784	z = -.224

*Significant at the 0.05 level.

Thus, on the basis of the above data, the fifth null hypothesis was accepted. The correlation of the normal

group was not significantly different from the correlation of the subnormal group when the correlations were compared.

Comparison of Correlations of Correct Responses and Total Mean Task Times on the Auditory Structured Tasks

In order to gain information concerning the differences between the total mean task times of the normal group and the subnormal group it was necessary to compare the correlations by converting them to z scores. These data are presented in Table 10.

The data in Table 10 reveal that there is no significant difference between the correlations of the normal group and the subnormal group when tested at the .05 level of confidence. The critical ratio was computed to be .672 which does not reach the .05 level of confidence at 1.96.

TABLE 10

CORRELATIONS OF CORRECT RESPONSES AND TOTAL MEAN TASK TIMES ON THE AUDITORY STRUCTURED TASKS TRANSFORMED TO FISHER'S Z

Normals		Subnormals
r = -.04		r = -.22
z = -.04	CR or Z = .672	z = -.224

*Significant at the 0.05 level.

Thus, on the basis of the above data, the sixth null hypothesis was accepted. The correlation of the normal

group was not significantly different from the correlation of the subnormal group when the correlations were compared.

The present chapter has presented data resulting from an experiment with normal and subnormal subjects concerning their categorization abilities. The following chapter discusses the conclusions and recommendations based upon these findings.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of the present study was to investigate some of the fundamental dimensions of simplicity and complexity of thinking in normal and subnormal children, and to investigate whether the affect of inhibition upon the impulse to respond indicated any relationship to one's ability to perform correctly on a categorization task. This information was revealed through the performance of the subjects on tasks which required their finding examples of categories by using visual structured cues and by their finding examples of categories with the aid of auditory structured cues. It was initially proposed that such studies as the present investigation are needed in order to determine the reliability of the traditional assumptions concerning the alleged simplicity of thinking patterns employed by subnormal subjects. Even though these assumptions appear to be quite common among both lay people and professional people, there have been few studies that provide conclusive evidence regarding the relationship of conceptual categorization, total time needed for individual tasks, and inhibition with one's ability to function intellectively.

In order to determine whether or not there was a significant difference between normal and subnormal children in their abilities to employ categories, and to determine whether or note the variables of impulse delay and the variables of total task time had any significant affect upon their abilities, a test that was devised by Stephens (1963) was used. This test was used in its original context and with modifications that were made by the examiner. This test and modification, thereof, enabled the examiner to gather information concerning the subjects' ability to employ categories in a visual structured situation and in an auditory structured situation. The examiner, also, was able to measure the response delay time and the total task time for each item pursued by each subject.

Two groups of subjects were compared in the present study. All subjects were boys from the same school system and were representative of families in the lower-middle to middle-lower socio-economic level. Each group consisted of 30 boys with a chronological age from 9 years to 11 years 2 months. The subnormal group had intelligence test scores ranging from 54 to 88. The normal group had intelligence test scores ranging from 92 to 115. No boys were used who evidenced observable emotional or physical handicaps.

Six hypotheses were tested. The hypothesis that there is no statistically significant difference between correct responses attained by the normal group and the correct responses attained by the subnormal group when the

responses of the groups to each of 25 visual structured categorization tasks are compared was accepted. Comparisons were possible between the two groups in 25 of the 25 categories tested, and significant differences in favor of the normal subjects were recorded on only two categories at the 0.05 level. The probability of this number occurring because of chance alone is .3576. Therefore, the probability that chance may be operating indicated that there was no significant difference between the groups, and the first null hypothesis was accepted.

The comparison of the abilities of the two groups to select appropriate categories on visual structured tasks indicated that subnormal subjects were not significantly less able than normal subjects to perform adequately unless total time allowed for the task became a factor. Stephen's study (1963) indicated that the subnormal subjects were less able to perform than normal subjects on independent use of categories; therefore the evidence tends to indicate that the subnormal subject's experiential framework lies within a narrow range unless he becomes activated to comprehend better through visual stimuli. Apparently the normal student has better independently operating conceptualization abilities which hence are not dependent upon additional stimuli. The subnormal subject has a narrow range for independent conceptualization, but his organization is enhanced greatly by having the aid of visual stimuli.

Hypothesis two, that there is no statistically sig-

nificant difference between the correct responses attained by the normal group and the correct responses attained by the subnormal group when the responses of the groups to each of 25 auditory structured categorization tasks are compared was also accepted. Comparisons were possible between the two groups in 25 of the 25 categories tested, and no significant differences in favor of the normal subjects were recorded at the 0.05 level.

The comparison of the abilities of the two groups to select appropriate categories on auditory structured tasks indicated that subnormal subjects again were not significantly less able than normal subjects to perform adequately unless total time allowed for the task became a factor. Stephen's study (1963) indicated that the subnormal subjects were less able to perform than normal subjects on auditory structured use of categories; but the difference again points to the subnormal subjects' inabilities to independently use categories. After the subnormal subjects had benefit of the visual cues on the first test they apparently became somewhat equated with the normal group. The raw scores and the total mean scores for the two groups (as shown in Chapter IV) again indicated that the major difference in the normal and subnormal groups is the total time needed to complete the task. Therefore, the evidence appears to indicate that the subnormal student can nearly conceptualize as well as the normal student, but his application is slower.

Hypothesis three, that there is no significant difference between the correlations of correct responses and

mean response delay times for the subnormal group and the normal group on visual structured tasks was sustained. Comparison was possible between the two groups after the correlation values were changed to z values and tested at the 0.05 level. The z value was 1.90, but to be significant at the 0.05 level it would have to reach 1.96.

Comparison of the correlations of the two groups indicated that there was no consistent graduation of response delay time with graduation of correct responses. The ranges of correct responses were somewhat limited (Table 3); therefore one may assume that had the range of scores been deeper, the correlation would have been significantly further from zero. The data reveal that response delay time had no particular affect upon the total performance. This information appears to be in agreement with Beck's studies cited in Chapter I.

Hypothesis four, that there is no significant difference between the correlations of correct responses and total mean task times for the subnormal group and the normal group on visual structured tasks was sustained. Comparison was possible between the two groups after the correlation values were changed to z values and tested at the 0.05 level.

Comparison of the correlations of the two groups indicated that there was no significant difference between their number of correct responses and total mean task times. A high plus correlation should indicate that as the number of correct responses get higher, the time needed to complete the task would rise. Apparently the range of scores

was too shallow, or the tasks which required little total time were too easy. The only difference noted from Table 4 was that to get an equal number of correct responses, the subnormal group required more time.

Hypothesis five, that there is no significant difference between the correlations of correct responses and mean response delay times for the subnormal group and the normal group on auditory structured tasks was sustained. Comparison was possible between the two groups after the correlation values were changed to z values and tested at the 0.05 level.

Comparison of the correlations of the two groups indicated that there was no increase in response delay time as the correct responses increased. Consequently the inhibition of response delay time appears to have no affect upon one's ability to perform a task correctly. This evidence appears to be in agreement with Beck's studies cited in Chapter I.

Hypothesis six, that there is no significant difference between the correlations of correct responses and total mean task times for the subnormal group and the normal group on auditory structured tasks was sustained. Comparison was possible between the two groups after the correlation values were changed to z values and tested at the 0.05 level.

Comparison of the correlations of the two groups indicated that there was no significant difference between their number of correct responses and their total mean task times. The normal group did attain more correct responses in less total mean time (Table 6) than did the subnormal

group, but there is no significant difference in the correlations of the two groups. Again the evidence tends to support the assumption that the subnormal subjects conceptualize somewhat slower than normal subjects, consequently they require a greater length of time to complete a task.

One conclusion drawn from the present study is that when normal subjects and subnormal subjects are faced with an equated task it is essential that the subnormal subjects have more total time to complete the task. Too many times the simplicity of a task in the classrooms of our schools is determined by a "mature, well-educated adult," consequently the subnormal, and even normal, subjects are faced with a task that is difficult for them and with insufficient time to perform adequately. Therefore, the subnormal child falls into a poorly functioning pattern, and soon learns that he cannot learn.

Another conclusion drawn from this study is that the effect of visual stimuli must be of far more value to the subnormal child than to the normal child. Visual stimuli appear to open the door for the subnormal child so he can reach back into his experiential framework and broaden his range of conceptual categories. This apparently is not of equal value to the normal child because he already has a wider range into which he can fit his experiences.

Another conclusion drawn from the present study is that inhibition of response delay does not have a relative effect upon one's ability to perform correctly on a task. This evidence appears to be in agreement with previous stud-

ies concerning the differences in response delay. Previous studies have also shown that there is no particular difference in response delay time of healthy adults, children, schizophrenics, or feebleminded. This study has shown that this holds true, also, when responding to conceptual categorization tasks.

The extreme variations in response delay times appear to indicate that those subjects who respond quickly, without benefit of concept formation; and those subjects who respond slowly, without integrating experiential background, should have greater chance for error in forming concepts. Information, relative to correct answers and response delay time, leads one to assume that as the correct responses increase the response delay time should also increase; but the present experiment has shown that response delay time has relatively little effect upon the choice of correct responses for either normal or subnormal subjects. Therefore the conclusion must be drawn that experiential background and external stimuli have more effect upon an individual's conceptual categorization ability than does inhibition of response delay time. In summary, the data in the present study appear to indicate that fast or slow response delay time is not the causation of conceptualization errors; but instead, correct conceptualization depends upon the subject's experiential framework to which he can associate and integrate new stimuli.

Further investigation of the dimensions of categorization abilities in normal and subnormal children is required

before the results of the present study can be fully evaluated. The paradoxical difference in the present study and the study made by Stephens (1963) indicates that further modification of a categorization test instrument is needed to gain information concerning all aspects of one's conceptual abilities, time needed to form concepts, and the affect of response delay upon the forming of concepts. It also would be of value to extend the present study's procedure to include a group of subjects in a higher chronological age range. Studies are also needed which will explore the sex differences in the ability to form conceptual categories. Finally, it appears to be quite essential to have a study which would compare the results of two subnormal groups from socio-economic levels that are somewhat different.

If further investigation does confirm the conclusions drawn from this study and other similar studies, a substantial step in the understanding of the differences between normal subjects and subnormal subjects will have been made.

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APPENDIX 1

TABLE 11

Name_____ Visual Acuity_____ Results: No. Correct % Correct

School_____ Color Vision_____ Pictured _____ _____

Date_____ Hearing_____ Named _____ _____

I.Q._____ C.A._____ Total _____ _____

Category No.	Pictured Task	Response Delay	Total Time	Category No.	Named Task	Response Delay	Total 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			
25				25			
Total				Total			
Mean Time				Mean Time			

APPENDIX 2

TABLE 12

PROBABILITY OF OBTAINING n OR MORE SIGNIFICANT STATISTICS BY CHANCE IN A GROUP OF N AS USED IN THE PRESENT STUDY

n	1	2	3	4	5	6	7
N							
12	.4596	.1184	.0196	.0022	.0002		
13	.4867	.1354	.0245	.0031	.0003		
15	.5367	.1709	.0362	.0055	.0006	.0001	
23	.6926	.3206	.1052	.0258	.0049	.0008	.0001
24	.7080	.3392	.1159	.0298	.0060	.0010	.0001
25	.7226	.3576	.1272	.0341	.0072	.0012	.0002

[1]Bryan Wilkinson, "A Statistical Consideration in Psychological Research," Psychological Bulletin, XLVIII (1951), 158.