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THE PERFORMANCE OF YOUNG CHILDREN
IN A CLASSIFICATION TASK

by

Frances Virginia Rau

A Thesis Submitted in Partial Fulfillment of
the Requirements for the Degree of

Master of Arts

in

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VITA

Chicago Normal School, Elementary Teacher's Certificate, 1922.

Ph.B., Loyola University, June, 1938.

Adjustment Teacher, Chicago Public Schools.

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CHAPTER I

INTRODUCTION

The present study has grown out of a desire to explore the manifestation of universal and abstract ideas by young children in a classification task with concrete objects. The materials used were forty-eight kindergarten beads of four different colors and three different shapes, selected with a view to studying a more or less spontaneous functioning of these higher mental processes. Twenty-three subjects were selected, ranging from kindergarten through grade 3B.

The purpose of this study is not to try to prove the existence of universal and abstract ideas, these being taken for granted, but rather to observe the degree of functional maturity of such concepts as evidenced in the handling of simple materials at the level of the child's mind. As Heidbreder says,

. . . it is, in fact, a point to be observed in experimental studies of thinking, generally, that certain situations can be counted on to produce the thought response in human beings. This fact rarely receives comment, possibly because it seems too obvious to mention. But it is none the less significant that there are certain situations which, as a rule, arouse the activities generally known as thinking, just as there are others which in most cases elicit the responses commonly classified as reflex, emotional, instinctive, and habitual behavior. (12:543)

One of the higher mental processes in which we are particularly in-

terested, and one which is directly concerned in the formation of universal and abstract ideas is that of attention which may be viewed from two different aspects. First there is sustained attention or the ability to keep attention focussed on the task at hand until it has been completed, attention being taken as "the special application of intellectual energy to any object." (18:347) Into this field enters the factor of distractibility, for, as Gruender points out, voluntary attention is difficult to sustain as there are so many things to claim attention which appeal to our natural tendencies and which tend to act as distractions. But "we know that by an effort we are capable of 'sustained attention to one and the same object.'" (8:231) This does not mean that we are able to fix our attention on one particular phase of an object for any considerable length of time, for our attention is constantly shifting. Gruender states it very clearly:

If we get interested in anything, it will grow and develop in our mind, and thus it will hold our attention. When this takes place, a great multitude of thoughts pass through our mind, each with its own object. But these objects are all phases of one and the same topic. Though thus the direction of our attention is continually changing, we call it "sustained" attention as long as we revolve the same topic in our mind. However, as soon as our interest in the topic flags, it ceases to develop and drops out of our mind: we pass to something irrelevant and are "distracted." (8:231) . . . [but] once we have launched ourselves on a definite topic with a deliberate effort, we are carried along by the stream of thought it provokes. (8:232)

From the above we see that interest in the task is an important factor and makes "voluntary attention easier and sustained attention possible."

(8:232) From this we would be led to expect that, because of individual

differences, some subjects would be able to apply themselves to the task in hand until it was carried through to completion particularly if they found the task interesting, while others would be distracted by the slightest extraneous occurrence and would have to be reminded to return to the unfinished task, while still others might steer a middle course, bestowing a moment's attention upon some trifling distraction and then returning unbidden to the task.

Another aspect of this factor of attention leads us directly to one of the processes in which we are particularly interested and that is the process of abstraction, for abstraction, according to Gruender, "is a special form of the familiar fact of attention." (8:310) He goes on to say that the process of abstraction is but a special form of attention in which one feature of an object is singled out for the focus of attention while the others are relegated to the background. That which is under the focus of attention is positively abstracted or isolated; those relegated to the background are negatively abstracted. We speak of abstraction only when we separate (or dissociate) by means of attention things which prior to attention are not separated from each other, for example, in this experiment, the shape or color of a bead.

The result of the process of abstraction is the universal idea, which is "that conscious process by which we become aware of what is common to several individuals and can be predicated of these individuals singly and in exactly the same sense." (8:311) For example, in this study, the subject who groups all four red cubes together is aware that the concept of

red cube can be applied to more than one object and therefore, by grouping them, manifests the use of a universal idea. "All other characteristics by which this object differs from other objects, recede into the background of consciousness." (8:311)

LaHer likewise maintains that there are truly universal concepts, that there is a real objective foundation for our Scholastic doctrine in regard to universal concepts "in the perfectly similar natures of the members of the same class." (18:249) Thus it is obvious that in classifying we make use of universal concepts.

Although, according to Gruender, we do not always go through a process of generalizing abstraction, but merely recall what we have retained, we do go through the process of generalizing abstraction "when the nature of the task before us demands it . . . as for instance, when we are confronted with a problem of classification." (8:318) Success in this particular task, then, being as it is a classification problem, calls for the exercise of generalizing abstraction and the formation of universal ideas.

A perfect performance, however, in this task, depends not only upon the formation of universal ideas but of abstract ideas as well. In using the terms universal and abstract ideas which are frequently confused, we are, in this study, taking them in the strictest Scholastic sense, universal concepts being understood, as mentioned before, as the result of generalizing abstraction in which "we focus our attention on some characteristic of an individual which it has in common with other individuals and we

thus separate it from the individual differences." (8:314) On the other hand "the abstract idea is the result of isolating abstraction which may be described as that mode of attention by which we focus it on any characteristic and separate it from the subject which has that characteristic. Of course we know full well that that characteristic does not exist separated, but we represent it as if it were. Thus the idea of man is universal, the idea of humanity is not only universal but also abstract." (8:314) Similarly the idea of a red cube is universal whereas the idea of redness or cubeness is both universal and abstract. The mental notion of a quality considered as if detached from any specific object is an abstract idea.

In this study the use of abstract ideas is manifested as well in the multiple relationships between groups of beads of similar shapes and groups of similar colors, and in the relationship between the total number of beads and the number of little boxes. The subject who arranged the box as a whole with each little homogeneous unit of four beads in a logical relationship to each of the other eleven units, manifested the use of abstract ideas in isolating the concept of redness or greenness or cubeness or sphericity and in perceiving their multiple relationships in his crossbar arrangement. A still higher degree of the manifestation of abstract ideas is indicated in the more intricate perception of relationship as manifested in the gradation from sphere with its complete roundness to cylinder with its partial roundness to cube with no roundness at all.

Even such a simple performance task as this appears to be involves considerable complexity of thinking, for, according to Karl Buehler, as

cited by Moore, "The solution of a task is not accomplished by a single series of concepts. Between concepts there goes on a great deal of thinking--the consciousness of the task to be performed--the relation of the given concepts to others and to the task. The general consciousness of manifold relationships constitutes a kind of setting or background in which special concepts appear." (20:103) And the perception of manifold relationships involves the use of abstract concepts.

Thus we see that any attempt at all at classification would be a manifestation of the use of universal concepts, and a higher degree of classification involving the perception of relationships would be a manifestation of the use of abstract concepts.

CHAPTER II

A REVIEW OF THE RELATED LITERATURE

There have been various other experiments, which, although differing from this study in many respects, have seemed to contain the same fundamental purpose, a study of the thought processes manifested by child subjects in particular in the performance of some task or problem. Among such experiments we find the work of Crudden which involved the abstraction of simple, learned geometrical figures "embedded in relatively unknown geometrical figures of varying degrees of complexity," (6:504) the subjects consisting of sixty-five children ranging in age from five years five months to six years six months.

This experiment is similar to the present study in its use of form abstraction, involving, as it appears to, the use of universal and abstract concepts. There are various differences in methods as well as materials. In one respect Crudden's experiment is less complex in that it involves the abstraction of form alone, while this study involves the abstraction of both form and color. The problem of abstraction of form has been attacked from a different angle in the two experiments, in Crudden's experiment the problem being the abstraction of a simple learned form from a more complex one, the present study involving the implicit abstraction of form as manifested in a classification task. Abstraction of form in Crudden's experiment is explicit, the subject's attention being definitely directed to this end; abstraction of form in this study being implicit, the directions being

indefinite enough so that such abstraction of form as is manifested comes as a more or less spontaneous tendency to classify. Furthermore, analysis is predominant in Crudden's work, involving the analysis of a complex form to find one of its elements, while, although analysis is also present in this study, synthesis is likewise prominent, involving as it does the putting together of the abstract concepts of form into a related whole. Both analysis and synthesis, however, are components of discrimination and judgment which constitute a part of abstract thinking. "Discrimination involves analysis, the splitting up of the perceived object into its constituent elements; whilst the very process of separation pre-supposes an intuitive synthetic grasp of the object as a whole in the original conception, which is now realized with greater distinctness." (18:298-299)

In both experiments a successful performance would seem to depend upon the use of universal and abstract concepts for, while Crudden describes his study as an abstraction of form and reports that successful abstraction was found to be based on a recognition of the general shape or certain characteristic part or parts of the figure to be abstracted, this seems to imply the Scholastic notion of generalizing abstraction and isolating abstraction. Thus in Crudden's problem the essential feature of a square, for example, must be apprehended to apply to all squares so that that figure will be recognized as such when embedded in a more complex geometrical figure, while in the present study the essential features of a red cube, for example, must be generalized sufficiently so as to be applied to all objects of this class. Furthermore, in Crudden's, the abstract concept of squareness or of

the right angle are essential to the recognition of the simple form as embedded in the more complex, while in this study a successful performance depends upon the abstraction of such concepts as redness, cubeness, etc., with their interrelationship in the making of a pattern. Thus, although manifested in different ways, for a successful performance both experiments seem to depend essentially upon the use of universal and abstract concepts.

Another experiment that seems to contain a fundamental similarity to the present study is that of Heidbreder, (12) the purpose of whose experiment was to study the reasons reported by children and adults while solving problems and to record similarities and differences in behavior in a problematical situation as objectively similar as possible.

In Heidbreder's study, there were three groups of ten subjects each ranging in age from two and one-half to ten years, and an adult group of ten subjects. There were various problems presented, but all essentially the same, namely, to find in which of two boxes, arranged in a particular manner, a doll was placed in the case of the two younger groups, and with the older groups which box contained cotton. Sometimes the clue was the position of the box and other times it was the design on the cover. A particular arrangement was repeated until the subject achieved five successive correct responses, then another was presented until the subject again achieved five successive correct responses. Then the two arrangements were presented in random order until there were ten successive correct responses. Some such question as, "Why did you take that one?" was asked. It was found that giving reasons was more readily elicited from adults and children over five

years of age.

The outstanding difference between Heidbreder's study and this one lies in the fact that her data was based upon both the objective performance and the introspective reports of her subjects while ours is based upon an analysis of the performance alone. Furthermore, her problem was more concerned with the comparison of children of various age groups and adults, while ours was a study of the performance of children falling within a certain age group. In both studies universal and abstract concepts seem to be involved. In Heidbreder's study, generalizing abstraction or the formation of universal concepts is an integral part of a correct response, for the subject cannot achieve five successive correct responses until he has generalized sufficiently to recognize the fact that the flowered box, for example, no matter in what position, always contains the doll. Or, as in another problem, that the right hand box, regardless of its being closer to the subject or farther away, always contains the doll. Abstract concepts appear also to be definitely involved in a successful performance, for the perception of the relationship between the pattern on the box and its contents, or the position of the box and its contents is essential for a correct response. This problem as well as the previous one described involves more of the analytical element than does the present study, for in Heidbreder's experiment the situation is to be analyzed to discover a certain relationship, while in our problem the relationship is to be built up or synthesized by the subject. However, there is an essential similarity between Heidbreder's experiment and the present study in that success in both appears to depend upon the use

of universal and abstract concepts.

Another experiment containing a certain fundamental similarity to the present study is that of Louis Long whose aim was to discover "how and when a child recognized that certain characteristics of objects of the genus group are similar to those possessed by familiar species; to discover by what process the delimitation of the species name takes place; and to study the course of development of further hierarchies, their flexibility and their range." (17:550)

The subjects consisted of fifteen children ranging in age from two to six years. Stimuli of three types were provided:

a. spherical objects b. cylindrical objects c. two-dimensional figures. As a result of the experiment, twelve subjects established a concept of spherical roundness; in ten of these the concept was broad enough to include cylindrical as well as spherical objects; transfer was found to be greatest from spherical to circular of two-dimensional figures and transfer least from spherical to rounder of two-dimensional figures.

The method employed in Long's experiment differed from that in the present study, but the aims show a striking similarity. It is evident that Long sought implicitly to study children's power of generalization and abstraction as based on the formation of genus-species concepts, while ours was to seek evidence of generalization and abstraction as based upon children's tendency to classify. The manifestation of universal and abstract concepts is involved in both.

The formation of genus concepts based upon characteristics of familiar

species is really but a further step in generalizing abstraction, or the formation of a universal concept, one which applies to each individual member of a class, and isolating abstraction or the formation of an abstract idea such as roundness, for example. When the subject abstracts the quality of roundness from an object he has an abstract concept and when he can apply it to various other objects possessing this same quality he is generalizing and has a universal concept. He not only abstracts positively the concept of roundness from the various objects he is comparing, but he abstracts negatively the other qualities possessed by these objects when he ignores them.

Abstraction and generalization are contained more explicitly in such an experiment planned to study the development of the genus-species concept than in such an experiment as the present one where the object is to elicit a more or less spontaneous tendency to classify, in which is contained implicitly the use of universal and abstract concepts, but they appear to form an integral part of both.

An experiment possessing points of great similarity to this study of ours is that of Meyer whose subjects consisted of ninety-three three to six and one-half year old children who were given three tasks as follows:

1. "to arrange freely in groups a limited number of similar objects or objects of two different kinds;
2. to assign a new object to one of two given groups of objects;
3. to choose from four objects two pairs." (19:3032)

The results of the experiment showed "that the genetic line of classi-

ficatory process leads from a merely functional activity to Gestalt formation. Children show preference for emotional qualities, for rhythmical, regular, balanced or contrasting wholes and for meaningful connections." (19:3032)

This experiment differed from the present study in that interest was centered on the genetic aspect of the classificatory process and on child preferences. Furthermore, the subjects for the most part belonged in a younger age group. However, the similarities between this experiment and ours are very marked. Both involve a classification task calling for the formation of a Gestalt or pattern involving the abstract concepts of relationship, and furthermore for success in both there must be the abstraction or singling out of a certain quality or qualities and the application of these to all the objects possessing this quality or these qualities for the purpose of classification; in other words, the manifestation of the presence of universal concepts.

Another experiment differing considerably from this study, yet containing certain fundamental elements of similarity was that of Thomas Verner Moore whose subjects were presented with twenty-five groups of five figures, each group exposed for a quarter of a second, with a quarter of a second's interval between exposure. The subject was to watch for the repetition of some figure and to turn the switch when he was sure he had seen a figure twice.

This experiment differs from the present study in various respects. For one thing it was carried on with adult subjects, this study with young children. In Father Moore's experiment memory and recognition play an important

part, while in this study the objects were before the subject all through the experiment, thus in Moore's experiment both images and percepts played an important part, whereas in ours, only percepts were involved. Likewise, his involves a preponderance of analysis, finding the common element in each group, ours involves a greater amount of synthesis. The primary purpose of Father Moore's experiment was to prove that concepts and images are not the same, while in ours this thesis was taken for granted.

In both experiments, however, the process of abstraction with its resultant universal and abstract ideas plays a predominant part. Both experiments involve abstraction of form, although the present study includes abstraction of color as well.

In his Chapter III on "Experimental Results," Father Moore discusses "isolation of the common element," in which he says, "In abstraction some element or characteristic is always picked out from a group and is recognized as identical with that which was found in another group." (20:122) This statement is likewise applicable to our study if we modify it to read "object" instead of "group." The isolating of the element of redness or cubeness or red-cubeness, is a process of abstraction leading to an abstract idea.

Father Moore also discusses "The Disappearance of the Surrounding Elements" and says that "the perception of the element to be abstracted has a tendency to obliterate the memory of the other elements," (20:125) which is closely related to our concept of negative abstraction where the qualities of an object "by which this object differs from other objects recede

into the background of consciousness." (8:311)

Besides the above experiments, the kind of ability "tapped" in various performance tests bears some resemblance to that in this task. Among these might be mentioned the works of Arthur, Drever, and Leiter.

Upon examination of THE POINT SCALE OF PERFORMANCE TESTS by Grace Arthur, we find certain resemblances between the task involved in the present study and the various parts of the performance test. In the various Form Boards we find the abstraction of a particular element such as that of shape, for example, and the generalization of this concept to apply both to the block and to the space into which it fits, and in the more complex Form Boards we have the further complexity of the perception of the relationship of the various pieces to form a given pattern. We have the universal idea where the subject generalizes the concept of shape sufficiently to apply it to both the block and the space into which the block fits. We have the abstract idea in the logical relationship involved in reproducing the given pattern. In these Form Boards, the clues leading to a successful performance are more definite than in our task, more immediately apparent as, for example, in the Healy Picture Completion there is not only the similarity in size and shape between block and space to guide the subject, but a logical congruity in the resulting picture as well. In the present study, the intricate interrelationships of the pieces are only indicated by the fact that the sections of the problem box correspond to the four colors and three shapes of the materials to be "put away."

Among certain non-verbal perceptual and performance tests of intelli-

gence discussed by Blackburn is the Leiter International Performance Scale with its size gradation test for year seven. In this test is a strip on which are five graduated circles. The subject is given five blocks on each of which is drawn a square of a different size. The problem is to arrange the squares in a graduated series corresponding to that of the circles.

Classification is involved in this test which gives it a similarity to our little task, but in the test classification is called for explicitly while in ours it is implicit. In the test a pattern is provided for the subject. Both tasks involve synthesis, but the factor of analysis is more preponderant in the test for the subject is called upon to analyze the given pattern and to synthesize the new materials to form a similar one. He is called upon to abstract the concept of gradation of size--an abstract concept involving relationship--and to apply this concept to a new, but similar problem, thus generalizing or making use of a universal concept.

Blackburn also mentions the performance test of Penrose and Raven of the analogies type, which makes use of tests of similarity, opposition and addition. The subject is given a board with three figures and blank spaces, and a number of loose blocks to complete the analogy. The subject must analyze the situation and abstract from it the underlying principle--which would be an abstract concept. He must then generalize so as to form a similar "pattern" in the completion of the analogy.

Thus we have found various other studies in which the formation and manifestation of universal and abstract concepts--as understood in the

Scholastic sense--are of prime interest, either explicitly stated as in Father Moore's experiments or implicitly indicated as in the experiments of Heidebreder, Crudden, Long and others.

CHAPTER III

THE EXPERIMENT

As mentioned before, the task in the present study was designed to elicit from young children a spontaneous tendency to classify and, in thus doing, to demonstrate the use of universal and abstract concepts. The materials consisted of forty-eight wooden kindergarten beads, four each of four different colors and three different shapes, presented to the subject on a tray in a heterogeneous assortment.

The colors were chosen as nearly as possible to avoid confusion where sensory perception and discrimination might be none too keen due to the immaturity of the subjects. From the very nature of the task, there could be no attempt at classification if the subject could not perceive likenesses and differences, and discriminate one shape from another and one color from another. Therefore, in devising the experiment care was taken to avoid colors too closely resembling one another such as orange and yellow.

Besides the kindergarten beads and the tray upon which they were presented, there was a problem box, a small, flat container like a type case subdivided into twelve smaller sections or compartments, four along the horizontal and three along the vertical, corresponding to the four colors and three shapes of the beads. The sections were of such size that four homogeneous beads would fit comfortably, each resting against the bottom, although a fifth cylinder or sphere could be crowded in.

With this set-up, there was a possibility of arranging the beads four to a section identical in color and shape. There was a further possibility of organizing the box as a whole in a cross bar design, with four vertical rows of color and three horizontal rows of a particular shape or form. There was a still further possibility of an even greater nicety of classification involving an even higher degree of abstraction in the blending or gradation from shape to shape.

Following is a diagram of the problem box, illustrating a possible perfect performance:

.....
4 r. cu.:	4 gr. cu.:	4 y. cu.:	4 p. cu.
.....
4 r.cyl.:	4 gr.cyl.:	4 y.cyl.:	4 p.cyl.
.....
4 r.sph.:	4 gr.sph.:	4 y.sph.:	4 p.sph.
.....
red row	green	yellow	purple

Diagram 1

A Possible Perfect Performance

Before the task proper a little preliminary task was introduced using wooden kindergarten beads identical in shape and color with those used in the task proper. These beads were presented in a heterogeneous assortment along with a shoestring such as is used in the kindergarten for the purpose of stringing such beads and the subject was invited to make "a nice string of beads." The purpose of the preliminary task was to insure adequate sensory experience of the materials as a basis upon which to perform the abstraction implicitly called for in the task proper. Through handling the

beads and stringing them, Visual, tactual and kinaesthetic experience was provided, so the subject did not approach the task proper without a certain familiarity with the materials involved, and was insured of fairly definite phantasms as a basis for further abstraction. Observations were made of the preliminary task as to whether there seemed any attempt at system or order in the stringing of the beads or any attempt to make a "pattern." These observations were later compared with the subject's performance on the task proper.

For subjects, twenty-three children were selected from the kindergarten, first, second, and third grades for this task, and those selected were chosen on the basis of slow, average, and bright, so that a sampling of each of the three categories was represented at each of the selected grade levels, providing a basis for study and comparison.

As the experimenter was not a complete stranger to any of the subjects the element of strangeness or shyness was practically negligible.

The subject was brought to the experimenter's room and asked if he would do a couple of things to help her. Then he was given the preliminary task, the heterogeneous assortment of beads on a tray and a shoe string to make "a nice string of beads" for the experimenter. While pretending to be busy about other things, the experimenter watched the performance closely. When the "necklace" was completed and duly admired, the experimenter said, "Now there is just one more thing I would like you to do for me. See these beads?" presenting the tray of beads for the test proper, also in a heterogeneous assortment. "They are all mixed up. Will you just put them away

for me in these little boxes, the very nicest way you can?" The instructions were purposely made somewhat indefinite in order to study the possibility of a somewhat spontaneous tendency to classify. The original plan had been to include the words, "put these in order for me," but was abandoned in order to give a chance to observe the spontaneous tendency. At the same time that the experimenter gave instructions she presented the problem box which, as mentioned before, was divided into twelve sections or compartments, four along the horizontal corresponding to the four colors and three along the vertical corresponding to the three shapes. The problem box was always presented lengthwise to a subject so that the four compartments were in a horizontal position. This was done to make the problem as objectively similar as possible for each subject.

Upon presentation of the problem box, the experimenter started the stop watch and unostentatiously but carefully observed the performance recording the results on a previously prepared chart. The experimenter likewise made notations of any apparently relevant observations such as slowness or awkwardness in manipulation, distractibility, emotional reactions, etc., which might exert an influence upon quality of performance.

Skill in the manipulation of the objects was obviously an influencing factor in the time element. Small hands show individual differences in the degree of motor coordination developed, and it might reasonably be expected that the time element in a particular performance might be considerably affected, due not alone or not at all to mental slowness, but to a not-too-well-developed motor coordination. An appreciable amount of time might be

lost in fumbling for each bead and in placing it into the desired setting, or in removing it from one compartment to another. The completion of the task might likewise be slowed up, as was actually the case, by the dropping of beads on the floor and the time consumed in pursuing them.

As mentioned before, distractibility would also influence both the time factor and the quality of performance, for not only would time be consumed while attention was diverted to some distraction, but a train of thought might be lost and not picked up again when attention was brought back to the task at hand.

Emotional factors, too, were found to enter into the situation, exercising a positive influence upon success in performance. Of these, the outstanding emotional reaction was an apparent embarrassment on the part of some of the more mentally mature subjects, probably due to the nature of the materials which are closely associated with kindergarten activities. There was definite evidence of this feeling that the task was beneath the dignity of several such subjects, with a resulting inferiority of performance. This factor would probably not have influenced older subjects who would have been able to "see past the materials" gaining insight into the possibilities of the nature of the task.

A description of each performance and the interpretation of these results forms the material for the two following chapters in which the data are analyzed both qualitatively and quantitatively.

CHAPTER IV

QUALITATIVE RESULTS

From a careful study of the possibilities of the experiment itself and of the performances given, it was discovered that there were eight readily distinguishable levels of performance that might be achieved, all but the lowest being manifested at least once by subjects in this experiment. Starting from the lowest to the highest, the eight following classifications were worked out, designated by the letters of the alphabet, A, B, C, D, etc.

- A. No Attempt at Classification - no cases.
- B. Classification within Compartments Based on One Common Element - 8 cases.
- C. Classification within Each Separate Compartment Based on Two Common Elements - 1 case.
- D. Classification within Each Separate Compartment According to Three Common Elements, Color, Shape, and Number of Objects - 1 case.
- E. Classification within Each Separate Compartment According to Three Common Elements Together with an Attempt to Relate Compartments to Each Other on the Basis of One Common Element - 7 cases.
- F. Classification of Homogeneous Compartments on the Basis of One Common Element, Based upon the Design of the Box - 2 cases.

G. Classification within Each Compartment with Four Homogeneous Beads, Together with a Partial Relating of Units to the Design of the Box as a Whole - 1 case.

H. The Classification of Homogeneous Compartments in Relationship to the Design of the Box Based Upon the Two Common Elements, Shape and Color - 3 cases.

It was decided that these classifications could best be illustrated by descriptions of actual performances.

A. No Attempt at Classification.

At this level there would be no apparent attempt at any sort of classification, as a result of which neither universal nor abstract concepts would be manifested.

None of our subjects fell within this category, for every one manifested at least the use of universal concepts by making some sort of classification of the objects on the basis of at least one common element such as shape or color or number of beads to a unit.

B. Classification within Compartments Based on but One Common Element.

At this level certain of the subjects classified the beads in the separate compartments in accordance with but one common element, ignoring the other common elements. In these cases one comparatively simple concept was apparently dominant as manifested in the attempt at classification, evidencing the presence of a universal idea, but there was no manifestation of any higher degree of abstraction as in a crossbar arrangement of the box as a whole in-

volving the use of abstract ideas.

Subjects reaching this level fell within one of three seemingly equivalent categories:

1. Arrangement of the beads within the separate compartments according to shape, with no regard to color nor of dividing the beads equally among the twelve compartments. Four of our subjects responded in this way.

a. George F. - Grade 2B - C.A.8-0, M.A.8-0, I.Q.100, 3'15"

This subject piled all spheres into one compartment, all cubes into another and all cylinders into another, disregarding color and the fact that nine vacant compartments remained.



Plate 1. Performance of George F.

- b. Anna M. - Grade 1A - C.A.7-0, M.A.8-4, I.Q.119, 3'27"

This subject piled all the spheres into two compartments, all the cylinders into two, and all the cubes into two, leaving six vacant, evidencing, as did the first mentioned subject, the presence of universal concepts of shape. In the case of Anna the dominance of these universal concepts of the different shapes was also indicated in her bead chain which consisted entirely of spheres of assorted colors with three cylinders on the end when the spheres had been used up.

- c. Elfrieda K.-Grade 2A - C.A.7-10, M.A.9-8, I.Q.123, 3'10"

Elfrieda piled all spheres regardless of color into two compartments, all cylinders into two, and the remaining cubes into four, thus leaving four vacant compartments.

Because, from a careful analysis of all the performances, few of the subjects with a mental maturity above 8-0 were found to reach the higher levels, it was conjectured that the more mature subjects might have regarded the task as too "babyish" and thus not worthy of serious effort. The fact that the materials used were kindergarten materials might have been an influencing factor. This assumption was further born out by Elfrieda who performed the task with an attitude of somewhat contemptuous compliance. It is possible, too,

that the preliminary task of stringing beads might have been "beneath her dignity," thus influencing her attitude towards the task proper.

When asked if she would like to make any changes in her classification she replied, "No, it's all right," as if she had had enough. (The tester asked this of each subject but where there is no reference to a second performance either the subject was satisfied with the first and did not try again, or the second performance was essentially similar to the first).

d. Dorothy H. - Grade 1A - C.A.6-9, M.A.7-5, I.Q.110, 2'6"

This subject filled all the compartments but one, arranging the beads according to shape, but with no regard to color nor to number of beads to a unit, some compartments having four beads, some more than four and some less. This performance, like the others in this same category, showed evidence of the presence of universal concepts of shape, but of no higher degree of abstraction. The preliminary bead chain showed no evidence of any higher abstraction, being but a heterogeneous assortment of colors and shapes.

2. Classification of Beads within the Separate Compartments

Based on Color Only.

a. Nancy B. - Kg. - C.A.5-8, M.A.6-3, I.Q.110, 3'

Nancy showed evidence of having abstracted and generalized the concept of color for she piled all the green beads into one compartment, all the purples into another, all the yellows into another, and all the reds into a fourth. When the experimenter asked, "Would you like to change it?" she must have seen "possibilities," for her second performance would have brought her up to the D level of an accurate performance, arranging each separate compartment with four homogeneous beads to a unit, manifesting the use of universal concepts of shape, color, and uniformity in number of objects to a unit.

b. Joseph R. - Grade 3B - C.A.8-8, M.A.10-2, I.Q.117, 1'47"

This subject piled all the yellow beads into two compartments, all the purples into two, all the greens into two, and all the reds into two, leaving four vacant compartments.

There were evidences that this subject, too, found the task "babyish" as he seemed very self-conscious and worked rapidly as if to get it over with as quickly as possible. This subject's attitude, however, was more one of embarrassment than one of resentment. In this case, too, the preliminary bead stringing, associated as it is with kindergarten activities, may have evoked the wrong attitude towards the task proper. His bead

chain showed no evidence of a pattern, being a mere heterogeneous mixture of color and shape.

c. Robert G. - Grade 2B - C.A.8-1, M.A.8-2, I.Q.101, 1'32"

Robert piled all the purple beads into two compartments, all the greens into two others, divided the yellows among three compartments with no regard as to uniformity in number of beads to a unit, and filled the rest with red beads, ending with one red cylinder in his last compartment. His bead chain showed no indication of any attempt at a pattern. Although this subject worked very rapidly, there was no apparent embarrassment, nor evidence that he considered the task beneath his dignity.

3. Arrangement of four beads to a compartment, with no regard to homogeneity in color or shape.

One of the subjects responded in this manner, evidencing, besides, a slight indication of an attempt to classify by shape as well, but if such a plan existed, it was abandoned after the first two compartments were arranged.

a. Ronald D. - Grade 1B - C.A.6-5, M.A.7-0, I.Q.109, 3'49"

In this case we find the common element or universal idea manifested in the uniformity as to the number of objects to a unit, with a possible indication of a further abstraction of form which was not carried through to completion. The problem box was arranged

with four beads to a unit, the first compartment consisting of four cylinders of assorted colors, the second consisting of four cubes of assorted colors, and the remaining compartments consisting of four beads each of assorted shapes and colors. The possibility of a vague tendency to abstract the concept of shape is further indicated by the fact that his bead chain was made up of a series of cylinders of assorted colors, followed by a series of cubes of assorted colors.

In his second attempt this tendency to classify by shape as well as uniformity in number of beads to a unit is even more manifest, for ten of the twelve sections were arranged in this way.

C. Classification Within Each Separate Compartment Based on Two Common Elements.

a. Edward F. - Kg. C.A.5-10, M.A.5-5, I.Q.93, 4'43"

This subject arranged his problem box with uniformity in number of beads to a compartment and homogeneity in shape and started to relate compartments on the basis of shape, but did not sustain the plan.

D. Classification within Each Separate Compartment According to Three Common Elements - Color, Shape, and Number of Objects.

This fourth level might be termed an accurate performance in accordance with the directions given, "Just put these away for me in

these little boxes the very nicest way you can," in which the beads are sorted out so as to give four homogeneous beads to each compartment, yet with no attempt at a more intricate arrangement of the box as a whole. Such an arrangement would indicate the employment of such universal ideas as shape, color, and uniformity in number of objects to a unit. This particular level was achieved by only one subject, a kindergartner:

a. Duncan E. Kg. C.A.5-10, M.A.6-9, I.Q.116, 7'15"

This subject worked slowly, carefully, thoughtfully, setting each bead in place with the greatest of care.



Plate 2. Performance of Duncan E.

This performance showed a tendency to abstraction and the use of universal concepts in a higher degree than any of the aforementioned performances. In this one there was a higher degree of complexity involved as more than one quality was abstracted, namely, color, shape, and the uniformity of number of objects to a unit.

Up to and including this level, there was no evidence of any attempt to relate compartment to compartment, but only to relate bead to bead within each separate compartment. Starting with level E, attempts successful in whole or in part were manifest of a further classification involving the interrelationship of compartments.

E. Classification within Each Separate Compartment According to Three Common Elements Together with an Attempt to Relate Compartments to Each Other on the Basis of One Common Element.

This level could be divided into two categories as follows:

1. An Attempt to Relate the Homogeneous Units on the Basis of Shape.

a. Bernard B. Kg. C.A.5-11, M.A.6-4, I.Q.107, 5'7"

In this, as in the next case, the subject attempted to classify according to shape in a vertical direction instead of a horizontal, and as there were four units of each shape (a red, a green, a yellow, and a purple) and only three compartments in a vertical direction,

it meant one miscellaneous vertical "row," whereas, if he had gone in a horizontal direction he would have achieved his end. The following diagram of Bernard's results will illustrate:

```

.....
CUBE  : CUBE  : CYL. : SPHERE
  4 r. : 4 y.  : 4 gr.: 4 r.
.....
CUBE  : CYL.   : CYL. : SPHERE
  4 gr.: 4 r.  : 4 p. : 4 gr.
.....
CUBE  : SPHERE : CYL. : SPHERE
  4 p. : 4 p.  : 4 y. : 4 y.
.....

```

Diagram 2

Performance of Bernard B.

b. LeRoy McC. 1B C.A.6-10, M.A.5-11, I.Q.87, 5'40"

Although LeRoy's arrangement was not precisely the same as Bernard's, the underlying plan was identical.



Plate 3. Performance of LeRoy McC.

It would seem that an "element of luck" might have entered into these performances, in that if the subjects had happened to start arranging their units so that shape had gone in a horizontal direction, there might have been a flash of insight that might have suggested a further classification by color.

c. Joseph R. - 1A, C.A.8-0, M.A.6-9, I.Q.84, 4'46"

Joseph started out by classifying his separate compartments on the basis of shape in the right direction, but apparently lost his plan when he got to the middle of

the second row.

d. Herbert G. - 2B, C.A.7-9, M.A.6-10, I.Q.88, 7'8"

This subject apparently started out to relate his compartments on the basis of shape, apparently lost the thread of his thought along the way and then seemed to pick it up again in arranging his last three sections. It is characteristic of this subject that he is extremely self-conscious and distractible. He worked very slowly, wasting considerable time trying to make each bead "stand on end" until the experimenter finally told him not to bother about that. He seemed to play for the experimenter's attention, yet seemed embarrassed when he got it. Possibly these personality traits may have been partly responsible for his inability to hold his plan to the end, as well as the fact that through his dilly-dallying he prolonged the task considerably beyond the length of time taken by most of the other subjects.

2. An Attempt to Relate Homogeneous Units on the Basis of Color.

a. Elwyn P. 3B, C.A.8-8, M.A.9-0, I.Q.114, 2'10"

This subject apparently attempted to relate the homogeneous units on the basis of color in a back and forth arrangement as follows:

```

.....
GREEN      : GREEN      : GREEN      : YELLOW
(1)         : (2)         : (3)         : (4)
Cu.         : Cyl.         : Sph.         : Cyl.
.....
RED         : RED         : YELLOW      : YELLOW
(8)         : (7)         : (6)         : (5)
Cu.         : Sph.         : Cu.         : Sph.
.....
RED         : PURPLE      : PURPLE      : PURPLE
(9)         : (10)        : (11)        : (12)
Cyl.        : Cu.         : Cyl.        : Sph.
.....

```

Diagram 3

Performance of Elwyn P.

Reading the compartments as numbered we have green, green, green, yellow, yellow, yellow, red, red, red, and purple, purple, purple.

b. Mary Jean C. 3B C.A.7-11, M.A.9-0, I.Q.114, 2'14"

The underlying plan in Mary Jean's classification was identical with Elwyn's, but the arrangement differed in that Mary Jean, instead of following a back and forth pattern, followed the reading direction from left to right in each row.



Plate 4. Performance of Mary Jean C.

c. Martin S. 2A C.A.8-1, M.A.6-10, I.Q.85, 3'55"

It was noted that this subject started out by making one vertical row of yellow, but failed to carry the color classification through. Whether the start was intentional and he lost the plan along the way, or whether it was purely accidental cannot be positively decided from a mere objective observation of the performance. In making his initial bead string, the subject began with spheres, following a certain pattern--yellow, purple, red, green--until all spheres were used up, then con-

tinued the same color pattern with cylinders, finishing up with the same color pattern in cubes.

All seven performances at this level indicate not only the use of universal concepts of color, shape, and uniformity in number of beads to a unit, but a higher degree of abstraction as well, in an attempt to interrelate the separate units on the basis of one common element, either shape or color.

F. Classification of Homogeneous Compartments on the Basis of One Common Element, Based upon the Design of the Box.

There would have been a possibility of a classification of the homogeneous units on the basis of similarity in color, but, as it happened, none of our subjects made such a classification. Two of the subjects, however, did arrange the separate compartments into a pattern on the basis of shape.

a. Patricia McF. 3B C.A.8-3, M.A.8-4, I.Q.101, 4'50"

b. Carol Jean B. Kg. C.A.5-11, M.A.7-3, I.Q.122, 4'22"

Both of these subjects related the separate units to each other and to the design of the box by arranging the shapes in horizontal rows. The further possible arrangement of colors in vertical rows was apparently ignored. Both subjects carried their plan through to completion, thereby manifesting universal concepts in the homogeneous grouping of the beads in the separate compart-

ments, and of abstract concepts in the interrelationship of the compartments as based upon the common element of shape. In observing the performance of Carol Jean, the kindergartner, it was interesting to note that she invariably picked out all four of the homogeneous beads and held them in her hand before transferring them to their destined place in the problem box.

G. Classification within Each Compartment with Four Homogeneous Beads, together with a Partial Relating of Compartments to the Design of the Box as a Whole.

Only one of our subjects fell within this category:

a. James M. . 2A C.A.7-10, M.A.7-10, I.Q.100, 6'11"

In analyzing this performance it was noted that several changes were made in the course of the task which suggested that the subject was endeavoring to make the scheme come out right, but in making a wrong start and arranging the shapes in a vertical instead of a horizontal direction he did not quite grasp the significance of the possible relationship between units and problem box. Had he "chanced" to start his colors in a vertical direction and shapes in a horizontal, it is highly probable that he would have achieved a perfect performance.

There was a certain pattern or symmetry observable

also in his bead chain. He started with two groups of cylinders following the color pattern: red, yellow, green, purple, continuing with a series of spheres with no apparent color pattern, and finished off with two more series of cylinders in reverse order to those at the beginning: viz., purple, green, yellow, red.

In this performance we find not only the manifestation of universal concepts as evidenced by the homogeneous arrangement of each separate unit, but of the use of abstract concepts as well, shown by a deliberate effort to interrelate the units with each other and the design of the box, according to both shape and color. The arrangement of objects in their groups seems to manifest a consciousness of relationship when done consistently throughout the box; it seems to show evidence of the abstract concept of relationship. A further abstraction is suggested in the fact that there was a gradation from sphere with its complete roundness to cylinder having partial roundness to cube which has no roundness at all.

H. The Classification of Homogeneous Compartments in Relationship to the Design of the Box Based upon the Two Common Elements - Shape and Color.

This final, or H level, we might call a perfect performance, in

which we find the arrangement of four homogeneous beads to each compartment, with a further crossbar arrangement of these compartments based on both color and shape in harmony with the design of the box--shapes going in a vertical direction and colors in a horizontal. This highest level was reached by three of the subjects as follows:

- a. Ralph V. 3B C.A.9-2, M.A.7-5, I.Q.81, 2'45"
- b. Gloria C. 1B C.A.6-8, M.A.7-10, I.Q.117, 4'10"
- c. Doris G. 2B C.A.7-6, M.A.8-0, I.Q.107, 3'

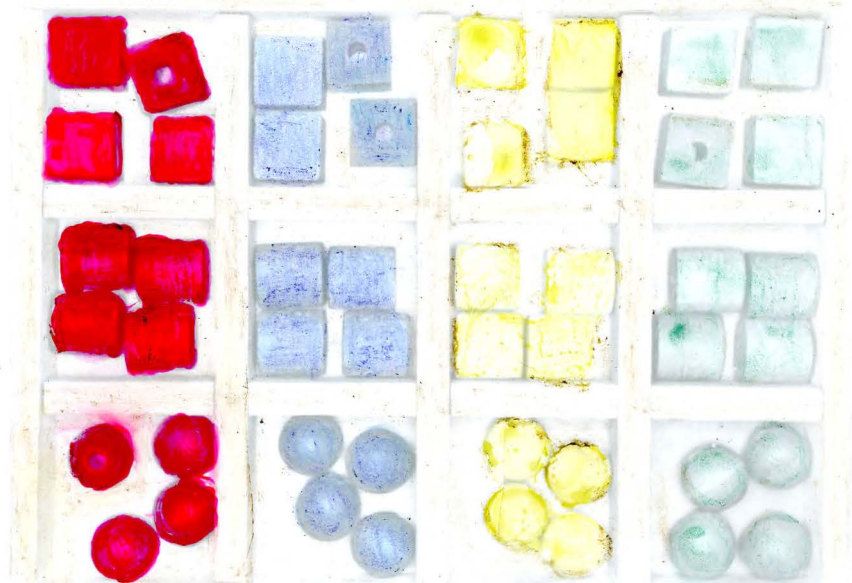


Plate 5. Performance of Ralph V.

In each of these cases there was a still greater nicety of classification in the gradation from sphere with its

complete roundness to cylinder with its partial roundness to cube with no roundness at all.

These performances would seem to indicate the employment of UNIVERSAL ideas in the grouping together of similar objects, for example, red cubes, and, in some cases, of a higher degree of abstraction, or ABSTRACT ideas, as indicated by the interrelationship shown between shape and color, and the design of the box, and a further degree of abstraction in the even more subtle gradation from shape to shape.

The foregoing data has been summarized as follows:

A. No Attempt at Classification - None.

B. Classification within Compartments Based on ONE Common Element:

1. Shape

- a. George F. - Grade 2B - C.A.8-0, M.A.8-0, I.Q.100 - 3'15"
- b. Anna M. - " 1A - C.A.7-0, M.A.8-4, I.Q.119 - 3'27"
- c. Elfrieda K.- " 2A - C.A.7-10, M.A.9-8, I.Q.123 - 3'10"
- d. Dorothy H. - " 1A - C.A.6-9, M.A.7-5, I.Q.110 - 2'6"

2. Color

- a. Nancy B. - " Kg - C.A.5-8, M.A.6-3, I.Q.110 - 3'
- b. Joseph R. - " 3B - C.A.8-8, M.A.10-2, I.Q.117 - 1'47"
- c. Robert G. - " 2B - C.A.8-1, M.A.8-2, I.Q.101 - 1'32"

3. Four Beads to a Unit

- a. Ronald D. - Grade 1B - C.A.6-5, M.A.7-0, I.Q.109 - 3'49"

C. Classification within Each Separate Compartment Based on TWO Common Elements -

1. Shape and Four Beads to a Unit

a. Edward F. - Kg - C.A.5-10, M.A.5-5, I.Q.93 - 4'43"

D. Classification within Each Separate Compartment Based on THREE Common Elements--Color, Shape, and Four Beads to a Unit:

a. Duncan E. Kg - C.A.5-10, M.A.6-9, I.Q.116 - 7'15"

E. Classification within Each Separate Compartment according to Three Common Elements together with an attempt to Relate Compartments to Each Other on the Basis of One Common Element.

1. Shape

a. Bernard B. Kg - C.A.5-11, M.A.6-4, I.Q.107 - 5'7"

b. Joseph R. - Grade 1A - C.A.8-0, M.A.6-9, I.Q.84 - 4'46"

c. LeRoy McC. - " 1B - C.A.6-10, M.A.5-11, I.Q.87 - 5'40"

d. Herbert G. - " 2B - C.A.7-9, M.A.6-10, I.Q.88 - 7'8"

2. Color

a. Elwyn P. - " 3B - C.A.8-8, M.A.9-0, I.Q.104 - 2'10"

b. Mary Jean C. " 3B - C.A.7-11, M.A.9-0, I.Q.114 - 2'14"

c. Martin S. - " 2A - C.A.8-1, M.A.6-10, I.Q.85 - 3'55"

F. Classification of Homogeneous Compartments on Basis of ONE Common Element, Based upon the Design of the Box.

1. Shape

a. Patricia McR. Grade 3B - C.A.8-3, M.A.8-4, I.Q.101 - 4'50"

b. Carol Jean B. Kg - C.A.5-11, M.A.7-3, I.Q.122 - 4'22"

G. Classification within Each Compartment with Four Homogeneous Beads, together with a Partial Relating of Units to the Design of the Box as a Whole.

a. James M. - Grade 2A - C.A.7-10, M.A.7-10, I.Q.100 - 6'11"

H. The Classification of Homogeneous Compartments in Relationship to the Design of the Box Based upon the Two Common Elements--Shape and Color.

a. Gloria C. - Grade 1B - C.A.6-8, M.A.7-10, I.Q.117 - 4'10"

b. Doris G. - " 2B - C.A.7-6, M.A.8-0, I.Q.107 - 3'

c. Ralph V. - " 3B - C.A.9-2, M.A.7-5, I.Q.81 - 2'45"

CHAPTER V
QUANTITATIVE RESULTS

Following is the result of an attempt to devise a graded scale for scoring each performance, based primarily upon quality of performance, with a definite premium for each level of success over and above a basic satisfactory performance, and a definite penalty for each level of failure below:

- I. Basic satisfactory performance--four homogeneous beads to a unit, with no attempt further to classify the box as a whole - 100.
- II. Premiums:
 - a. A basic satisfactory performance plus an unsuccessful attempt further to classify the various units on the basis of either color or shape; non-success due to a non-sustained plan - plus 5.
 - b. Same as "a" except non-success due to attempt to carry out the further classification in the wrong direction; for example, shapes along the horizontal, or colors along the vertical - plus 10.
 - c. A basic satisfactory performance plus a successful attempt further to classify the various compartments on the basis of either color or shape only - plus 20.
 - d. A basic satisfactory performance plus an unsuccessful attempt further to classify the various units on the basis of both color

and shape; non-success due to attempt to carry out the further classification in the wrong direction; for example, shapes along the horizontal and colors along the vertical - plus 30.

- e. A perfect performance - a basic satisfactory performance plus a successful attempt further to classify the individual compartments on the basis of both color and shape - plus 40.

III. Penalties:

- a. Classification within each separate compartment according to color or shape only, four beads to a unit - minus 10.
- b. Classification within each compartment based on but ONE common element, - shape, color, or number of beads to each compartment - minus 20.
- c. Beads sorted out on basis of color or shape and piled into one or more compartments, leaving vacant compartments - minus 30.

In Table I we have a list of scores attained by the various subjects based on level of achievement, including premiums and penalties:

Table I

Raw Scores

Level H - Premium e:

1. Gloria C. - 1B - 140
2. Doris G. - 2B - 140
3. Ralph V. - 3B - 140

Level G - Premium d:

4. James M. - 2A - 130

Level F - Premium c:

5. Carol Jean Kg. - 120
6. Patricia M. 3B - 120

Level E - Premium b:

7. Bernard B. Kg. - 110
8. LeRoy McC. 1B - 110
9. Elwyn P. - 3B - 110
10. Mary Jean - 3B - 110

Level E - Premium a:

11. Joseph R. - 1A - 105
12. Herbert G. - 2B - 105
13. Martin S. - 2A - 105

Level D - Basic Satisfactory Performance:

14. Duncan E. - Kg. - 100

Level C - Penalty a:

15. Edward F. - Kg. - 95

Level B - Between penalties a and b (a not sustained):

16. Ronald D. - 1B - 85

Level B - Penalty b:

17. Robert G. - 2B - 80

Level B - Penalty c:

18. Nancy B. - Kg. - 70
19. Anna M. - 1A - 70
20. Dorothy H. - 1A - 70
21. George F. - 2B - 70
22. Elfrieda K. 2A - 70
23. Joseph R. - 3B - 70

IV. Time Factor:

From a careful examination of the data, it appeared that there were various poor performances due to hasty, careless work, and others to the fact that the task seemed too prolonged, and thus too difficult for the child's mentality. This latter observation was particularly noticeable in the cases of the lower I.Q.'s where the subject gave the appearance of starting out with a plan, but seemed to lose the thread of thought along the way.

Because of these observations it was thought advisable to impose a penalty for those performances which were too hasty and for those which were too-long-drawn-out, and thus a time standard was devised as follows:

Taking our three highest levels of achievement, that of a perfect performance and the next two which approach it closely, we find performance speeds to be as follows:

Level H:

Ralph V. - 3B - 165"
Doris G. - 2B - 180"
Gloria C. - 1B - 250"

giving an average of 198"

Levels G and F:

James M. - 2A - 371"
Patricia M. - 3B - 290"
Carol Jean - Kg.- 262"

giving an average of 308"

Taking the average of these averages for the three highest levels and weighting that of the highest group by doubling it we have 235" or 3'55" which, in round numbers we could consider four minutes.

This could stand for the midpoint of our standard for a satisfactory performance.

Taking, arbitrarily, a minute and a half above and a minute and a half below this midpoint of four minutes, we could then set the limits of 2'30" to 5'30" for our standard for a satisfactory performance. We would then impose a penalty of, say one point for every ten seconds exceeding the upper limit, and likewise a penalty of one point for every ten seconds below the lower limit of our standard, on the assumption that a slower and more careful performance might have yielded better results.

In Table II is given the list of final scores attained by the various subjects based on level of achievement and speed of performance, from highest to lowest:

Table II

Final Scores Including Time Penalties

Level	Name	Grade	Speed	Raw Score	No. Seconds over or under	Time Penalty	Final Score
H	1.Gloria	1B	4'10"	140	0	0	140
	2.Doris G.	2B	3'	140	0	0	140
	3.Ralph V.	3B	2'45"	140	0	0	140
G	4.James M.	2A	6'11"	130	41	4	126
F	5.Patricia	3B	4'50"	120	0	0	120
	6.Carol Jean	Kg.	4'22"	120	0	0	120
E	7.Bernard B.	Kg.	5'7"	110	0	0	110
	8.LeRoy McC.	1B	5'40"	110	10	1	109
	9.Elwyn P.	3B	2'10"	110	20	2	108
	10.Mary Jean	3B	2'14"	110	16	2	108
	11.Joseph R.	1A	4'46"	105	0	0	105
	12.Martin S.	2A	3'55"	105	0	0	105
	13.Herbert	2B	7'8"	105	98	10	95
C	14.Edward F.	Kg.	4'43"	95	0	0	95
D	15.Duncan E.	Kg.	7'15"	100	105	10	90
B	16.Ronald D.	1B	3'49"	85	0	0	85
	17.Robert G.	2B	1'32"	80	58	6	74
	18.Nancy B.	Kg.	3'	70	0	0	70
	19.Elfrieda	2A	3'10"	70	0	0	70
	20.Anna M.	1A	3'27"	70	0	0	70
	21.George F.	2B	3'15"	70	0	0	70
	22.Dorothy	1A	2'6"	70	24	2	68
	23.Joseph R.	3B	1'47"	70	43	4	66

In scanning Table III we can see no apparent relationship between grade level and excellence of performance, nor between chronological age and excellence of performance. (The correlation between grade level and performance was found to be insignificant-- r equals plus .115, and that between chronological age and performance was also very low-- r equals plus .073.) Among the six highest scores there is a complete range of grade levels from kindergarten to 3B inclusive with the exception of 1A, and among the six lowest scores there is likewise a complete range of grade levels from kindergarten to 3B with the exception of grade 1B. Similarly, the age range for the six highest scores is five years eleven months to nine years two months, and for the six lowest scores five years eight months to eight years eight months.

There seems to be little positive relationship, too, between intelligence quotient and excellence of performance, the average I.Q. at the lowest level (eight cases) being 111, while the average intelligence quotient at the highest level (three cases) is only 101. (We find the correlation to be a negative one-- r equals minus .334.) If, according to Blackburn (4), performance tests are not only of value in testing the deaf, illiterates and foreigners, but also a person's intelligence in concrete situations, might not this be a possible explanation why, in this task, resembling as it does in many respects the performance type of test, several of the subjects with a lower I.Q. on the Kuhlmann-Anderson test outstripped others with a higher intelligence quotient?

It is also interesting to note that in those cases where a pattern was begun but not sustained, three out of the four had I.Q.'s in the eighties,

Table III

COMPLETE SUMMARY OF DATA

Level	Name	Grade	C.A.	M.A.	I.Q.	Speed	Raw Score	Final Score
H	1.Gloria C.	1B	6-8	7-10	117	4'10"	140	140
H	2.Doris G.	2B	7-6	8-0	107	3'	140	140
H	3.Ralph V.	3B	9-2	7-5	81	2'45"	140	140
G	4.James M.	2A	7-10	7-10	100	6'11"	130	126
F	5.Patricia	3B	8-3	8-4	101	4'50"	120	120
F	6.Carol J.	Kg	5-11	7-3	122	4'22"	120	120
E	7.Bernard	Kg	5-11	6-4	107	5'7"	110	110
E	8.LeRoy Mc.	1B	6-10	5-11	87	5'40"	110	109
E	9.Elwyn P.	3B	8-8	9-0	104	2'10"	110	108
E	10.Mary J.	3B	7-11	9-0	114	2'14"	110	108
E	11.Joseph R.	1A	8-0	6-9	84	4'46"	105	105
E	12.Martin S.	2A	8-1	6-10	85	3'55"	105	105
E	13.Herbert G.	2B	7-9	6-10	88	7'8"	105	95
D	14.Duncan E.	Kg	5-10	6-9	116	7'15"	100	90
C	15.Edward F.	Kg	5-10	5-5	93	4'43"	95	95
B	16.Ronald D.	1B	6-5	7-0	109	3'49"	85	85
B	17.Robert G.	2B	8-1	8-2	101	1'32"	80	74
B	18.Nancy B.	Kg	5-8	6-3	110	3'	70	70
B	19.Elfrieda	2A	7-10	9-8	123	3'10"	70	70
B	20.Anna M.	1A	7-0	8-4	119	3'27"	70	70
B	21.George F.	2B	8-0	8-0	100	3'15"	70	70
B	22.Dorothy	1A	6-9	7-5	110	2'6"	70	68
B	23.Joseph R.	3B	8-8	10-2	117	1'47"	70	66

while the fourth, although with an I.Q. of 109, was one of our less mature subjects, being in the next to the lowest grade level group--that of 1B.

The relationship in the present experiment between mental age and excellence of performance seems to be confused. There is a range in mental age in the two highest levels (G and H) from seven years five months to eight years, with only two other subject falling within this mental age range. Other factors not readily apparent might have been responsible for the failure of these two to achieve a better performance. But curiously enough, the correlation between final score and mental age was a negative one-- r equals minus .282--but this might be due in part to the inclusion of those cases with a higher mental age where emotional factors appeared to influence the performance adversely, for, when these were eliminated, there was a sharp change from the sizable negative correlation to a low positive correlation-- r equals plus .136.

From a careful scrutiny of the data, it seems possible that failures above the mental age range, seven years five months to eight years, may have been due to emotional factors as suggested, while failures below would seem to be due to a lack of mental maturity.

CHAPTER VI

SUMMARY AND CONCLUSION

The foregoing study has developed from a desire to explore the manifestation of universal and abstract concepts as evidenced by young children in a classification task in which concrete objects were used. Twenty-three subjects were selected, ranging from kindergarten through grade 3B, and the task consisted in "putting away" a heterogeneous assortment of forty-eight kindergarten beads, four each of four different colors and three different shapes in a problem box divided into twelve sections, four along the horizontal corresponding to the four colors and three along the vertical corresponding to the three shapes. The directions were given without explicit instructions to classify in an attempt to observe a possible spontaneous tendency of this nature.

We have seen that in a classification task of this kind a successful performance would indicate the use of both universal and abstract concepts. We have shown that a classification task calls for the use of universal concepts in the perception of "the perfectly similar natures of the members of the same class." (18:249) Furthermore, for a successful performance in this particular task abstract as well as universal concepts are involved in the complex interrelationships between colors, shapes, and number of beads to number of sections.

Therefore, from the nature of the task, we would be led to expect that

older children, particularly those with a higher intelligence quotient and mental age, would prove the most successful. But to our surprise we did not find this to be invariably the case. In fact, we found a definite drop in excellence of performance among older subjects, particularly those of superior mental age, the higher levels of success being reached by those with a mental age between seven years five months and eight years. Above eight years there seemed a definite drop in quality of performance, suggesting that other elements, such as emotional factors, might have entered in, causing the more mature subjects to feel the task beneath their dignity and thus not worthy of serious effort. This feeling may have been enhanced by the fact that materials so closely associated with kindergarten activities were used. The choice of a preliminary task, designed as it was to make sure that each subject was provided with adequate sensory experience of the materials, may also have been unfortunate for the mature subjects, consisting as it did of making a "nice string of beads." This conclusion was reenforced by observations made during the various performances, in which one of the more mentally mature subjects manifested a definite contempt for the task and another embarrassment, and both a desire to get it over with as quickly as possible. Others of the more mature subjects who gave an inferior performance may also have been equally, though less obviously, the victims of emotional "blocking."

No significant correlations were found between grade level and successful performance or between chronological age or intelligence quotient and successful performance, with only a low correlation (r equals plus .136) between mental age and success where those of a mental maturity above nine

years were dropped out.

However, upon a careful scrutiny of our results, we find that every one of the subjects made some attempt at classification, thus manifesting the use of UNIVERSAL concepts even at the kindergarten level, and demonstrating the existence of a spontaneous tendency even among young children to classify. None of the subjects with a mental maturity below seven years showed evidence in their performances of any higher type of abstraction and the capacity for sustained attention in carrying out a task of this length involving more abstract thought processes.

For those of a mental maturity above eight years, non-success appeared to be due to an unfortunate choice of materials and preliminary task, causing emotional "blocking." Had the materials been of a different nature, it seems reasonable to assume that a performance might have been given by these subjects that would have manifested a higher degree of abstract thinking.

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APPROVAL SHEET

The thesis submitted by Frances Virginia Rau has been read and approved by three members of the Department of Psychology.

The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated, and that the thesis is now given final approval with reference to content, form, and mechanical accuracy.

The thesis is therefore accepted in partial fulfillment of the requirements for the Degree of Master of Arts.

December 6, 1943
Date

Charles S. Doyle, Jr.
Signature of Adviser