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The Picture Completion Test

BY

RUDOLF PINTNER AND MARGARET M. ANDERSON
Ohio State University

WARWICK & YORK, INC.
BALTIMORE, U. S. A.
1917

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EDITOR'S PREFACE

Progress in mental testing has been greatly reduced, as all workers in that field are well aware, because of lack of standardization both with respect to the methods of administering tests and also with respect to the methods of scoring them. Closely allied with these lacks is the further lack of adequate norms of performance, gathered from a sufficient number of cases to indicate not merely the average performance but also the entire range of performance as conditioned by age, sex, school training and what other factors may be influential.

The present monograph supplies these desired data for a single test—the Healy Picture Completion Test. By applying it to over 1500 children the authors have been able to arrive at an empirically determined method of scoring, to establish norms of percentile distribution for each age from 6 to 14 and incidentally to ascertain the connections between performance in it and sex, social environment and school standing.

Work of this sort is directly valuable to all persons who make use of mental tests with children and it is equally valuable to those who are interested in the technique of standardizing tests and in working out by empirical methods the best rules for administering and scoring them.

G. M. W.

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CHAPTER I

Introduction

The growing demand on the part of clinical psychologists for a greater variety of tests to aid in mental examinations and for adequate standardizations of tests is leading to the introduction of new tests and to more intensive studies of tests already in common use. The necessity on the part of the practical worker for a number of tests and the relative ease with which a new test can be devised has resulted, in many instances, in the use of a test for practical work before any real analysis or standardization of the test has been made. To draw conclusions from any specific performance in a test before a real study of it has been made, is at best a very dangerous procedure, and the basing of diagnoses of individual cases upon the results of tests that have not been carefully studied is one of the things which in some quarters has helped to bring clinical psychology into disrepute. If we are to use a test for purposes of differential diagnosis, we must be certain that we know what is a normal performance. We have no justification in saying that any specific performance is a bad performance, say for a six-year-old child, until we know what the average six-year-old can do. What may seem to us as adults a very bad performance may be the common six-year-old response to the situation. In short, the careful clinical worker will not use for diagnostic purposes any test until it has been adequately standardized.

The question of the adequate standardization of mental tests has been until recently a somewhat neglected phase in the psychology of individual differences. Previous workers did not attempt to set standards, but were primarily interested in the results

of tests as applied to specific groups of individuals, and the main emphasis was thrown upon the study of the test rather than upon the individual. It was the test that was primarily under consideration. Furthermore, great interest was shown in the question as to what the test was testing, whether memory or imagination, or other psychical process. This point of view dominates the earlier work in the psychology of tests, such as the studies of Cattell and Farrand,[1] Kirkpatrick,[2] Woodworth and Wells,[3] and many others.

This point of view is, of course, a necessary one and naturally precedes the use of tests for practical diagnostic purposes. The results of the large amount of work with individual tests of varying nature are best seen in the compilation of Whipple,[4] and the arrangement of the tests into tests of sensory capacity, of attention, of perception, etc., is indicative of the point of view.

Paralleling this development of the psychology of tests, and in recent times very largely overlapping, we have the question of the relation of test to test, or of the relation of abilities as tested by any two or more tests. This is the question of the correlation of tests and the decided interest shown in this aspect of the problem may be traced back to the work of Spearman,[5]

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[1] Cattell, J. McK., and Farrand, L., Physical and Mental Measurements of the Students of Columbia University. *Psych. Review*, 3, 1896, 618–648.

[2] Kirkpatrick, E. A. Individual Tests of School Children. *Psych. Review*, 7: 1900, 274–280.

[3] Woodworth, R. S. and Wells, F. L. Association Tests. *Psych. Review Monographs*, 13: 1911, No. 5.

[4] Whipple, G. M. *Manual of Mental and Physical Tests*. 2 Vols. Warwick and York, 1914–15.

[5] Spearman, C., General Intelligence, Objectively Determined and Measured, *Amer. J. of Psych.*, 15: 1904, 201–293.

Hart, B., and Spearman, C., General Ability, its Existence and Nature, *Brit. J. of Psych.*, 5: 1912, 51–79.

Krueger, F., and Spearman, C., Die Korrelation zwischen verschiedenen geistigen Leistungsfähigkeiten, *Zeitschr. f. Psych.*, 44: 1907, 50–114.

although some work had been done before his time, notably by Wissler,[6] and although the question had been raised at the very beginning of the interest in mental measurements by Galton[7] himself. The studies bearing upon the correlations of tests have been numerous. Among such studies may be mentioned the work of Burt,[8] Simpson,[9] Whitley,[10] Brown,[11] and others. Although the results of this work are often contradictory, yet the point of view emphasized has thrown a great deal of light upon our knowledge of tests. It is a line of approach that raises very definitely the questions what the tests are testing and what is the meaning of intelligence itself.

Neither of these two streams in the development of the psychology of tests leads us directly to the problem of standardization with which we are here more nearly concerned. Both of them are fundamentally concerned with the test itself or with the psychical process it is supposed to be testing. A slight shift in point of view from the test or the psychical process to the individual tested leads to another line of development in the history of mental tests. This appeared as soon as the question was raised what light performance in a test throws upon the psychological make-up of the individual tested. This slight change in point of view was a natural outgrowth of the in-

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[6] Wissler, C., The Correlation of Mental and Physical Tests, *Psych. Review Monographs*, 3: 1901, No. 6.

[7] Galton, F., *Inquiries into Human Faculty and Its Development*, 1883.

[8] Burt, C., Experimental Tests of General Intelligence, *Brit. J. of Psych.*, 3, 1909, 94–178.

[9] Simpson, B. R., Correlations of Mental Abilities, *Teachers Coll. Contr. to Educ.*, No. 53, 1912.

[10] Whitley, M. T., *An Empirical Study of Certain Tests for Individual Differences*, New York, 1911.

[11] Brown, W., *Essentials of Mental Measurement*, Cambridge, Eng., 1911.

creasing interest in individual psychology. Binet's work[12] on the different psychological characteristics of individuals or groups of individuals led him to apply tests for differential purposes. We have from him and his co-workers, Henri and Simon, a long series of studies in which single tests or groups of tests are used for the analysis of individuals. This work culminated in the construction of a scale of tests for practical diagnostic purposes. He originated the idea of systems of tests with age-gradations, which in turn has led to the idea of norms of performance in practical clinical work. Norms are demanded for comparative purposes. One normal standard is not enough for children, because every age must have its separate standard. The only means of measuring the mental retardation of a ten-year-old child is to compare his intelligence with that of normal children of different ages or of many ten-year-old children.

Various attempts have been made to establish such a working basis with different sets of tests, but in most cases the investigators seem to have lost sight of their end in the desire to put their material to practical use. This very fact has resulted in many false conclusions and wrong judgments. No more striking example could be found than that of the Binet-Simon scale, itself. In the first place, the separate tests were not "tried out" with large enough groups of children, and, as a result, many were misplaced. In the second place, lack of a standard method of procedure has led to difficulty in the comparison of results of different workers.

This lack of adequate standardization was felt immediately after the scale was put into use and led to

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[12] Binet, A., Attention et Adaptation, *L'année psychologique*, 6: 1899, 248–404. Binet, A., et Henri, V., La Psychologie Individuelle, *L'année psychol.*, 2: 1895–6, 411–465.

the re-standardization of the scale by Goddard.[13] This was the starting point for a discussion of standardization in general, and has given us the work of Kuhlman,[14] Bobertag,[15] Stern,[16] Terman,[17] Otis,[18] and others. All this work was done mainly from the point of view of the scale of mental measurement, and the discussion centers around the adequate placing of a test at a specific age. The appearance of other scales, such as those of Knox,[19] de Sanctis,[20] Yerkes-Bridges,[21] and Terman[22] served still further to emphasize the problems of standardization. At the same time, the use of special tests devised by different workers and used by them in practical clinical work led to the necessity of norms in order to evaluate the performance of any individual.

With this growing demand for age-norms appeared the elaborate work of Sylvester[23] with the Seguin

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[13] Goddard, H. H., Two Thousand Children Measured by the Binet Measuring Scale of Intelligence, *Ped. Sem.*, 18: 1911, 232–259.

[14] Kuhlman, F., The Results of Grading Thirteen Hundred Feebleminded Children with the Binet-Simon Tests, *J. of Educ. Psych.*, 4: 1913, 261–268.

[15] Bobertag, O., Ueber Intelligenzpruefungen, *Zeitschr. f. angewandte Psychologie*, 5: 1911, 105; and 6: 1912, 495.

[16] Stern, W., *The Psychological Methods of Testing Intelligence*, Trs. by Whipple, Ed. Psych. Monographs, No. 13.

[17] Terman, L. M., and Childs, H. G. A Tentative Revision and Extension of the Binet-Simon Measuring Scale of Intelligence, *J. of Educ. Psych.*, 3: 1912.

[18] Otis, A., Some Logical Aspects of the Binet Scale, *Psych. Rev.*, 23: 1916, 129–152, 165–179.

[19] Knox, H. A. A Scale, Based on the Work at Ellis Island, for Estimating Mental Defect, *J. of Amer. Medical Assoc.*, 62: 1914, 741–747.

[20] de Sanctis, S., Mental Development and the Measure of the Level of Intelligence, *J. of Ed. Psych.*, 2: 1911, 498–507.

[21] Yerkes, R. M., Bridges, J. W., and Hardwick, R. S., *A Point Scale for Measuring Mental Ability*, Warwick and York, 1915.

[22] Terman, L. M., *The Measurement of Intelligence*, Houghton, Mifflin Company, 1916.

[23] Sylvester, R. H., The Form-Board Test, *Psych. Review Monographs*, 15: 1913.

Form-Board, who with some fifteen hundred children worked out very reliable norms. Pintner's[24] revision of the Knox Cube Test and Wallin's[25] norms for the Seguin Form-Board are further indications that the need for more reliable standards in intelligence testing is being met. Other indications of the need for norms appears in the work of Schmitt,[26] who arrived at tentative norms for many of Healy's tests, and in the work of the Bureau of Investigation of the New York State Board of Charities.[27] In the latter study the Picture Completion Test is included and reference to the results will be made in a later chapter.

The task of standardization probably falls under two main heads, (1) the determination of a method of presentation and method of scoring, (2) the establishment of norms. Under the first heading is included a specific mode of procedure that will be common to all investigators and likewise a specific method of recording and scoring results, so that the results from different workers may be comparable. A change in method of procedure in giving a test may alter entirely the significance of the test. As Whipple[28] has well said, "No detail in the setting of a test is too trivial to be neglected. . . . It is noteworthy that the lack of accordance between the results obtained by different investigators in the use of what is ostensibly the same test almost invariably turns out to be due to seemingly

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[24] Pintner, R., The Standardization of Knox's Cube Test. *Psych. Review*, 22: 1915, 377–401.

[25] Wallin, J. E. W., Age Norms of Psycho-motor Capacity, *J. of Educ. Psych.*, 7: 1916, 17–24.

[26] Schmitt, C., Standardization of Tests for Defective Children, *Psych. Review Monographs*, 19: 1915, No. 3.

[27] New York State Board of Charities, Eleven Mental Tests Standarized, *Eugenics and Social Welfare Bulletin*, No. V, 1915.

[28] Whipple, G. M., *A Manual of Mental and Physical Tests*, Vol. I, p. 5.

trivial variations in the method of administering the test." The second heading, the establishment of norms, includes two possibilities, either the establishing of average or median performances at each age, *i. e.*, the so-called age-norms, or the determination of performances for any number of percentile groups at each age. The former is the method adopted by Sylvester, Wallin, and Pintner in the articles mentioned above, while Woolley,[29] in her work at the Bureau of Vocational Guidance at Cincinnati, has preferred the percentile method, according to which the child is compared with children of the same age. The age-norm assigns a mental age to a child; he is either at, above or below his chronological age. His performance is compared to the average performance of another age-group. For example, a ten-year-old child may be spoken of as equalling in a test the average performance of six-year-old children. This is the method made familiar by the Binet system of mental ages. The growing criticism of this method is based upon the theory underlying the growth of intelligence in general, whereby we know that growth of intelligence does not advance by equal stages corresponding to the equal stages of chronological growth. No harm is done so long as we keep strictly to mental ages, but confusion immediately arises when results are expressed in amounts of retardation as determined by the difference between the chronological and mental ages. Trying to avoid this has led to the Intelligence-Quotient method of Stern, the Coefficient of Intelligence of

[29] Woolley, H. T., and Fisher, C. R., Mental and Physical Measurements of Working Children, *Psych. Review Monographs*, 18: pp. 247. See also Woolley, H. T., A New Scale of Mental and Physical Measurements for Adolescents and Some of Its Uses, *J. of Educ. Psych.*, 6: 1915, 521–550.

Yerkes, and the Percentile Method as suggested by Woolley. The last two methods are based upon a direct comparison of any performance with the performances of children of the same age.

The percentile method allows the comparison to be made with groups of children of the same age, since the percentile scores give us the distribution of the ability of each age-group. It is this latter method that has been used in the computation of the results of this study. At the same time, the fifty percentile gives us the norm, or average performance, for each age, so that age-norms are obtained. It is the belief of the authors that ultimately the percentile method will prevail in standardization. The drawbacks of the method at present are that we require a large number of cases at each age in order, with any degree of certainty, to mark off the percentile limits, and furthermore, we do not yet know what significance is to attached to a ten-percentile or twenty-percentile or any other percentile performance. It will not take long, however, for us to learn to think in terms of percentile abilities.

CHAPTER II

The Test

This test was devised by Healy[1] through the desire to secure one which would involve the principle of the Ebbinghaus *Combinationsmethode* and at the same time eliminate the language factor. The Ebbinghaus Completion Method is now largely used for language tests and it is proving to be one of our best methods for measuring language ability.[2] It seems also to be highly correlated with well-known tests of general intelligence. It seems reasonable to suppose that much the same sort of ability is required to complete a picture as to complete a sentence. In both cases the essential element is the noticing of something lacking in the general situation and the supplying of a missing part to complete the general scheme. In the Picture-Completion Test, however, the choice of a missing part is limited to the blocks supplied to the subject, whereas in the language-completion tests in common use the subject has the whole range of his vocabulary from which to supply the missing word. A direct analogy to the Picture-Completion Test would be a language-completion test in which the subject was supplied with a limited number of words from which he must select the word best suited to complete the sense of the sentence before him.

The material consists of a picture, brightly colored, measuring 10 by 14 inches (see Figure 1). It repre-

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[1] Healy, W., A Pictorial Completion Test, *Psych. Review*, 21: 189–203, 1914; and Healy, W. and Fernald, G. M., Tests for Practical Mental Classification, *Psych. Review Monographs*, 13: 1911, No. 54.

[2] Trabue, M. R., Completion Test Language Scales. Teachers College, 1916.

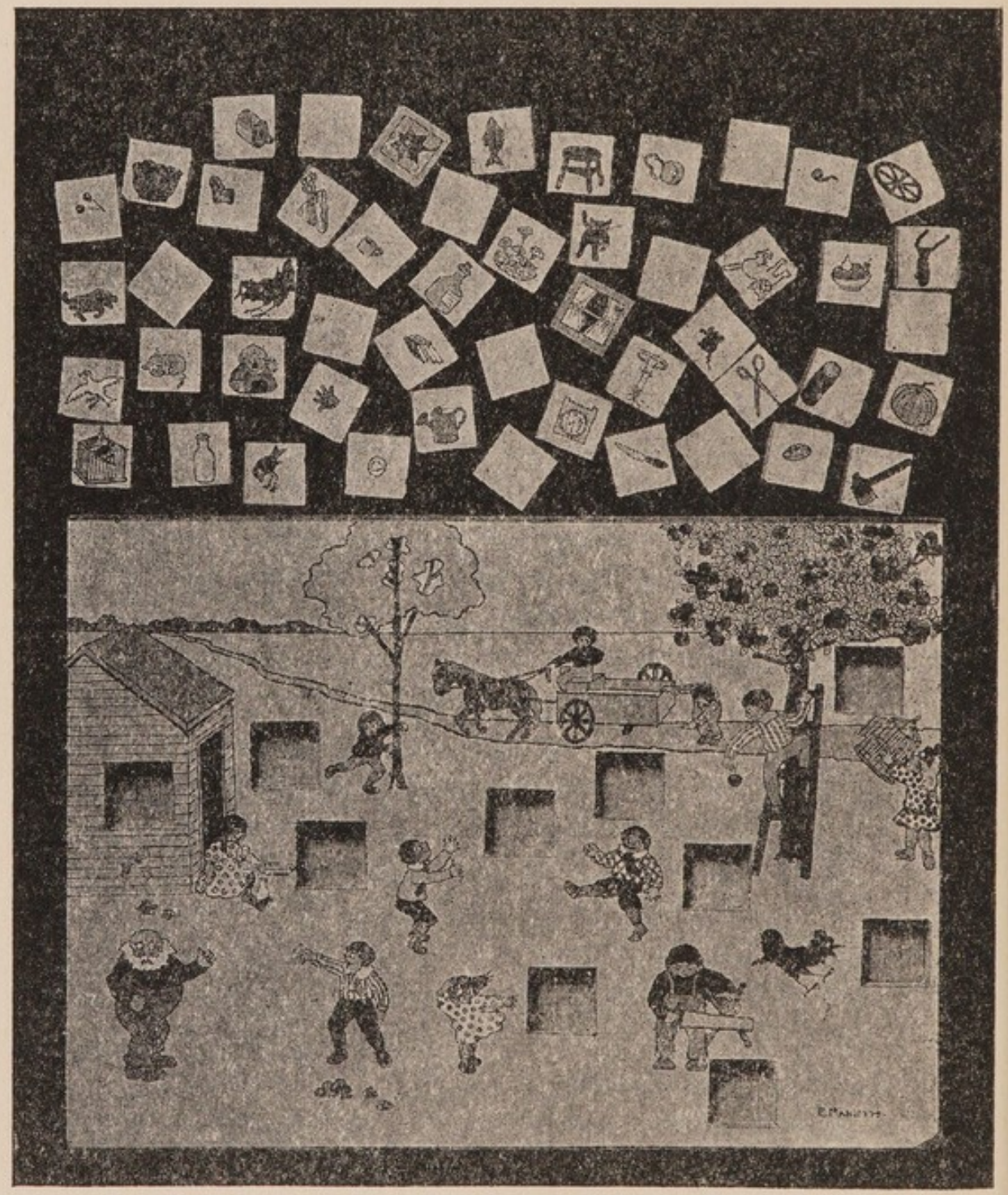

FIGURE 1

sents an outdoor, or barnyard scene in which ten simple activities are going on. There is no obvious connection between each activity, but each is of such a nature as to appeal to the childish imagination. A significant object necessary for the completion of any one of the activities is omitted and it is the task of the examinee to find the most appropriate object. For example, two boys are playing with a football, one has just kicked it into the air while the other is preparing to catch it. The significant object, the football, has been omitted and the blank space appears between the two boys. Or again, a boy is standing on a ladder plucking fruit from an apple tree and dropping it into a basket beneath. In this group the basket has been omitted.

Besides the ten most appropriate blocks there are forty others from which to choose, ten of which are blank while the others bear objects. Each aperture is one inch square, and the blocks are so cut that any one will fit in any space. No indication of the correct solution is made by the background of the picture, which is all of the same color and the same for every block. Size, shape and color of every block, then, is identical, and it remains for the subject to meet the requirements of each situation by grasping its meaning. In this way it is possible to get some measure of the child's apperceptive ability, to see how well he is able to use his past experience in meeting new situations. As this very factor corresponds in the main to the definition of intelligence given by many writers, like Binet, Burt, Stern, and others, we should expect a high correlation with general ability. The test differs from the ordinary picture-puzzle tests inasmuch as it demands a choice on the part of the child. It calls

for a choice reaction. There are fifty blocks from which to choose and the unfinished situation can be completed in a great many different ways. This gives us the possibility of measuring different degrees of adequacy in responding to the situation.

Already a fair amount of work has been done with this test. Healy himself gives the results of some five-hundred cases, including the following groups: (1) 110 children from a private school, (2) five unusually bright young children, (3) 248 juvenile delinquents, (4) 15 feeble-minded cases, (5) 95 Wellesley College students, (6) 33 psychopathic individuals, and (7) a group of unselected intelligent adults. These results, while valuable in studying various possible types of reaction, are not sufficiently representative for the establishment of norms.

Healy says that the group of exceptionally bright young children did the test quite well. Three eight-year-olds were able to do the test in less than four minutes with a perfect score. This, he says, offers "most convincing proof of the validity of the test for naive minds." Healy presents a table of his 110 normal cases arranged according to age and school grade, showing the range of total errors, the range of illogical errors and the range of time, as well as the median total errors and the median illogical errors. Because he has divided each age-group into sub-groups according to school grade, there are never more than 14 individuals in any one group. The medians, therefore, are of little value. We may say here that Healy divides his errors into two types, logical and illogical. He has selected somewhat arbitrarily ten moves which he calls logical errors and on this basis his evaluation of the performance is based. A totally different

method has been used in this study, and therefore the results are not comparable with his.

The performances of his delinquents correlated well with their apparent mentality. In speaking of the results obtained with the group of feeble-minded, the brightest members of the school at Vineland, Healy makes the following statement: "The feeble-minded group, as seen under two conditions, tally well in their extremes only. Nearly all make bad failures. It is obvious that rare individuals among them have developed the ability to apperceive such relationships as are demanded by this test, even though on other levels their mental equipment is demonstrably poor. This is as we, who observe the special abilities and disabilities of these mental defectives as well as normal persons, would expect. It is not to be anticipated that any single test can be evolved which will discriminate the feeble-minded."

An interesting factor is presented in the inferiority of the performance of the Wellesley students when compared with the school children and the higher classes of delinquents. Here we find college students with a median of two total errors, while the median for both groups of children is one. The percentage of illogical errors is 64 in the Wellesley group, which is noticeable in comparison with 50 per cent. at the private school and approximately 36 per cent. with the delinquents. These college records, which were secured by Eleanor Gamble, of Wellesley, seem to show that this sort of test may not be reliable when applied to adults whose more varied experience leads to an unlimited number of complex responses which could not be evaluated by the method of scoring used by Healy.

The psychopathic cases tested displayed the expected variability, and Healy suggests the idea that

the test might become of possible use in diagnosing the various types of insanity by observing the method of procedure and peculiar reactions displayed by such individuals.

In concluding his article Healy says: "We evidently have in our completion picture a test for ability primarily adapted to the child type of mind. Every detail of the meaning has proved to be understandable even by morons. The performance of naive individuals of ordinarily good intelligence above ten years of age should be better than in five minutes, and not more than one 'illogical' and two total errors should be made. A worse record than this should arouse suspicion of defect in mental ability." It is only in this way, therefore, that Healy has standardized the test. A presentation of our results worked out according to Healy's method is given in Chapter VIII.

Work with the test has also been carried out by the New York State Board of Charities[3] with different groups of subjects. In all, 659 cases were examined, but this included only 180 public-school children; the others were from various corrective and protective institutions. Such results are interesting for comparison, but not essential for purposes of standardization. A summary, nevertheless, may be given here. Practically the same method of procedure was employed in this investigation as in Healy's, that is, the kind and number of errors were recorded and notes were made upon the method of work and the kind of reasoning used by the subjects. Perhaps the most significant table for our purpose is that showing the results of the public-school children. The following shows

[3] New York State Board of Charities, Eleven Mental Tests Standardized, *Eugenics and Social Welfare Bulletin*, No. V, 1915.

the average number of errors for thirty children at each age:

Age	7	8	9	10	11	12
Av. No. errors	7.2	5.4	3.3	3.8	3.0	3.8

A comparison of these results with ours is given in Chapter VIII. Here it is indicated that Healy's norms are too high, since his standard allows only two errors at age 10. Here, however, we find the average number of errors at 10 years to be 3.8, and not even at 12 years does the average fall as low as two.

These results and the results of our own cases indicate clearly the necessity for a more complete standardization and a more critical study as to the best method of evaluating the performance.

CHAPTER III

The Method of Procedure and the Subjects Tested

The Procedure

As Healy says, this is a test easy of presentation. It appeals to the child's interest, which goes far toward eliminating such disturbing factors as fear and self-consciousness. The child likes to do it, and the whole performance is not so long that the task loses its charm and fascination. While the subject is at work the examiner has ample time to study his general attitude and to observe any lack of coördination or serious want of poise that may be evident.

The picture should be placed directly in front of the child with the fifty blocks arranged haphazardly above it as shown in Figure 1. It was found that a few words of explanation should precede the performance. In this investigation the same instructions were given to every subject from the five-year through the adult group. Each was told to look at the picture carefully and see what was happening, or what the people were doing, or what activities were going on. Further, he was informed that any of the blocks was just the right size to fit in any of the spaces, but that, since there were more blocks than spaces, he must select the ones which seemed to him to be the very best with which to finish the picture. In order to make certain that the directions were fully comprehended, questions were asked about one group until the situation was perfectly understood. Like Healy, we have taken for an example the wagon group as being one of the simplest of the ten and we have kept rather closely to his words. The examiner says to the

child: "Look at this picture and see what is happening, look what the people are doing. You are to fill in these empty spaces so as to make the picture look right, so as to make the best sense. Any of these blocks up here will fit into any of these spaces. Choose those which seem to you the best, those which will make the best picture." Then, pointing to the wagon group, "What is the man looking for? What is gone?" If the answer is "the wheel," then he says to the child: "That's fine. Find the wheel among the other blocks and put it in." If the correct response is not given, he prompts the child; if that is not successful, he explains to him more fully the situation and tells him to find the wheel and put it in. The correct answer is, however, generally forthcoming and the child is told: "Do the others in the same way as carefully and as quickly as possible." The factor of speed is not emphasized, but it is always mentioned. When every space is filled and the subject looks up, or otherwise indicates that he has finished, the experimenter says: "Now look it over carefully. See if every block suits you. See if it is exactly as you want it and then tell me when you have finished." The time was taken when the child indicated he had finished and also after he had been allowed to make corrections.

An exact record was kept of every move made by the examinee. Although the recording would seem at first somewhat complex, it is really quite simple. At the top of the record sheet were written the names of the nine spaces; the tenth was disregarded since it is used as an illustration. As each block is put in, its name is recorded under the proper heading unless it happens to be the right block, which is then denoted by a check mark. If changes are made, they, too, are, of course, recorded. If a change is made after the

examiner has told the child to look over the picture carefully, *i. e.*, during the last phase of the test, then this is noted on the record blank by a horizontal line in the space where the change is made. Under this horizontal line the change is recorded. A sample record appears thus:

Name	B. Window	Dog	Cat	Football	Hat
Age and grade..	C. Wind.	V	D. Cat V	Baseball V	V

	Basket	Log	Chicken	F. Bird
	Bucket Cherries	V	V	S. Bird V

This sample record is to be read as follows: The Curtain-Window block was put in the Broken-Window space; the Dog block, *i. e.*, the right block, was put in the Dog space; the D. Cat (departing cat) block was put in the Cat space and this was later on changed for the right block; the Baseball block was put in the Football space and this was later changed for the Football block, *i. e.*, the right block; the right block was put in the Hat space; the Bucket block was put in the Basket space and in the second phase of the test, when the child was given an opportunity to make changes, the Cherries block was substituted for the Bucket block in the Basket space; the Log and Chicken spaces were filled in correctly; the S. Bird (standing bird) block was put in the Flying-Bird space and in the second phase of the test changed for the right block. The two horizontal lines show us that the child made two changes in the second phase of the test.

In almost every respect this method is identical with that of Healy, with the exception that no record is made in this procedure of the order in which the spaces are filled.

The Subjects

In all, 1538 presumably normal individuals were tested. This number, we feel, should be fairly representative, and the results of an investigation with such a group should approach a normal distribution. The children who served as subjects were pupils in the Columbus public schools; the adults were in the main university students.

In selecting the schools care was taken that they should lie in districts which would represent different social classes, in order that the children tested at each age should be representative of all children of that age. Two schools were in communities where the majority of the children came from the homes of professional and prosperous business men; one was in a lower middle class district, and a fourth in a part of the city where the majority of the children came from very poor families, and here, too, was found a colored and a foreign element.

TABLE I.

Number of Subjects Tested

	SCHOOLS				
Age	Better Class	Middle Class	Poorer Class	Additional	Total
5	18	2	0		20
6	99	17	34		150
7	84	25	41		150
8	82	41	27	2	152
9	66	36	48		150
10	68	42	40		150
11	74	41	35	5	155
12	88	35	27		150
13	109	20	21		150
14	70	18	12	9	109
15	35	8	7	2	52
16–18	14	2	2		18
Ad.					132
				Total.....	1538

The ages of the subjects ranged from five to fifteen years, inclusive. The number tested at each age is shown in Table I. The second column shows the number of children in the better-class schools; the third column the number in the middle-class school, and the fourth column in the poorest school. The next column gives a few additional cases that were not used in the determination of the method of scoring, because they were collected after this part of the work was completed; they are included, however, in the distribution of scores for each age and thus enter into the determination of the medians and percentiles. The last column shows the total number of individuals in each age-group. It will be noted that there are only eighteen cases between the ages of sixteen and eighteen. Since the number of these cases was so small, and since a great many of them were extremely retarded pupils in the grades, it was decided that they were not representative of any of these ages, and therefore their records have been omitted entirely in this work. This gives us a total of 1520 cases upon which the medians and percentiles are based. The small number of cases at Age 5 makes the norms for this age somewhat less reliable. We may say here that the usual difficulty in securing 14- and 15-year-old children was encountered. It was felt that the subjects at those ages found in the grade schools would probably be considered retarded pupils. Consequently, permission was obtained to get an equal number at those ages from one of the junior high schools in a good residential section of the city. These children, being probably slightly accelerated, would tend to balance any possible retardation of those in the grades. An equal number of unselected children was tested at every age from six up to and including thirteen, which increases the reliability of comparisons between these ages.

The adults, as mentioned above, were mainly university students who had volunteered to act as observers in a series of experiments, but the others were unselected, presumably normal persons who could be prevailed upon by the examiner to take part in the experiment with a fair amount of seriousness. As Healy has pointed out, this is not a test adapted to the adult mind. Not only is there evident that tendency toward lack of seriousness among adults when taking tests, and especially this kind of performance test, but also the simple nature of the picture calls forth from mature individuals all sorts of criticisms which never seem to trouble the child. The nature of the drawing, with its lack of perspective, and the somewhat exaggerated, though simple, situations present difficulties and possibilities to the adult which sometimes make his performance little superior to the performance of the child.

The conditions prevailing while this test was being given were practically ideal. The test was given to the children individually in a room where the examiner only was present. If a third person chanced to come in and the performance of the child seemed to be influenced in any way, that record was cast out. Each child was made to feel at ease, and without exception, unless it was among the five-year-olds, the problem was attacked with interest and without self-consciousness. There seemed to be great demand in every grade to be allowed to be the next one to "do the puzzle."

With such a large number of cases and such a short task, it would have been impractical to have limited the giving of the test to any particular hour of the day. The experiment was, therefore, performed during the regular morning and afternoon school sessions.

CHAPTER IV

The Results

As has been described, a complete record was taken of every move made by the subjects in completing the picture. A portion of the record sheet has been shown in the previous chapter. After working with the test, one becomes impressed with the inadequacy of the method of scoring used by Healy and other previous users of the test. Healy says: "The errors are obviously of two kinds, rational and irrational." That may be perfectly true, but after considerable experimentation it was found that individuals differed decidedly as to what should be called logical and what illogical. It was decided, therefore, to abandon any attempt to determine *a priori* what moves are logical and what illogical and to base the method of scoring upon the frequency with which the moves were actually made. To this end, the first tabulation of the results was made on large sheets that showed the number of times any one position occurred. These numbers were then converted into percentages and transferred to other sheets to show the percentages for each possible position at each age. A record of these percentages is given in Tables II to XLII.[1]

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[1] In these tables and in the text the following abbreviations for the names of the blocks and spaces will be used: Broken Window=B. Wind; Curtained Window=C. Wind; Football=F. Ball; Baseball=B. Ball; Flying Bird=F. Bird; Departing Cat=D. Cat; Sleeping Cat=S. Cat; Milk Bottle=M. Bottle; Sprinkling Can=S. Can.

TABLE II.

Broken Window

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.	15.0	12.6	25.3	24.0	38.7	44.6	50.0	52.6	52.6	52.0	60.0	51.6	39.9
Dog.....		5.3	6.7	0.7		0.7			0.7				1.5
Cat.....			1.3	0.7									0.2
Football.		1.3		0.7									0.2
Hat.....	5.0	1.3	0.7					1.3					0.4
Basket ..		1.3	0.7										0.2
Log.....		0.7	1.3	2.0									0.5
Chicken .			0.7										0.1
F. Bird..				2.0		0.7		0.7					0.3

TABLE III.

Dog

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		2.0	0.7										0.3
Dog.....	15.0	20.0	30.0	50.6	60.0	70.0	73.5	86.0	82.6	80.0	88.0	78.0	62.7
Cat.....	5.0	4.6	2.7	2.0			0.7						1.1
Football.		4.0	1.3	0.7	0.7			0.7	0.7		2.0		0.9
Hat.....	5.0	2.0	3.3	4.0		2.0	2.6				2.0	1.1	1.7
Basket ..		0.7				0.7	0.7						0.2
Log.....		0.7	0.7		0.7								0.2
Chicken .		4.0	3.3		2.0	0.7	0.7	1.3					1.2
F. Bird..			0.7	0.7									0.1

TABLE IV.

Cat

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		0.7											0.1
Dog.....	5.0	4.0	2.7	2.6	2.7	1.3	1.3	1.3	3.3	2.0	2.0	3.3	2.4
Cat.....	10.0	21.3	25.3	44.6	47.4	50.0	62.0	60.6	58.7	65.0	60.0	69.2	49.1
Football.		3.3	1.3	0.7	0.7	0.7		0.7					0.7
Hat.....	5.0	3.3	5.3	4.0	2.0	2.0	2.6	2.6	2.7	2.0		1.1	3.0
Basket ..		3.3	0.7	0.7		0.7	0.7						0.6
Log.....		1.3	1.3	1.3									0.4
Chicken .		5.3	4.0	4.6	3.3	4.6	2.6	2.0	4.7	2.0	2.0	2.2	3.5
F. Bird..			2.0		0.7			0.7	0.7				0.4

TABLE V.

Football

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		0.7					0.7						0.1
Dog.....		2.0	0.7			0.7							0.3
Cat.....					0.7								0.1
Football.	10.0	12.6	22.6	44.0	52.0	57.3	53.4	52.0	64.6	60.0	70.0	59.4	47.7
Hat.....		2.0	2.0	0.7	1.3								0.6
Basket ..		1.3		1.3	0.7				0.7	1.0			0.4
Log.....		1.3	0.7		0.7								0.3
Chicken .						0.7							0.1
F. Bird..	5.0							0.7					0.1

TABLE VI.

Hat

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		0.7		0.7									0.1
Dog.....		2.6	2.0		1.3								0.6
Cat.....		1.3	2.0	0.7				0.7					0.4
Football.		2.0	2.7	2.0									0.7
Hat.....	10.0	18.7	38.0	46.6	64.0	68.6	70.0	72.6	82.6	88.0	84.0	80.3	61.3
Basket ..			0.7										0.1
Log.....		0.7											0.1
Chicken .				0.7									0.1
F. Bird..		1.3	1.3										0.3

TABLE VII.

Basket

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.			0.7	0.7									0.1
Dog.....		1.3	0.7	1.3									0.3
Cat.....		4.6	1.3	0.7		0.7	0.7		0.7				0.9
Football.		5.3	2.0	0.7				1.3	1.3				1.0
Hat.....		2.6	1.3										0.4
Basket ..	30.0	37.4	53.3	64.0	77.3	78.6	80.0	84.0	88.1	87.0	86.0	85.8	72.6
Log.....	5.0		2.0				0.7						0.3
Chicken .	5.0	5.3	2.7	1.3	0.7	0.7				1.0			1.3
F. Bird..	15.0	7.3	3.3	4.6	2.0	4.6	0.7	1.3	1.3	1.0	4.0	1.1	3.0

TABLE VIII.

Log

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.			0.7										0.1
Dog.....		0.7	0.7										0.1
Cat.....		1.3	1.3		0.7								0.3
Football.	5.0												0.1
Hat.....	5.0	0.7	1.3										0.3
Basket ..													
Log.....	30.0	32.0	40.6	68.0	82.6	88.6	88.0	92.0	93.4	93.0	96.0	95.6	76.2
Chicken .		2.0	0.7										0.3
F. Bird..		2.6											0.3

TABLE IX.

Chicken

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		1.3	0.7										0.2
Dog.....			2.0	0.7	1.3	1.3	0.7		0.7				0.7
Cat.....	5.0	3.3	5.3	4.0	2.7	2.0	4.0	1.3	6.7	4.0	4.0	1.1	3.5
Football.		0.7	1.3	1.3									0.3
Hat.....		3.3	2.7	4.6	2.0	1.3	0.7	0.7	0.7	1.0		2.2	1.8
Basket ..	5.0	2.0	2.7	0.7	0.7				0.7				0.8
Log.....	5.0	4.0	0.7	0.7									0.6
Chicken .	45.0	35.3	53.3	52.0	68.7	72.0	80.7	84.8	84.6	82.0	88.0	90.1	69.5
F. Bird..		2.6	0.7	1.3	0.7	0.7	0.7				2.0		0.7

TABLE X.

Flying Bird

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.			1.3										0.1
Dog.....		0.7	2.0	0.7		2.0		1.3	0.7		2.0	1.1	0.9
Cat.....		4.6	1.3	2.0	4.7	2.6	2.0		1.3	3.0	4.0		2.2
Football.	5.0	3.3	2.7		0.7	2.0	2.0	0.7	0.7	1.0	2.0	1.1	1.6
Hat.....	10.0	2.0	2.7		4.7	2.0	1.3	0.7	1.3				1.6
Basket ..		1.3	1.3	1.3									0.5
Log.....		2.0		0.7									0.3
Chicken .		1.3		0.7	2.7	2.0	1.3	2.0	2.7	4.0			1.6
F. Bird..	15.0	18.7	29.3	38.7	45.3	46.0	55.4	52.0	60.0	66.0	58.0	73.6	46.1

TABLE XI.

Standing Bird

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		0.7											0.1
Dog.....	5.0	4.0	1.3	2.0	2.0	2.6	2.0	2.0					1.7
Cat.....		1.3	0.7	2.6	3.3	4.6		3.3	0.7	4.0		1.1	2.0
Football.		3.3				1.3		0.7	0.7				0.6
Hat.....		2.0		1.3	0.7	0.7	2.0					1.1	0.7
Basket ..		0.7		1.3									0.2
Log.....		1.3		1.3									0.3
Chicken .	10.0	5.3	2.0	4.0	3.3	2.6	0.7	2.6	1.3				2.2
F. Bird..	10.0	14.7	25.3	23.3	32.7	32.7	36.0	30.6	27.4	24.0	26.0	22.0	26.9

TABLE XII.

Curtained Window

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.	35.0	47.3	54.0	58.7	50.6	49.3	41.4	42.6	42.6	42.0	38.0	44.0	47.1
Dog.....		1.3	1.3	0.7					0.7				0.4
Cat.....		1.3											0.1
Football.			0.7										0.1
Hat.....		1.3	1.3				0.7						0.3
Basket ..		0.7											0.1
Log.....		1.3					0.7						0.1
Chicken .		0.7	0.7										0.1
F. Bird..			2.0	2.0	0.7	0.7	0.7	1.3	0.7				0.8

TABLE XIII.

Departing Cat

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.													
Dog.....	5.0	3.3	3.3	4.7	5.3	1.3	4.0	0.7	2.7	6.0		1.1	3.1
Cat.....		10.0	9.4	10.7	10.7	13.3	7.3	10.0	8.7	7.0	10.0	20.8	10.5
Football.		1.3	0.7										0.3
Hat.....	5.0	4.6		0.7		0.7	0.7		0.7		4.0	1.1	1.1
Basket ..			2.0	1.3	0.7			1.3					0.7
Log.....													
Chicken .		1.3	2.7	2.0	3.3	0.7	1.3	2.6	0.7	2.0	2.0	1.1	1.7
F. Bird..		1.3	0.7										0.2

TABLE XIV.

Sleeping Cat

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.													
Dog.....		1.3	1.3		0.7	1.3	0.7						0.5
Cat.....		2.0	1.3	3.3	1.3	4.0	6.0	3.3	3.3	2.0	8.0		3.0
Football.		1.3	1.3										0.3
Hat.....		2.0	0.7		0.7								0.3
Basket..	5.0	0.7		1.3									0.3
Log.....		2.6		0.7			0.7						0.4
Chicken.	5.0	3.3	1.3		0.7	0.7	2.0					1.1	0.9
F. Bird..			1.3	0.7			0.7	0.7					0.3

TABLE XV.

Baseball

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.	5.0				0.7				0.7				0.2
Dog.....		1.3		0.7		0.7			0.7	2.0			0.5
Cat.....		0.7											0.1
Football.	20.0	19.3	30.6	31.3	32.0	29.3	35.4	39.4	27.4	33.0	24.0	33.0	30.6
Hat.....		0.7	1.3	1.3	0.7			1.3					0.5
Basket..			1.3							1.0			0.2
Log.....		0.7	0.7	0.7				1.3					0.3
Chicken.		0.7		0.7	0.7								0.2
F. Bird..			0.7										0.1

TABLE XVI.

Baby

Age	5	6	7	8	9	10	11	12	13	13	15	Ad.	Total
B. Wind.		2.6	0.7			0.7	0.7			1.0			0.5
Dog.....	10.0	5.3	3.3	5.3	6.0	2.6	4.6	2.0	0.7	1.0		2.2	3.4
Cat.....	10.0	2.6	5.3	8.7	6.7	8.0	6.7	8.0	7.3	4.0	6.0	2.2	6.2
Football.		1.3	4.0	1.3			0.7			1.0			0.8
Hat.....	5.0	3.3	3.3	7.3	6.7	6.0	5.3	4.6	0.7	4.0	2.0	3.3	4.5
Basket..		2.6		1.3		2.0	2.6		0.7		2.0		1.0
Log.....		2.6		1.3			1.3						0.5
Chicken.		3.3	5.3	2.6	1.3	3.3			1.3	1.0		2.2	1.9
F. Bird..		0.7	1.3										0.3

TABLE XVII.

Hatchet

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.													
Dog.....	5.0	2.0	2.7	4.6	2.7		0.7	1.3	0.7	3.0		1.0	1.8
Cat.....													
Football.	5.0	3.3		1.3									0.6
Hat.....		4.6	1.3	0.7	0.7	0.7	0.7						0.9
Basket ..	10.0	4.6	2.7	1.3	1.3		1.3		0.7				1.4
Log.....	10.0	16.0	22.0	6.7	7.3	6.7	5.3	3.3	4.7	4.0		3.3	8.0
Chicken .	5.0	1.3	2.0	4.0	0.7	4.0	2.6	0.7	0.7	1.0	2.0	1.1	2.0
F. Bird..													

TABLE XVIII.

Mouse

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		2.0											0.2
Dog.....		4.6	5.3	2.0	2.7	0.7	1.3	0.7	2.7	1.0			2.1
Cat.....	5.0	0.7	1.3	0.7	0.7	0.7				1.0			0.5
Football.		0.7	1.3					0.7					0.3
Hat.....	5.0	1.3	4.0	4.0	1.3	4.0	2.6	5.3	2.0		6.0	2.2	3.2
Basket ..		2.0		1.3	0.7								0.4
Log.....		2.0	0.7										0.3
Chicken .		0.7	2.0	5.3	1.3	2.0	1.3			2.0		1.1	1.5
F. Bird..		1.3		1.3			0.7	0.7					0.4

TABLE XIX.

Cage

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		2.6	2.0	4.0		0.7	1.3	2.6	0.7	1.0		1.1	1.5
Dog.....		2.6	2.0	1.3	1.3	2.0	1.3				2.0		1.2
Cat.....		2.0	5.8	0.7	0.7	0.7		0.7		1.0			1.2
Football.	5.0	2.0	0.7	2.0	1.3	0.7	1.3	0.7	1.3				1.1
Hat.....		2.0	2.0	0.7	0.7	0.7	0.7	0.7	2.0	1.0			1.0
Basket ..	5.0	2.0	0.7	0.7	0.7	0.7							0.5
Log.....		0.7	1.3				0.7						0.3
Chicken .		5.3	3.3	4.0	1.3	1.3	0.7	0.7					1.7
F. Bird..	25.0	30.0	14.7	15.3	10.7	7.3	2.6	4.6	8.7	3.0	4.0	3.3	10.5

TABLE XX.

Blank

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.	15.0	7.3	7.3	6.0	4.0	0.7	2.0		2.0	1.0			3.2
Dog.....	15.0	4.0	3.3	3.3	7.3	0.7	3.3	2.6	0.7	1.0	4.0	3.3	3.2
Cat.....	5.0	2.0	3.3	1.3	2.0	1.3	1.3	0.7			2.0		1.3
Football.	10.0	2.0	2.0		2.0	0.7						1.1	0.9
Hat.....	5.0	1.3	1.3	1.3	1.3	1.3	0.7	2.0	1.3		2.0	2.2	1.4
Basket ..	5.0		3.3	0.7	1.3	2.0		1.3		1.0	2.0	1.1	1.2
Log.....	5.0	0.7	1.3	3.3	2.7	0.7	0.7	1.3	0.7	3.0	2.0		1.5
Chicken .	5.0	0.7	2.0	1.3	2.0					1.0	4.0	1.1	0.9
F. Bird..	5.0	2.0	2.7	2.0		2.6		0.7		1.0	2.0		1.2

TABLE XXI.

Clock

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		5.3	2.0	0.7	0.7	1.3	0.7		1.3				1.2
Dog.....	10.0	2.6	2.7	1.3		0.7							0.9
Cat.....	10.0	0.7											0.2
Football.		3.3	1.3			0.7							0.5
Hat.....		3.3			0.7					1.0			0.4
Basket ..		0.7	0.7	2.0	0.7								0.4
Log.....		2.6	2.0										0.5
Chicken .	5.0	0.7	0.7	0.7									0.3
F. Bird..		0.7		0.7									0.1

TABLE XXII.

Sprinkling Can

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		0.7											0.1
Dog.....	5.0			0.7	0.7	0.7						1.1	0.3
Cat.....		0.7				0.7				1.0			0.2
Football.		1.3											0.1
Hat.....		1.3	2.0	2.6	0.7								0.7
Basket ..		1.3	1.3				1.3						0.4
Log.....		1.3	0.7				0.7	0.7	0.7				0.3
Chicken .		2.6	2.0										0.6
F. Bird..													

TABLE XXIII.

Glove

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		1.3											0.1
Dog.....				0.7									0.1
Cat.....		0.7	0.7	0.7				0.7	0.7				0.3
Football.		0.7	1.3		0.7	0.7	0.7					1.1	0.5
Hat.....		0.7	0.7	0.7	0.7	0.7			1.3				0.5
Basket ..		0.7	0.7		0.7								0.3
Log.....	5.0	0.7	0.7										0.3
Chicken .			0.7							2.0			0.1
F. Bird..													

TABLE XXIV.

Bottle

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.	5.0	2.6											0.3
Dog.....		1.3	0.7	0.7	0.7		0.7	0.7	0.7	1.0			0.6
Cat.....	5.0	4.0	0.7	0.7		0.7	0.7						0.7
Football.	5.0	2.0	1.3		0.7								0.5
Hat.....	5.0	2.0										1.1	0.3
Basket ..		0.7											0.1
Log.....		0.7	0.7										0.1
Chicken .	5.0	0.7	1.3										0.3
F. Bird..													

TABLE XXV.

Milk Bottle

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Toral
B. Wind.			0.7	1.3		0.7	0.7						0.3
Dog.....		3.3	1.3	1.3	0.7								0.7
Cat.....	5.0	10.0	9.4	4.6	5.3	1.3	2.6	5.3	7.3	5.0		4.4	5.5
Football.		1.3	1.3										0.3
Hat.....	5.0	0.7	2.0	0.7									0.4
Basket ..			0.7										0.1
Log.....	10.0	0.7	0.7										0.3
Chicken .			0.7	0.7					0.7				0.2
F. Bird..		0.7											0.1

TABLE XXVI.

Cup

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.	5.0	0.7	0.7										0.2
Dog.....		2.0	0.7			0.7							0.3
Cat.....	15.0	2.0	2.0	2.0	1.3	2.6	0.7	1.3		1.0			1.8
Football.	5.0	0.7	0.7										0.1
Hat.....		1.3		0.7									0.3
Basket ..		2.0	1.3		0.7								0.3
Log.....		1.3	0.7										0.3
Chicken .		0.7	0.7	0.7	0.7								0.4
F. Bird..	5.0		0.7										0.2

TABLE XXVII.

Shoe

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.													
Dog.....		2.6	2.6	1.3		2.0	0.7		0.7	1.0			1.1
Cat.....		1.3	0.7	0.7	1.3								0.4
Football.			0.7			0.7							0.1
Hat.....		1.3	0.7	1.3									0.3
Basket ..	5.0	2.0	0.7			0.7		0.7					0.5
Log.....		2.0											0.3
Chicken .		0.7	1.3	0.7									0.3
F. Bird..	5.0												0.1

TABLE XXVIII.

Flowers

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.	5.0	0.7	0.7	0.7	1.3	0.7	0.7			2.0			0.7
Dog.....		2.6	2.7	1.3	0.7	1.3	0.7	0.7		1.0			1.1
Cat.....		2.0	0.7	1.3	0.7	0.7			0.7				0.6
Football.		4.0			0.7								0.5
Hat.....		2.0	2.0	0.7	0.7	0.7	1.3		0.7	1.0			0.9
Basket ..													
Log.....	5.0		0.7	0.7									0.2
Chicken .		0.7	1.3							1.0			0.3
F. Bird..		2.0	1.3	0.7									0.1

TABLE XXIX.

Pumpkin

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.	5.0	1.3											0.2
Dog.....		3.3	1.3	1.3									0.6
Cat.....		0.7	2.0	0.7	1.3	0.7		0.7					0.7
Football.	15.0	2.6	6.0	2.0	2.0	0.7	0.7	2.0				1.1	1.9
Hat.....	5.0	2.6	2.0	1.3	2.7	1.3	0.7		0.7				1.2
Basket ..	5.0	3.3	2.0	1.3									0.7
Log.....		3.3	2.0	3.3	0.7								0.9
Chicken .		4.6	0.7	0.7	0.7		0.7		0.7		2.0		0.8
F. Bird..	5.0		1.3	0.7									0.3

TABLE XXX.

Candle

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		2.6		1.2	2.0	0.7	0.7					2.2	0.9
Dog.....	5.0	2.6		0.7									0.4
Cat.....			0.7		0.7		0.7						0.2
Football.		2.0	0.7	2.0									0.5
Hat.....		2.6	1.3	1.3	0.7		0.7						0.7
Basket ..			0.7										0.1
Log.....		0.7	1.3	0.7									0.3
Chicken .													
F. Bird..		2.6											0.3

TABLE XXXI.

Fish

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.					0.7								0.1
Dog.....		2.6	0.7										0.4
Cat.....	5.0		0.7	0.7	0.7	0.7							0.4
Football.		1.3					0.7						0.2
Hat.....	5.0	4.0	2.0										0.7
Basket ..	5.0	0.7				0.7							0.2
Log.....		2.0	1.3										0.3
Chicken .		4.0	0.7	2.0	0.7								0.9
F. Bird..		0.7	0.7	0.7		0.7			0.7				0.3

TABLE XXXII.

Knife

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.			0.7										0.1
Dog.....			0.7										0.1
Cat.....		0.7	2.0	0.7	0.7	0.7	0.7		0.7				0.6
Football.		1.3											0.1
Hat.....		0.7											0.1
Basket ..		0.7	1.3	0.7									0.3
Log.....	10.0	2.6		0.7	1.3								0.6
Chicken .				1.3		0.7							0.2
F. Bird..													

TABLE XXXIII.

Fruit

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		1.3	0.7		0.7		0.7						0.3
Dog.....		0.7	0.7		0.7	0.7							0.3
Cat.....	5.0	5.3	2.7	1.3	2.7	1.3	2.0	1.3	1.3	1.0	2.0	1.1	2.1
Football.		3.3	0.7	0.7	1.3	0.7		0.7					0.7
Hat.....	5.0	1.3	2.0										0.4
Basket ..	5.0	2.0	2.0			0.7	0.7		0.7				0.7
Log.....		1.3	0.7			0.7							0.3
Chicken .		1.3	0.7	2.0		0.7		0.7		2.0			0.6
F. Bird..		0.7	0.7			0.7							0.2

TABLE XXXIV.

Cherries

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.													
Dog.....		1.3	2.0	1.3	0.7	1.3							0.7
Cat.....	5.0	0.7											0.1
Football.		4.0	4.0	4.0	2.7	4.0	3.3		2.0	4.0	4.0	3.3	3.0
Hat.....		1.3											0.1
Basket ..	10.0	15.3	12.7	14.7	10.7	9.3	6.0	10.0	4.0	8.0	8.0	9.9	10.0
Log.....			0.7									1.1	0.1
Chicken .		2.6	2.6	6.7	4.7	3.3	2.0	1.3	1.3	1.0			2.6
F. Bird..	5.0	3.3	6.0	4.6	6.0	3.3	2.0	5.3	1.3	5.0	4.0		4.0

TABLE XXXV.

Stool

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		1.3					0.7				2.0		0.3
Dog.....	10.0	3.3	6.0	1.3	0.7	2.6	2.0		0.7		2.0		1.9
Cat.....	5.0	2.6	5.3	2.0	2.0	0.7	1.3	1.3	1.3	1.0	4.0		1.9
Football.		0.7		0.7									0.1
Hat.....		2.6	0.7	1.3	0.7	0.7							0.6
Basket ..		2.0	1.3	0.7	0.7	1.3	2.6	1.3	2.0	1.0			1.3
Log.....	5.0	4.0	7.3	6.7	3.3	2.6	0.7	2.0	1.3				2.9
Chicken .	5.0	1.3		0.7									0.3
F. Bird..		1.3	0.7		0.7			1.3					0.3

TABLE XXXVI.

Purse

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.													
Dog.....				0.7									0.1
Cat.....		1.3	1.3			0.7							0.3
Football.		1.3	2.0				0.7						0.4
Hat.....	5.0	5.3	4.7	2.6	4.7	4.0	5.3	2.0	2.0	2.0		2.2	3.5
Basket ..													
Log.....	5.0	0.7	0.7				0.7						0.3
Chicken .		0.7											0.1
F. Bird..		0.7	0.7										0.1

TABLE XXXVII.

Books

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.	5.0	0.7	0.7										0.3
Dog.....	10.0	2.0	0.7	1.3	1.3		2.0	0.7	1.3				1.1
Cat.....		1.3	1.3		0.7	0.7	0.7		0.7				0.5
Football.		1.3	3.3	1.3	2.7	0.7		0.7	1.3	1.0			1.2
Hat.....	5.0	2.6	2.0	3.3	0.7	0.7	0.7	2.6	0.7				1.5
Basket ..		2.0		0.7	0.7		0.7	0.7	0.7			1.1	0.6
Log.....			1.3										0.1
Chicken .	10.0	1.3											0.3
F. Bird..				0.7									0.1

TABLE XXXVIII.

Bucket

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.													
Dog.....		0.7	1.3	2.6									0.5
Cat.....		0.7	1.3	2.0		0.7							0.5
Football.		0.7		0.7			0.7	0.7					0.3
Hat.....		2.0	1.3		0.7	0.7	0.7		0.7				0.6
Basket ..		4.0	4.7	2.6	2.6		2.0	0.7	2.0	1.0	2.0	2.2	2.4
Log.....		0.7	0.7			2.0							0.1
Chicken .													
F. Bird..	5.0	2.6											0.3

TABLE XXXIX.

Tie

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.													
Dog.....			2.0	1.3	0.7	1.3							0.6
Cat.....		1.3	0.7										0.2
Football.	5.0		0.7										0.1
Hat.....		2.0	1.3	2.6	0.7	1.3		1.3				1.1	1.0
Basket ..	5.0	0.7											0.2
Log.....		1.3		0.7									0.2
Chicken .		1.3	0.7	0.7	1.3		2.0						0.7
F. Bird..		1.3											0.1

TABLE XL.

Scissors

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.		0.7		1.3									0.2
Dog.....		1.3	1.3										0.3
Cat.....	5.0		0.7										0.2
Football.	5.0												0.1
Hat.....	5.0		1.3	1.3									0.3
Basket ..	5.0	0.7				0.7							0.2
Log.....	5.0	2.0	0.7										0.3
Chicken .													
F. Bird..		0.7		0.7									0.1

TABLE XLI.

Pipe

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Total
B. Wind.	5.0												0.1
Dog.....													
Cat.....					0.7								0.1
Football.	5.0	0.7	0.7				0.7						0.3
Hat.....				1.3									0.1
Basket..		0.7	0.7										0.1
Log.....		1.3	2.6		0.7								0.5
Chicken.				0.7		0.7	0.7	0.7					0.1
F. Bird..			0.7										0.1

TABLE XLII.

No Block

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.	Toral
B. Wind.			0.7	0.7	0.7	0.7		2.0	1.0			1.1	0.6
Dog.....		0.7	1.3	0.7		0.7	0.7					1.1	0.5
Cat.....													
Football.													
Hat.....		0.7	0.7									1.1	0.2
Basket..							0.7						0.1
Log.....			1.3	0.7									0.2
Chicken.		0.7											0.1
F. Bird..			0.7										0.1

The tables show the percentages for each one of the 41 blocks for each age-group. The horizontal rows give the name of the spaces and the vertical columns the percentages at each different age. Table II for the B. Wind. block shows every position in which this block was placed and the percentage of cases in which it was placed in such position at each age. The table is to be read as follows: the B. Wind. block was placed in the B. Wind. space (*i. e.*, the correct position) by 15 per cent. of the five-year-olds, by 12.6 per cent of

the six-year-olds, by 25.3 per cent of the seven-year-olds, and so on. Continuing to Line Two, we note that the B. Wind. block was placed in the space for the dog by 5.3 per cent of the six-year-olds, by 6.7 per cent of the seven-year-olds, by 0.7 per cent of the eight-year-olds, and so on. The last vertical column headed "Total" gives the results for the combination of all the age-groups and includes 1479 cases. The percentages do not total 100 because only 9 of the 41 blocks can be used. Some of the blocks, e. g., Scissors (Table XL) were used very seldom. From these 41 tables every possible type of move and the number of times such a move occurred can be seen.

Tables II to X inclusive deal with the nine correct moves for the spaces. We note a fairly steady increase in the percentages from age to age. This means that as we proceed to the higher ages an increasingly greater number of subjects are putting the correct block in its correct space. There is obviously a better and better performance at each age. Furthermore, we note that the nine blocks in question are never inserted in any other space a greater number of times than they are inserted in the correct space. These nine blocks, therefore, have been shown by observers at all ages to be better adapted to the space for which they were originally designed than for any other space. In this particular, at least, the actual performance of children at all ages corroborates the original design of the test. There also seems to be a greater amount of scattering in the lower than in the higher ages.

Coming now to Tables XI, XII, XIII, XV, XVI, XVII, XVIII, XIX, and XXV, we note a series of blocks that seem to be preferred for a specific space by a fairly large percentage at each age. For example,

in Table XII the C. Wind. is put in the B. Wind. space by a fairly large percentage of observers at all ages. The same holds true of the S. Bird and Cherries in the F. Bird space, of the D. Cat in the Cat space, of the Baseball in the Football space, of the Baby in the Cat or Hat space, of the Hatchet in the Log space, of the Cage in the F. Bird space, of the M. Bottle in the Cat space, of the Purse in the Hat space, of the Cherries in the Basket space, of the Cat in the Chicken space and the Chicken in the Cat space. In some of these cases the percentage is very high, notably the C. Wind in the B. Wind space, indeed at some ages a larger percentage of subjects choose this block rather than the correct one. The percentage of the total number of subjects is 47.1 or a little below half. None of the other cases mentioned reaches such a high percentage.

The reason for this group of cases is obvious from an inspection of the test. The C. Wind is put in the B. Wind. space, because the house is obviously lacking a window and the subject has failed to note the activity of the boy who has thrown a stone or the broken pieces of glass or the enraged man, or if he has noticed these things, he has failed to combine them into a story. The D. Cat is put in the Cat space because the child is obviously offering milk to a cat but the subject has not noticed that there is a more appropriate cat than the one that is walking away. The substitution of the Baseball for the Football is again obvious and not entirely illogical. The Baby in the Cat space is explicable by the common association of baby and milk, and in the Hat space by the idea that the girl is very much concerned about the crying baby. The Hatchet in the Log space is due to the association between hatchets and logs. The Cage in the F. Bird space seems merely due to the association be-

tween one cage and another. The girl may be transferring the bird from one cage to the other. The M. Bottle for the Cat seems again to rest upon a mere association between milk and milk bottle. The S. bird in the F. Bird space is due to overlooking the fact that there is a more logical block (the F. Bird) for that space, and the Cherries in this same space is supposed to mean that the fruit is dropping from the tree, while the subject fails to notice the activity of the girl with the cage. The Purse in the Hat space is interpreted as meaning that the wind has blown the girl's purse away. The Cherries in the Basket space means that the subject fails to see that the tree is an apple tree. The Cat in the Chicken space is taken for a chicken frightened at a cat. The Chicken in the Cat space is interpreted as the girl feeding a chicken.

These cases, therefore, are all easily understandable, and occur because the subject has failed to note that there is another block that would make a still better completion of the picture than the one he has chosen. If we were to make a classification of errors into logical and illogical ones, as Healy has suggested, it would seem to us that these cases are the ones to merit the former title. Healy gives nine moves as logical errors. We have discussed above the thirteen most frequent errors of our subjects and according to our point of view, these ought to be called the logical errors, if a classification into logical and illogical errors is to be made. Six of our "logical" errors correspond to Healy's, namely the C. Wind. for the B. Wind., the Baseball for the Football, the S. Bird for the F. Bird, the D. Cat for the Cat, the Purse for the Hat, and the Hatchet for the Log. We have eight "logical" errors that are not mentioned by Healy. They are the Baby

in the Cat and Hat spaces, the Cage in the F. Bird space, the M. Bottle and Chicken in the Cat space, the Cherries in the Basket and F. Bird spaces, and the Cat in the Chicken space. Two of Healy's logical errors do not occur in our list of the 61 most frequent moves to be discussed later, and these are the Baby in the Basket space—a move made by but one per cent. of the total, *i. e.*, by only 15 of 1479 people; the Mouse in the Cat space, which occurs only in 0.54 per cent of the total, *i. e.*, 8 cases. These two so-called logical moves evidently did not seem logical to our subjects. These do not appear at all in our list of common moves, since the number who make these moves is in every case less than 22, or 1.5 per cent of all the subjects tested. They therefore do not warrant any score, according to our method (see Chapter V, The Determination of the Scores).

The rest of the blocks are inserted in the spaces so seldom as not to warrant special consideration. In looking through Tables II to XLII it will be noted that most of these scattered cases tend to occur in the lower ages.

Changing slightly our point of view, we may now examine Figures 2 to 10. These graphs show the percentage of responses at each age for the nine spaces, and the curves denote the blocks that were most commonly inserted into these spaces. The solid line in each case represents the block that was originally designed for the space. For example, Figure 7 shows the three most common responses to the Basket space. The solid line shows that in this space the correct block, *i. e.*, the Basket, was put in the Basket space by 30 per cent of the five-year-olds, by 37 per cent of the six-year-olds, and so on. Further that the Cherries block

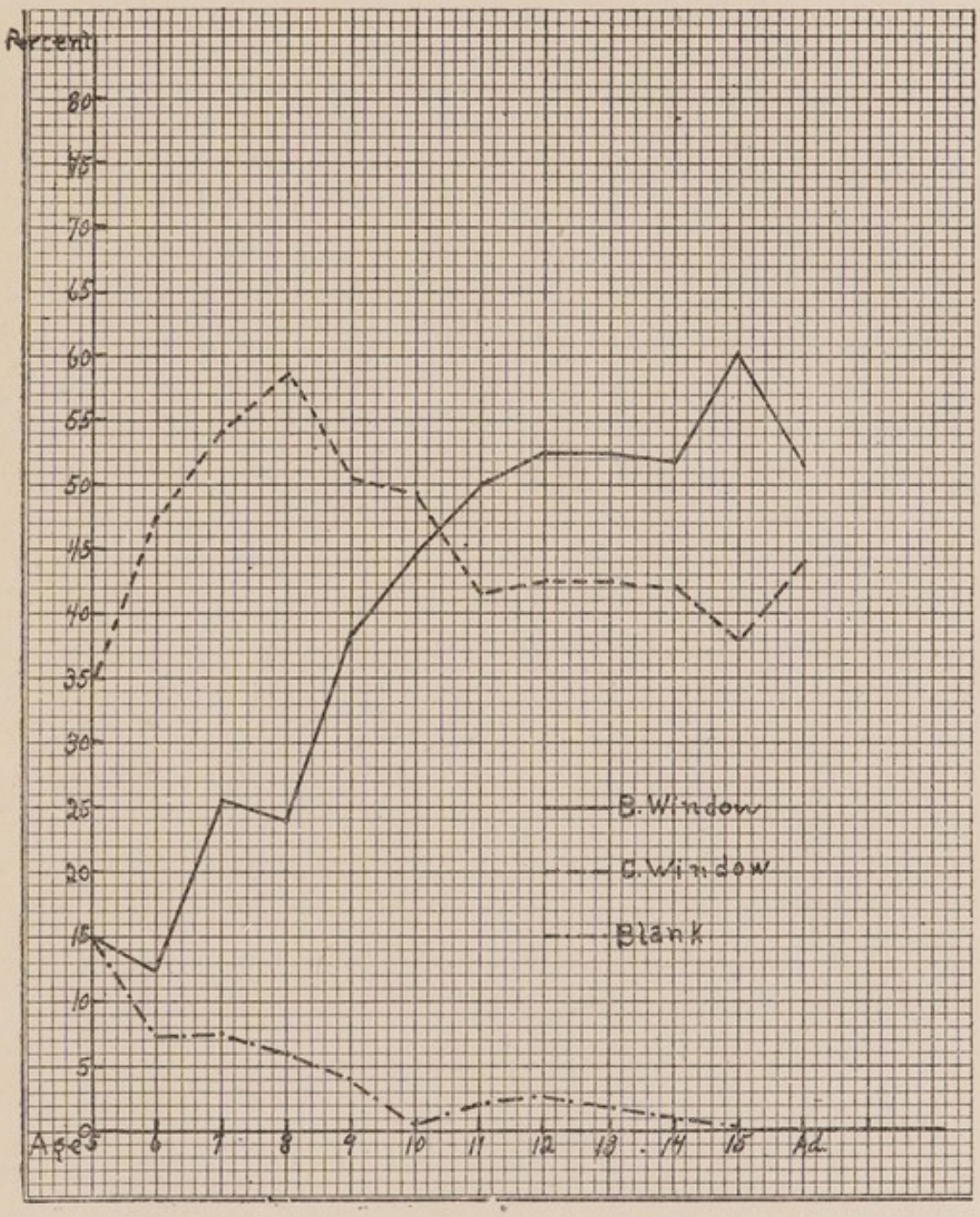
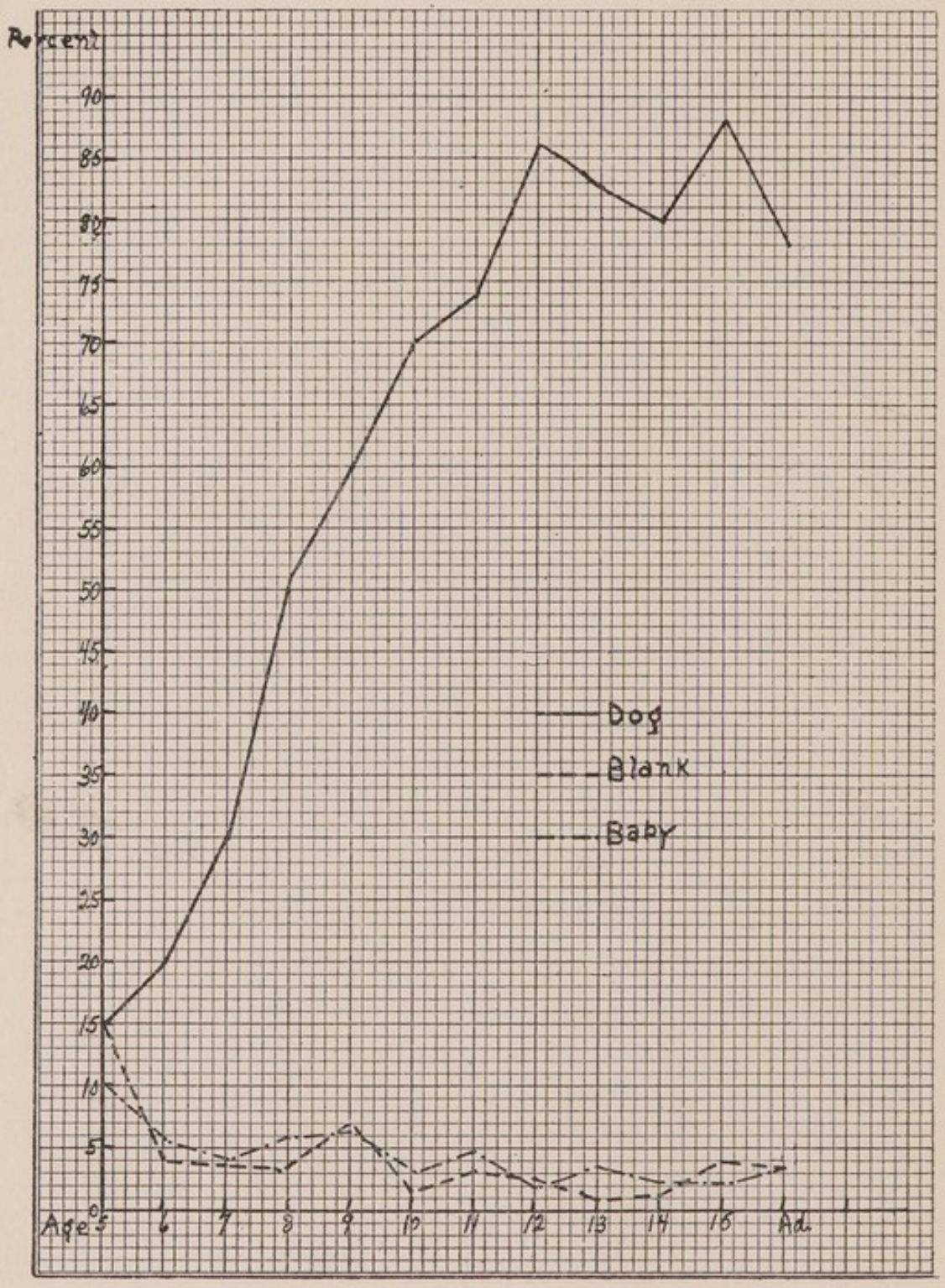

Percent
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
Ages
5
6
7
8
9
10
11
12
13
14
15
Ad.
B. Window
G. Window
Blank

FIGURE 2


Percent
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85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Age 5
6
7
8
9
10
11
12
13
14
16
Ad.
Dog
Blank
Baby

FIGURE 3

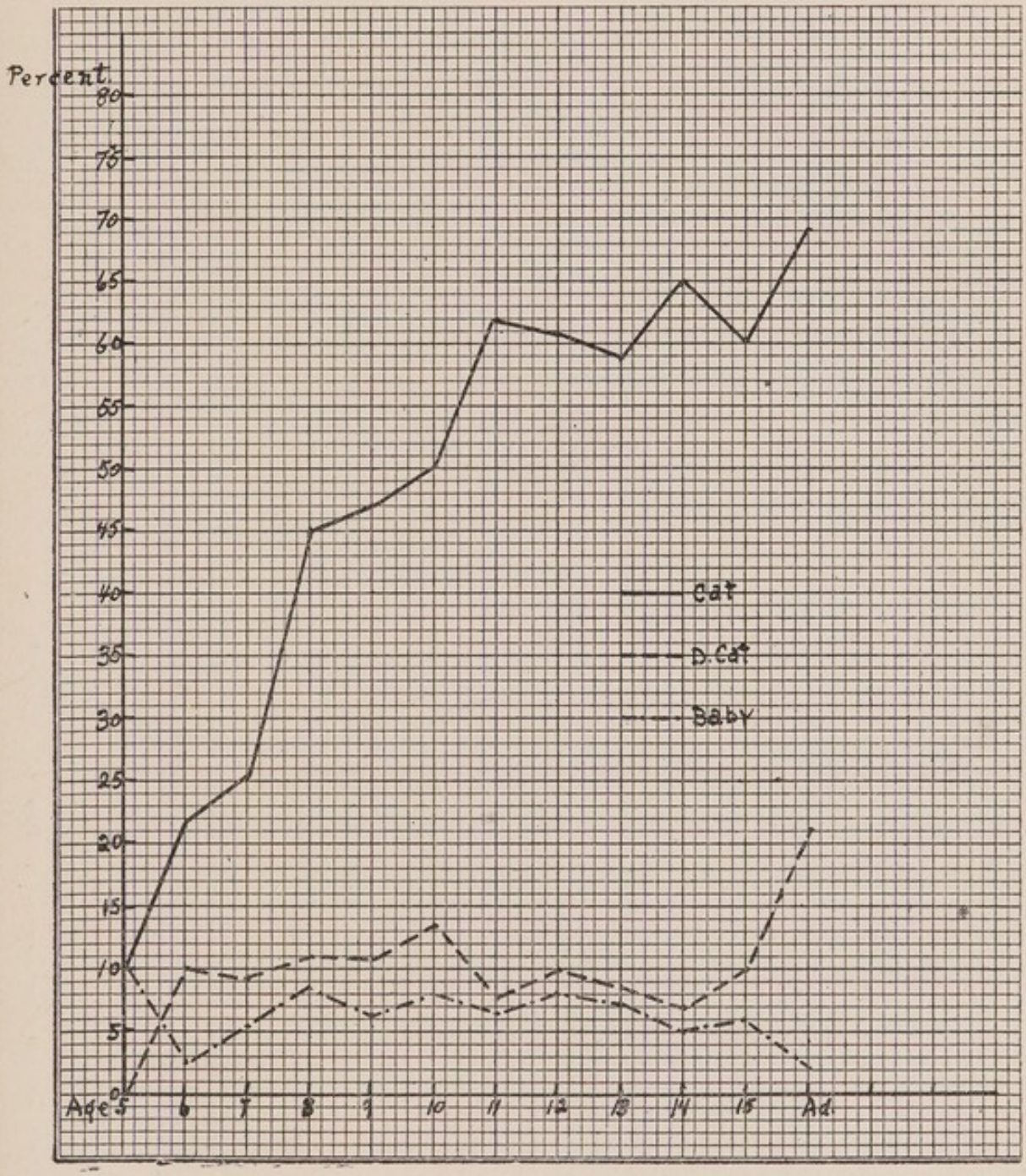
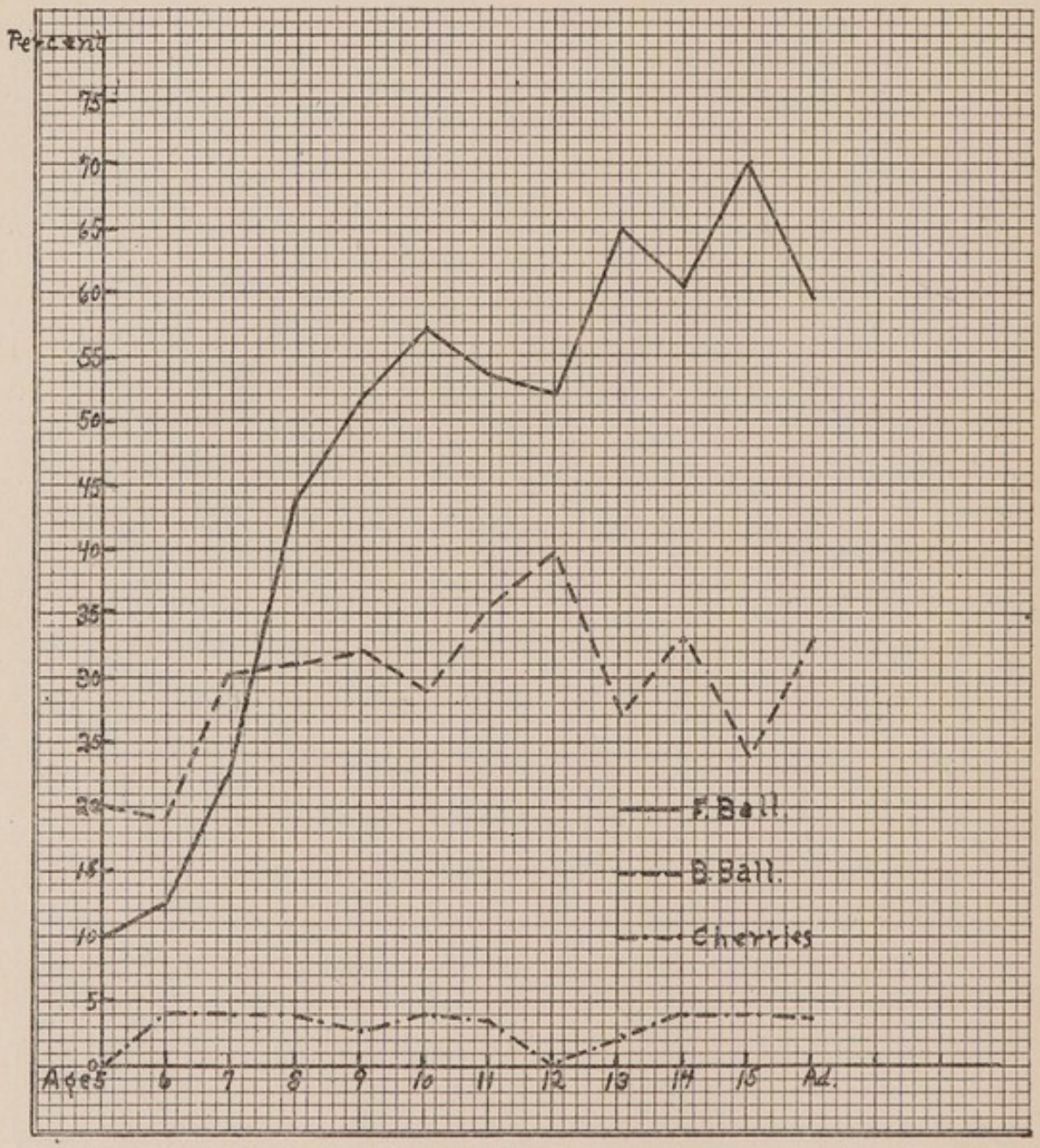

Percent.
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Age 5
6
7
8
9
10
11
12
13
14
15
Ad.
Cat
D. Cat
Baby

FIGURE 4


Percent
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70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Ages
5
6
7
8
9
10
11
12
13
14
15
Ad.
F. Ball.
B. Ball.
Cherries

FIGURE 5

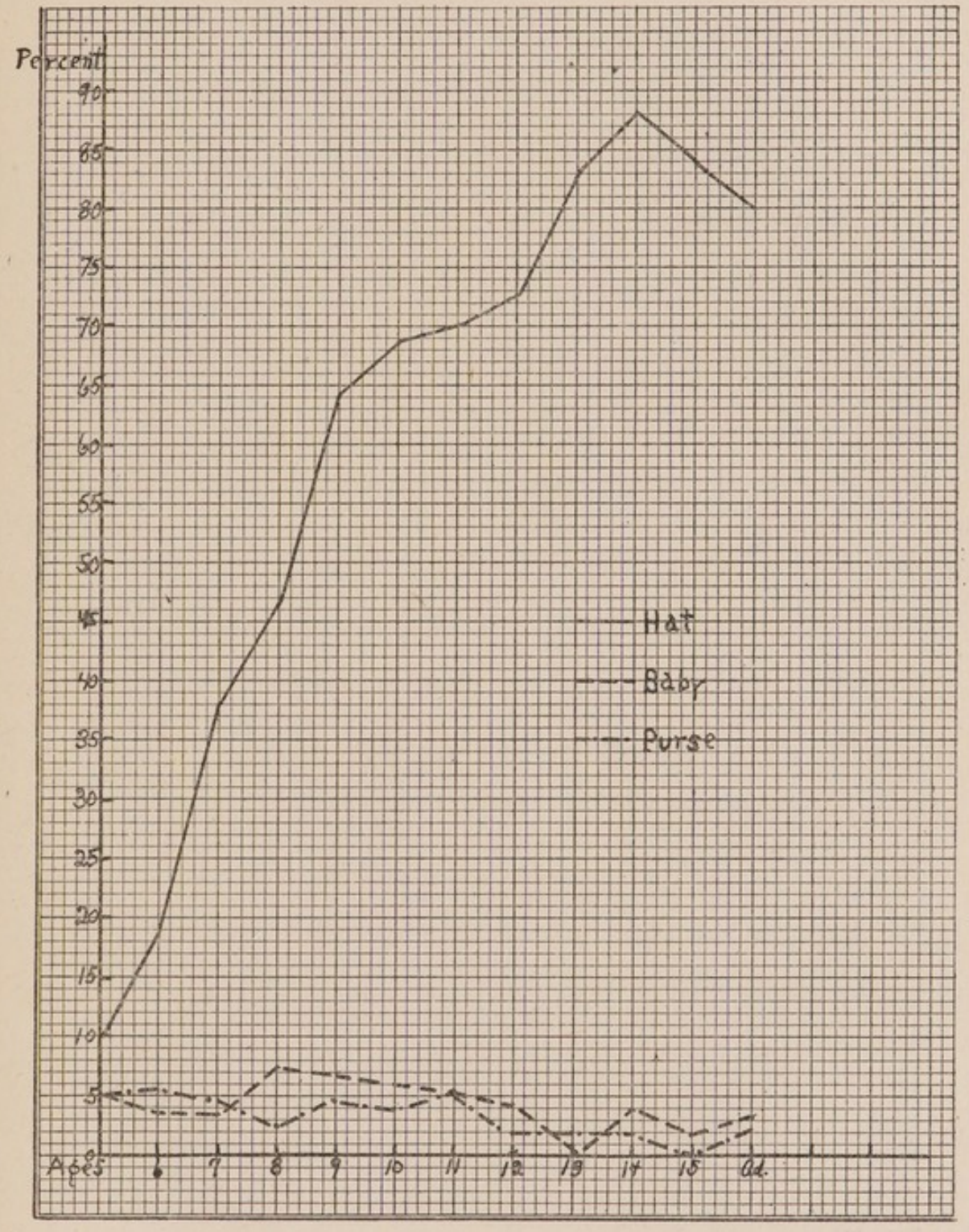
Percent
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
Hat
Baby
Purse
Ages
6
7
8
9
10
11
12
13
14
15
Ad.

FIGURE 6

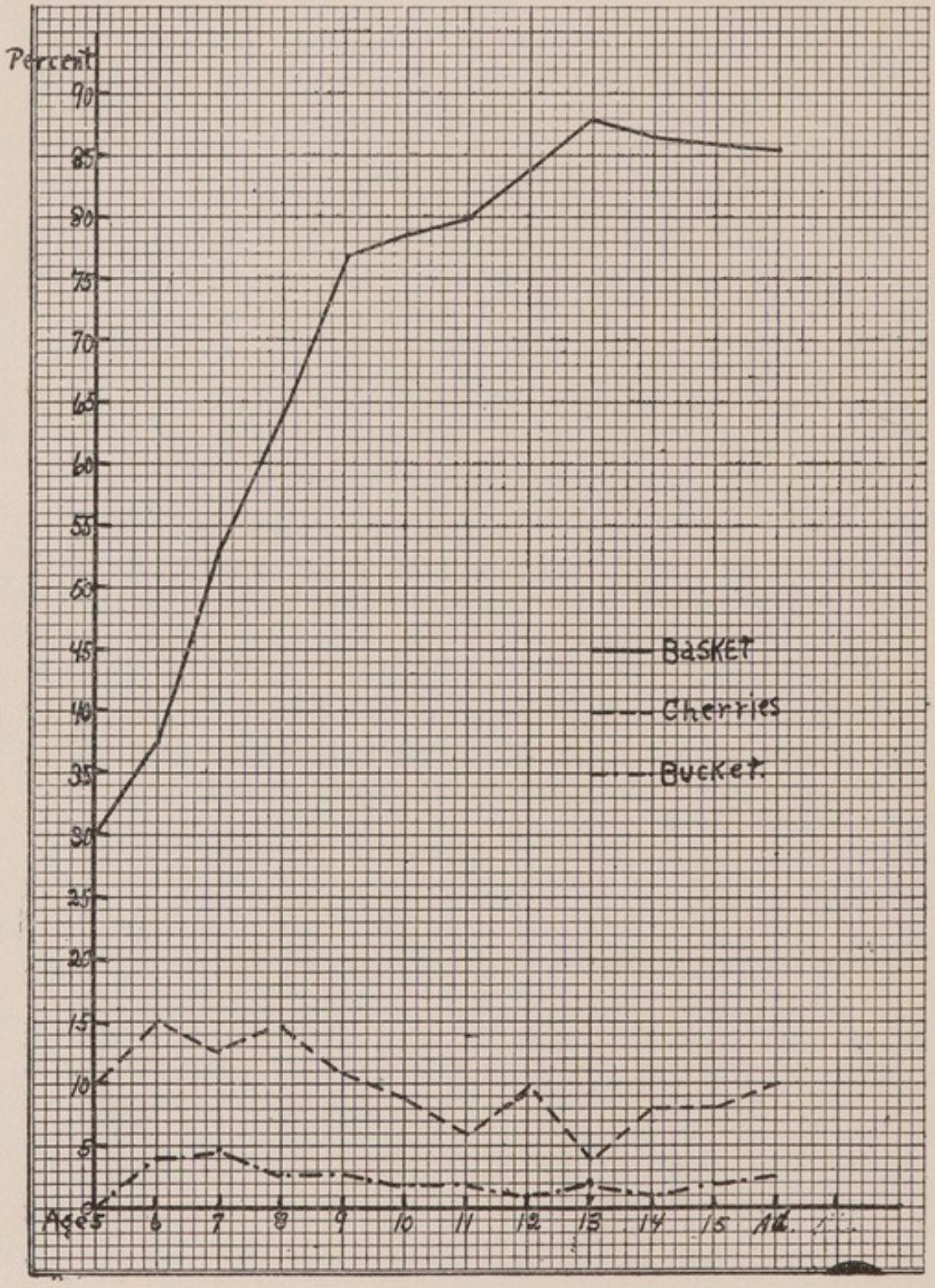
Percent
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Ages
5
6
7
8
9
10
11
12
13
14
15
Basket
Cherries
Bucket.

FIGURE 7

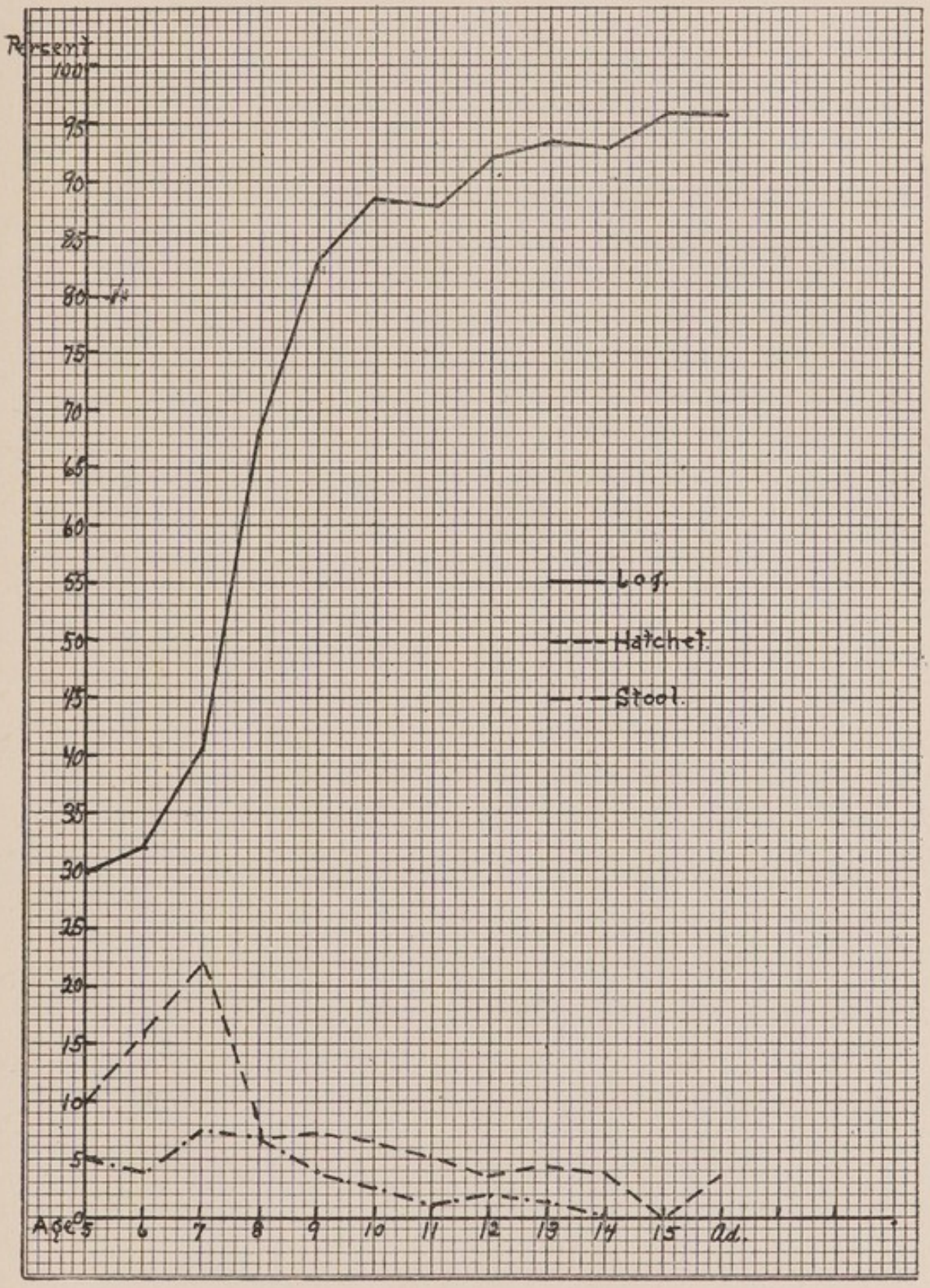
Percent
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Log.
Hatchet.
Stool.
Age 5
6
7
8
9
10
11
12
13
14
15
Ad.

FIGURE 8

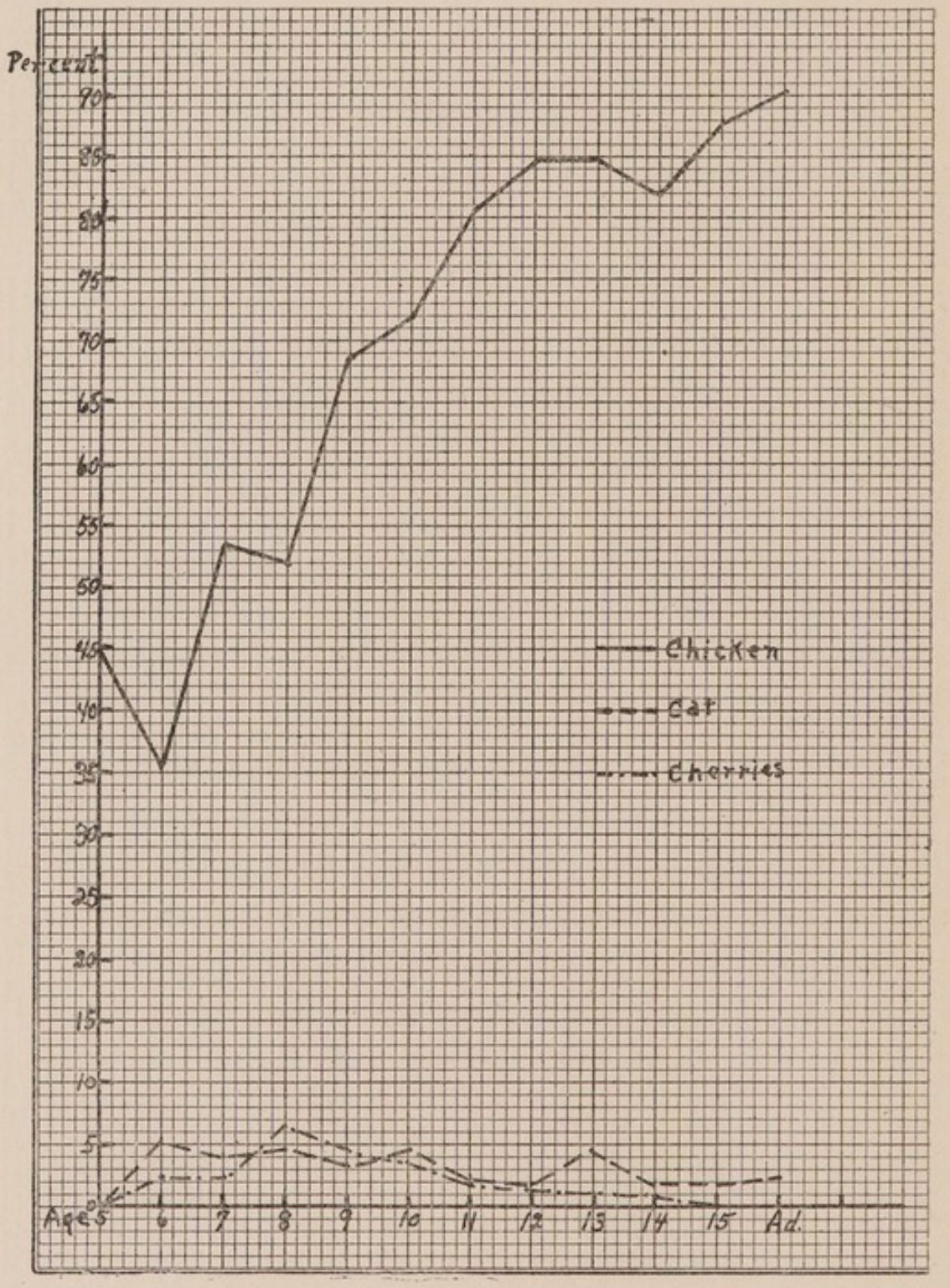
Per cent
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
Chicken
Cat
Cherries
Ages
5
6
7
8
9
10
11
12
13
14
15
Ad.

FIGURE 9

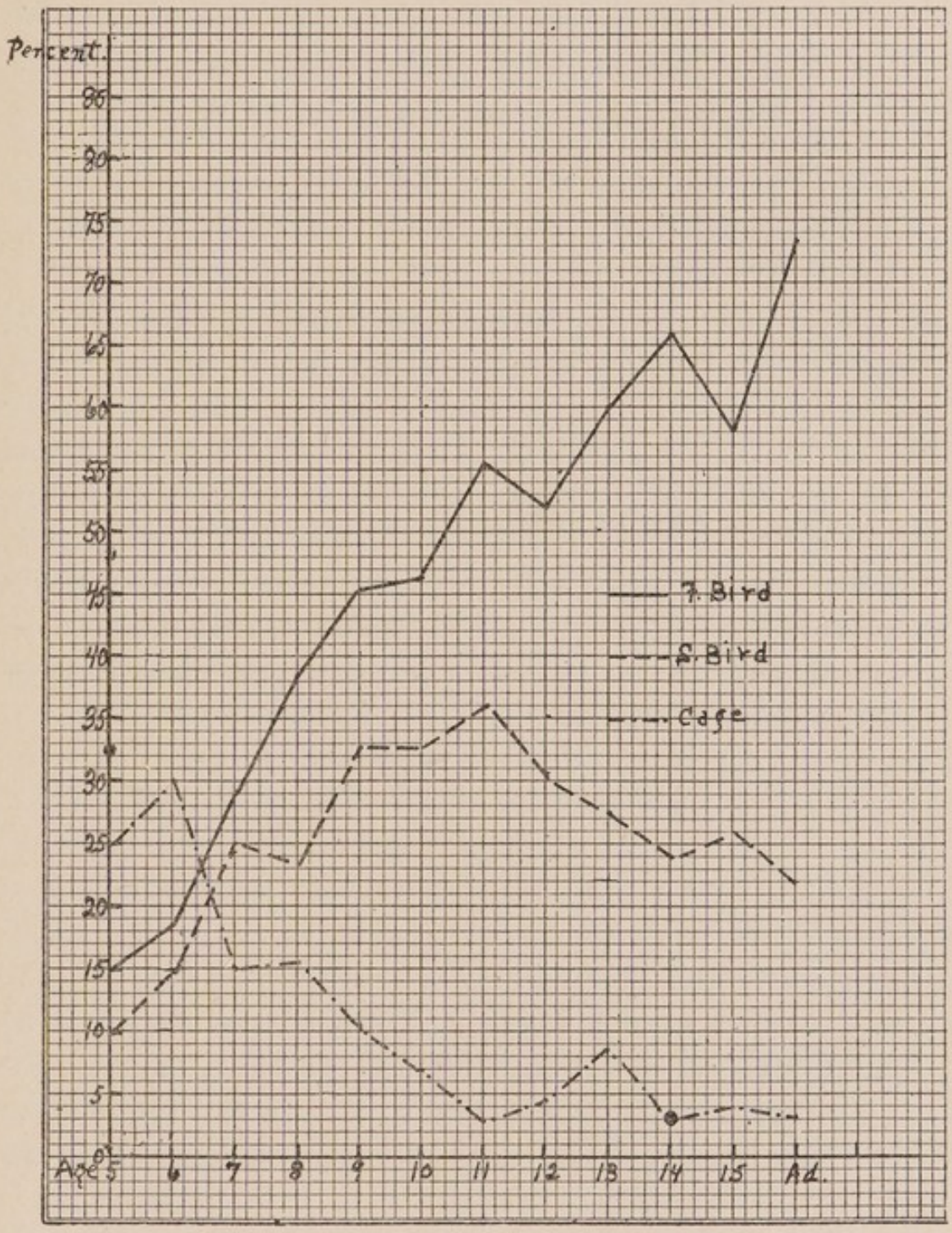
Percent.
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Age 5
6
7
8
9
10
11
12
13
14
15
Ad.
T. Bird
S. Bird
Cage

FIGURE 10

(broken line) was put in the Basket space by 10 per cent of the five-year-olds, by 15 per cent of the six-year-olds, by 12 per cent of the seven-year-olds, and so on. And further, that the third most common response that was made to this space was the insertion of the Bucket block (dot and dash line), which occurred in 4.5 per cent of the six-year-olds, 5 per cent of the seven-year-olds, 2.5 per cent of the eight-year-olds, and so on.

Similarly Figure 2 shows the three blocks most commonly inserted in the B. Wind. space, namely the B. Wind., the C. Wind., and a blank block. Note that blank refers to a block which has no picture on it. There are 10 blank blocks as can be seen from the picture on Figure 1.

All the other graphs are to be read in the same way. In general, the correct block for the space is distinctly above all the other curves. Indeed, in most cases the percentages for the other responses are so low as to be relatively insignificant (see Figures 3, 6, and 9 in particular). Three graphs differ decidedly from this general tendency, in that the curve for the correct block falls below some one of the other curves at some ages. This is the case in Figures 2, 5, and 10. It is most marked in Figure 2, where the curve for the C. Wind. remains above the B. Wind. curve at Ages 5 to 10, inclusive. This means that at these ages it is more common for the observer to insert the C. Wind. rather than the B. Wind. It marks this space out as being definitely the most difficult, but it does not prove that the C. Wind. is really the more logical block. This question was raised after the test had been completed by asking a great number of the subjects who made this error to state which block was the

better, the C. Wind. or the B. Wind. Almost invariably the B. Wind. was chosen. The ability to put in the right block, the B. Wind. shows an almost steady increase from six to fifteen years. Figure 5 shows that at Ages 5, 6, and 7 the Baseball is chosen more often than the Football. Figure 10 shows that at Ages 5 and 6 the Cage is chosen more often than the correct block. In the determination of the scores later on, it will be noted that the B. Wind. in the B. Wind. space is the hardest move.

The interesting feature about the curves for the correct blocks is that all show a distinct tendency to rise from the lower to the higher ages. The actual performances of the subjects go to show that the blocks as originally designed are best adapted to the spaces they were intended to fill. It is added evidence of the excellence of the test. We must keep this fact in mind when we raise the question of scoring, for these moves should obviously receive the highest scores in any method of scoring.

CHAPTER V

The Determination of the Scores

Percentage Distribution

The total group of subjects tested was made the basis for the determination of the scores. Table XLIII shows the percentage distribution of the total number of 1479 cases used for the determination of the scores. The vertical column gives the name of the block and the horizontal row the name of the space. There are nine spaces in the horizontal rows and 41 blocks along the vertical columns. The table is to be read as follows: the B. Wind. space (first horizontal row) was filled in by the B. Wind. block by 39.9 per cent of the subjects (upper figure) and this move was given a score of 100; the B. Wind. space (continuing along the row) was filled in by the Dog block by 0.3 per cent of the subjects and received a score of 0.2, and so on. Passing to the next row we find that the Dog space was filled in by the Dog block by 62.7 per cent of the total number of individuals and was given a score of 63.7; next that the Cat was put in the Dog space by 2.4 per cent. of the subjects and was given a score of 1.6, and so forth.

In determining these scores, an examination of the nine correct moves was made first. This shows that the B. Wind. in the B. Wind. was the hardest, because the fewest subjects were able to do it; it was given a score of 100. The other eight correct moves were given scores in inverse proportion to the percentage of cases recorded. If 39.9 per cent are able to put the B. Wind. in the B. Wind. space and receive a score of 100, then 62.7 per cent who put the Dog block in the

TABLE XLIII.

Distribution of Total Number Tested

PERCENTAGES AND SCORES

	B. Wind.	Dog	Cat	Football	Hat	Basket	Log	Chicken	F. Bird
B. Wind.—									
Per Cent...	39.9	0.3	0.07	0.14	0.14	0.14	0.07	0.2	0.14
Score.....	100	0.2		0.07	0.07	0.07		0.15	0.07
Dog—									
Per Cent...	1.5	62.7	2.4	0.3	0.6	0.3	0.1	0.7	0.9
Score.....	1.0	63.7	1.6	0.2	0.4	0.2	0.07	0.5	0.6
Cat—									
Per Cent...	0.2	1.1	49.1	0.07	0.4	0.9	0.3	3.5	2.2
Score.....	0.2	0.8	81.3		0.3	0.6	0.2	2.4	1.5
Football—									
Per Cent...	0.2	0.9	0.7	47.7	0.7	1.0	0.07	0.3	1.6
Score.....	0.2	0.6	0.5	83.9	0.5	0.7		0.2	1.0
Hat—									
Per Cent...	0.4	1.7	3.0	0.6	61.3	0.4	0.3	1.8	1.6
Score.....	0.4	1.2	2.0	0.4	65.2	0.4	0.2	1.2	1.0
Basket—									
Per Cent...	0.2	0.2	0.6	0.4	0.07	72.6		0.8	0.5
Score.....	0.2	0.2	0.4	0.4		55.0		0.6	0.3
Log—									
Per Cent...	0.5	0.2	0.4	0.3	0.07	0.3	76.2	0.6	0.3
Score.....	0.5	0.2	0.4	0.2		0.2	52.4	0.4	0.2
Chicken—									
Per Cent...	0.07	1.2	3.5	0.07	0.07	1.3	0.3	69.5	1.6
Score.....		0.8	2.4			0.9	0.2	57.5	1.0
F. Bird—									
Per Cent...	0.3	0.1	0.4	0.07	0.3	3.0	0.3	0.7	46.1
Score.....	0.2	0.07	0.4		0.2	2.0	0.2	0.5	86.6

TABLE XLIII—(Continued)

	C. Wind.	D. Cat	S. Cat	Baseball	Baby	Hatchet	Mouse	S. Bird	Cage	Blank
B. Wind.—										
Per Cent...	47.1			0.2	0.5		0.2	0.07	1.5	3.2
Score.....	32.3			0.1	0.3		0.1		1.0	2.2
Dog—										
Per Cent...	0.4	3.1	0.5	0.5	3.4	1.8	2.1	1.7	1.2	3.2
Score.....	0.3	2.1	0.3	0.3	2.3	1.2	1.4	1.2	0.7	2.2
Cat—										
Per Cent...	0.1	10.5	3.0	0.07	6.2		0.5	2.0	1.2	1.4
Score.....	0.07	7.2	2.0		4.3		0.3	1.4	0.7	0.9
Football—										
Per Cent...	0.07	0.3	0.3	30.6	0.8	0.6	0.3	0.6	1.1	0.9
Score.....		0.2	0.2	21.0	0.5	0.4	0.2	0.4	0.7	0.6
Hat—										
Per Cent...	0.3	1.1	0.3	0.5	4.5	0.9	3.2	0.7	1.0	1.4
Score.....	0.2	0.8	0.2	0.3	3.1	0.6	2.2	0.5	0.7	0.9
Basket—										
Per Cent...	0.07	0.7	0.3	0.2	1.0	1.4	0.4	0.2	0.5	1.2
Score.....		0.5	0.2	0.1	0.7	0.9	0.4	0.1	0.3	0.7
Log—										
Per Cent...	0.1		0.4	0.3	0.5	8.0	0.3	0.3	0.3	1.5
Score.....	0.07		0.3	0.2	0.3	5.5	0.2	0.2	0.2	1.0
Chicken—										
Per Cent...	0.1	1.7	0.9	0.2	1.9	1.9	1.5	2.2	1.7	0.9
Score.....	0.07	1.2	0.6	0.1	1.3	1.3	1.0	1.5	1.2	0.6
F. Bird—										
Per Cent...	0.8	0.2	0.3	0.07	0.3		0.4	26.9	10.7	1.2
Score.....	0.5	0.1	0.2		0.2		0.3	18.4	7.2	0.8

TABLE XLIII—(Continued)

	Clock	S. Can	Glove	Bottle	M. Bottle	Cup	Shoe	Flowers	Pumpkin	Candle	Fish
B. Wind.—											
Per Cent...	1.1	0.07	0.1	0.3	0.3	0.2		0.7	0.2	0.9	0.07
Score.....	0.8		0.07	0.2	0.2	0.1		0.5	0.1	0.6	
Dog—											
Per Cent...	0.9	0.3	0.07	0.6	0.7	0.3	1.1	1.1	0.6	0.4	0.4
Score.....	0.6	0.2		0.4	0.5	0.2	0.8	0.8	0.4	0.3	0.3
Cat—											
Per Cent...	0.2	0.2	0.3	0.7	5.5	1.8	0.4	0.6	0.7	0.2	0.4
Score.....	0.1	0.1	0.2	0.5	3.8	1.2	0.3	0.4	0.4	0.2	0.2
Football—											
Per Cent...	0.5	0.1	0.5	0.5	0.3	0.1	0.1	0.5	1.9	0.5	0.2
Score.....	0.3	0.07	0.3	0.3	0.2	0.07	0.07	0.4	1.3	0.4	0.2
Hat—											
Per Cent...	0.4	0.7	0.5	0.3	0.4	0.3	0.3	0.9	1.2	0.7	0.7
Score.....	0.3	0.5	0.3	0.3	0.4	0.2	0.2	0.6	0.8	0.4	0.4
Basket—											
Per Cent...	0.4	0.4	0.3	0.07	0.07	0.3	0.5		0.7	0.07	0.2
Score.....	0.4	0.4	0.2			0.2	0.4		0.5		0.2
Log—											
Per Cent...	0.5	0.3	0.3	0.1	0.3	0.3	0.3	0.2	0.9	0.3	0.3
Score.....	0.3	0.2	0.2	0.07	0.2	0.2	0.2	0.2	0.6	0.2	0.2
Chicken—											
Per Cent...	0.3	0.6	0.07	0.3	0.2	0.4	0.3	0.3	0.8		0.9
Score.....	0.2	0.4		0.2	0.1	0.3	0.2	0.2	0.6		0.6
F. Bird—											
Per Cent...	0.1				0.07	0.2	0.07	0.4	0.3	0.3	0.3
Score.....	0.07					0.1		0.3	0.2	0.2	0.2

TABLE XLIII—(Continued)

	Knife	Fruit	Cherries	Stool	Bucket	Purse	Books	Tie	Scissors	Pipe	No Block
B. Wind.—											
Per Cent...	0.07	0.3		0.3			0.3		0.2	0.07	0.6
Score.....		0.2		0.2			0.2		0.1		0.4
Dog—											
Per Cent...	0.07	0.3	0.7	1.9	0.5	0.07	1.1	0.6	0.3		0.5
Score.....		0.2	0.4	1.3	0.4		0.8	0.4	0.2		0.4
Cat—											
Per Cent...	0.6	2.1	0.1	1.9	0.5	0.3	0.5	0.2	0.2	0.07	
Score.....	0.4	1.4	0.07	1.3	0.4	0.2	0.3	0.2	0.2		
Football—											
Per Cent...	0.1	0.7	3.0	0.1	0.3	0.4	1.2	0.1	0.07	0.3	
Score.....	0.07	0.5	2.0	0.07	0.2	0.3	0.8	0.07		0.2	
Hat—											
Per Cent...	0.07	0.4	0.1	0.6	0.6	3.5	1.5	1.0	0.3	0.1	0.2
Score.....		0.3	0.07	0.4	0.4	2.5	1.0	0.7	0.2	0.07	0.2
Basket—											
Per Cent...	0.3	0.7	10.0	1.3	2.4		0.6	0.2	0.2	0.1	0.07
Score.....	0.2	0.5	6.8	0.9	1.6		0.4	0.2	0.2	0.07	
Log—											
Per Cent...	0.6	0.3	0.1	2.9	0.1	0.3	0.1	0.2	0.3	0.5	0.2
Score.....	0.4	0.2	0.07	2.0	0.07	0.2	0.07	0.2	0.2	0.4	0.2
Chicken—											
Per Cent...	0.2	0.6	2.6	0.3		0.2	0.3	0.7		0.1	0.07
Score.....	0.2	0.4	1.8	0.2		0.07	0.2	0.4		0.07	
F. Bird—											
Per Cent...		0.2	4.0	0.3	0.3	0.1	0.07	0.1	0.1	0.1	0.07
Score.....		0.2	2.7	0.2	0.2	0.07		0.07	0.07	0.07	

Dog space should receive a pro rata score of 64 (62.7: 39.9 = 100: 64), and so on for the nine correct blocks. The easiest of these nine moves is the Log in the Log space, since the largest proportion of successes, 76.2 per cent, is with this move.

Now in regard to the other moves made, which we may call errors, it is obvious that the most pardonable error is the one made by the greatest number of people. We might term such an error the "most logical" error, meaning by "logical" that it occurs most frequently. Therefore all the other moves merit scores in proportion to the number of people making the move. The greater the frequency of the move, the higher the score. We cannot, however, allow any of these so-called errors to exceed the score of any of the correct moves, hence all of them must fall below a score of 52, the score for the easiest correct move. The relative merit of these errors can be determined, then, by using 52 as a starting point. The greater the frequency of the move the larger the score. If 76.2 per cent (Log in Log) is equal to a score of 52, then by direct proportion, 47.1 per cent (C. Wind. in B. Wind.) is equal to a score of 32. These scores are all given in Table XLIII. The second figure, the figure below the percentage, denotes the score in each case.

For practical purposes the scores recorded in the table were needlessly fine, so the decimals were dropped and the nearest integer was taken. Neglecting all scores below 1.0, we arrive at the scores given in Table XLIV.

Sixty-one moves have been found to merit some score by this procedure. To make the lowest score 1 is, of course, purely an arbitrary procedure. It would be perfectly feasible to go beyond this and include

TABLE XLIV.

Scores

B. WIND.	
B. Wind	100
C. Wind	32
Blank	2
Cage	1

DOG	
Dog	64
Baby	2
Blank	2
B. Wind	1
Cat	2
D. Cat	2
Hatchet	1
Mouse	1
S. Bird	1
Stool	1

LOG	
Log	52
Blank	1
Hatchet	6
Stool	2

BASKET	
Basket	55
Bucket	2
Cherries	7

CAT	
Cat	81
Baby	4
Chicken	2
Cup	1
D. Cat	7
Fruit	1
M. Bottle	4
F. Bird	2
S. Cat	2
S. Bird	1
Stool	1

FOOTBALL	
Football	84
Baseball	21
Cherries	2
F. Bird	1
Pumpkin	1

F. BIRD	
F. Bird	87
Basket	2
Cage	7
Cherries	3
S. Bird	18

HAT	
Hat	65
Baby	3
Books	1
Cat	2
Chicken	1
Dog	1
F. Bird	1
Mouse	2
Purse	3

CHICKEN	
Chicken	58
Baby	1
Cat	2
Cherries	2
Cage	1
D. Cat	1
F. Bird	1
Hatchet	1
Mouse	1
S. Bird	2

more cases or to stop before this and include fewer cases. A score of 1 denotes that from about 1.5 to 2.2 per cent made this move. It seemed, from examination of the moves which have been credited, that almost all of them had some degree of justification, at least such as would warrant a small amount of credit. If we were to discard all scores below 2, many moves that seem logical would have no score attached to them, such for example as the Pumpkin in the Football space, the Baby, the D. Cat, the F. Bird, the Hatchet, or the Mouse in the Chicken space and so on. Most of these seem to warrant at least the small score of 1. The most illogical ones that receive a score of 1 by this method seem to be the Hatchet and the Stool in the Dog space, and the Fruit and the Stool in the Cat space. The B. Wind. in the Dog space seems at first sight absurd, but a questioning of many children who made this move elicited the information that the B. Wind. was taken for a large spider or other monster from which the boy was fleeing. In view of such explanations by children, it seemed to be wisest to keep to the scores determined objectively by frequency of move. Table XLIV, which gives the scores, is therefore the criterion we have used in scoring the results. It is to be read as follows: The B. Wind. block put into the B. Wind. space is scored 100; the C. Wind. block in the B. Wind. space is scored 32, and so on. No score is allowed for any move not found in this table.

Correlations

The method of determining the scores adopted and described above is based on the pooled results of all ages. It will be remembered that the performances of all the tested individuals were combined and the

frequency of the position of any block in any of the squares was noted. Upon these frequencies the scores were allotted. That is to say, the method of scoring is based entirely upon what is actually done by the subjects. The performance of the subject is a measure of the ease or difficulty of any position, and this in turn determines the value allotted to that particular move.

Now, in view of the fact that the number of tested individuals is not constant at each age, the objection may be raised that any age possessing a proportionately larger number of subjects might influence unduly the scoring values. This is the first point that calls for a correlation between the relative ease or difficulty of each move at each age and the same move for the total group.

Another and more important question also demands this kind of a correlation. If the type of performance, *i. e.*, the relative ease or difficulty of the various moves, is radically and characteristically different at any one age or group of ages from the type of performance common to the other ages, then the method of scoring as determined by the total of all tested may be unfair to that age or group of ages, since the method of scoring is supposed to be determined by what the subjects actually do. If, for example, the relative ease and difficulty of the various moves for Ages 6 and 7 were to vary from the relative ease and difficulty for the other ages, then the scoring values as determined by the total tested would be unfair to Ages 6 and 7, meaning by unfair that they would not be based upon what six- and seven-year-olds actually find to be easy or difficult, but upon what a group of individuals, of which the six- and seven-year-olds form a small number, find to be easy or difficult. In other words, if any age or age-group were to deviate in this respect

from the total group, that age-group would be scored by values obtained from other sources. Such a method of scoring would be perfectly legitimate and defensible. In fact, the best possible move for the nine correct squares is determined by such a method. And in regard to the other moves, excluding the nine best possible ones, it would have been entirely feasible to have decided upon a method of scoring based upon the performances of a select group of adults. This method would imply that such a group of adults makes moves that are the most logical or the least illogical. This method was not adopted since it was thought that the child's performance might differ so radically from the adult's as to make a method of scoring derived from adults' performances artificial when applied to children. And further, a practical consideration enters in, namely that a select group of adults would make so few illogical moves as to limit the range of scores very materially. As a matter of fact, the total number of moves, other than the nine correct ones, chosen by the adults amounts to 54. Since there are 369 possible moves in addition to the nine correct ones, 54 is a relatively small number.

To arrive at these correlations, the rank according to difficulty of the 61 moves which have been allowed a scoring value was taken. These 61 moves are the most frequent, as determined by the total number of individuals tested. It was not deemed feasible to work out correlations for all the possible 369 moves; most of them are seldom met with. These 61 most common moves will give us a sufficient indication of the correlation between the total group and the different age-groups. It is to be noted, however, that this method of ranking excludes in certain age-groups

some moves which do not appear in the total group and which would have ranked higher than a few of the less frequently chosen moves. To this slight extent, therefore, our table of ranks is incomplete. Table XLV shows the ranking in order of frequency for the 61 moves, for the total group tested, and then for each group separately. From this table Figures 11, 12, and 13 have been constructed. These three graphs show the ranking at each age of the twelve most frequent moves as determined by the total group. Some idea of the similarity in ranking for the different age groups can be obtained from them. Figure 11 shows that the Log in the Log space was the move that received first rank at all ages except six and seven. The other three moves, namely the Dog—Dog, the Football—Football, and the B. Wind.—B. Wind. do not display such a constant rank, but the range of variability is small when we consider that there are 61 possible ranks. The four moves given in Figure 12 show very little fluctuation in rank; the Chicken—Chicken, the F. Bird—F. Bird, the Cat—Cat, and the S. Bird—F. Bird moves vary only from one to three places. In Figure 13 the same relatively constant tendency is observed in the ranks for the Basket—Basket and Hat—Hat moves, but when we come to the two "logical" errors, the C. Wind. in the B. Wind. space and the Baseball in the Football space, there appears a somewhat greater range of ranks, although this is comparatively slight if we consider the total length of the series. The change in rank of these two moves is somewhat abrupt as we proceed from the lower to the higher ages.

The correlations determined from the table of ranks (Table XLV) are, first, between each age-group and

TABLE XLV.

Ranks of Positions

Position	Age Groups											
	Total	6	7	8	9	10	11	12	13	14	15	Adult
Log–Log	1	4	4	1	1	1	1	1	1	1	1	1
Basket–Basket	2	2	2.5	2	2	2	3	4	2	3	4	3.5
Chicken–Chicken	3	3	2.5	4	3	3	2	3	3	4	2.5	2
Dog–Dog	4	7	7	5	5	4	4	2	4.5	5	2.5	3.5
Hat–Hat	5	9.5	5	6	4	5	5	5	4.5	2	5	5
Cat–Cat	6	6	10	7	8	7	6	6	8	7	7.5	7
Football–Football	7	14.5	12	8	6	6	8	8.5	6	8	6	8
C. Wind.–B. Wind.	8	1	1	3	7	8	10	10	10	10	10	10
F. Bird–F. Bird	9	9.5	8	9	9	9	7	8.5	7	6	9	6
B. Wind.–B. Wind.	10	14.5	10	11	10	10	9	7	9	9	7.5	9
Baseball–Football.	11	8	6	10	12	12	12	11	11.5	11	12	11
S. Bird–F. Bird	12	13	10	12	11	11	11	12	11.5	12	11	12
Cage–F. Bird	13	5	14	13	14	16	28	20	13.5	26.5	22	18.5
D. Cat–Cat	14	16.5	16.5	15	14	13	13	13.5	13.5	14	13	13
Cherries–Basket	15	12	15	14	14	14	15.5	13.5	20	13	14.5	14
Hatchet–Log	16	11	13	19	16.5	17	18	23	18.5	21	49	18.5
Baby–Cat	17	46.5	26.5	16	18.5	15	14	15	15.5	21	16.5	25.5
M. Bottle–Cat	18	16.5	16.5	27	22.5	47.5	28	17	15.5	16.5	49	15
Baby–Hat	19	39	38	17	18.5	18	18	20	48.5	21	32	18.5
Cherries–F. Bird	20	39	22	27	20.5	28	36	57	36.5	16.5	22	52
Purse–Hat	21	23	30.5	46.5	25.5	24	18	32	28.5	32	49	25.5
Chicken–Cat	22.5	39	26.5	35	38	40.5	21.5	40	17	21	22	36
Cat–Chicken	22.5	23	33	27	31	20	28	32	18.5	32	32	25.5
Baby–Dog	24	23	38	25	20.5	33	20	32	48.5	43.5	49	25.5
Blank–B. Wind.	26	18.5	18.5	21	28	55.5	36	57	28.5	43.5	49	52
Blank–Dog	26	31.5	38	41.5	16.5	55.5	23.5	26.5	48.5	43.5	22	18.5
Mouse–Hat	26	57	33	35	51.5	24	28	17	28.5	56.5	16.5	25.5
D. Cat–Dog	28	39	38	27	22.5	47.5	21.5	48.5	24	15	49	36
Basket–F. Bird	29.5	18.5	38	27	45.5	20	53.5	40	36.5	43.5	22	36
Cherries–Football	29.5	31.5	33	35	38	24	23.5	17	28.5	21	22	18.5
Cat–Hat	31.5	39	26.5	35	45.5	40.5	28	20	24	32	49	36
S. Cat–Hat	31.5	52	57.5	41.5	51.5	24	15.5	23	21.5	32	14.5	52
Stool–Log	33	31.5	18.5	19	31	33	53.5	32	36.5	56.5	49	52
Cherries–Chicken	34	46.5	45.5	19	25.5	28	36	40	36.5	43.5	49	52
Cat–Dog	35	31.5	45.5	46.5	38	47.5	44.5	40	21.5	32	32	18.5
Bucket–Basket	36.5	31.5	30.5	46.5	38	40.5	36	48.5	28.5	43.5	32	25.5
S. Bird–Chicken	36.5	23	52.5	35	31	33	53.5	26.5	36.5	56.5	49	52
F. Bird–Cat	38	27.5	57.5	52.5	25.5	33	36	57	36.5	26.5	22	52
Fruit–Cat	39.5	23	45.5	56.5	38	47.5	36	40	36.5	43.5	32	36
Mouse–Dog	39.5	27.5	26.5	52.5	38	55.5	44.5	48.5	28.5	43.5	49	52
S. Bird–Cat	41	57	60	46.5	31	20	60	23	48.5	21	49	36
Baby–Chicken	44	39	26.5	46.5	51.5	28	60	57	36.5	43.5	49	25.5
Hatchet–Chicken	44	57	52.5	35	56.5	24	28	48.5	48.5	43.5	32	36
Pumpkin–Football	44	46.5	22	46.5	45.5	55.5	53.5	32	58.5	56.5	49	36

TABLE XLV—(Continued)

Position	Age Groups											
	Total	6	7	8	9	10	11	12	13	14	15	Adult
Stool–Cat.....	44	46.5	26.5	52.5	45.5	55.5	44.5	40	36.5	43.5	22	52
Stool–Dog.....	44	39	22	56.5	56.5	33	36	57	48.5	56.5	32	52
Chicken–Hat.....	48	39	45.5	27	45.5	47.5	53.5	48.5	48.5	43.5	49	25.5
Cup–Cat.....	48	52	52.5	52.5	51.5	33	53.5	40	58.5	43.5	49	52
Hatchet–Dog.....	48	52	45.5	27	38	61	53.5	40	48.5	26.5	49	36
Cage–Chicken.....	51.5	23	38	35	51.5	47.5	53.5	48.5	58.5	56.5	49	52
Dog–Hat.....	51.5	52	38	35	60	40.5	28	57	58.5	56.5	32	36
D. Cat–Chicken...	51.5	57	45.5	52.5	31	55.5	44.5	26.5	48.5	32	32	52
S. Bird–Dog.....	51.5	31.5	57.5	52.5	45.5	33	36	32	58.5	56.5	49	52
F. Bird–Hat.....	54	52	45.5	60.5	25.5	40.5	44.5	48.5	36.5	56.5	49	52
Cage–B. Wind.....	56	46.5	52.5	35	60	55.5	44.5	26.5	48.5	43.5	49	36
F. Bird–Football..	56	39	45.5	60.5	56.5	40.5	36	48.5	48.5	43.5	32	36
F. Bird–Chicken..	56	57	61	58.5	38	40.5	44.5	32	24	21	49	52
Blank–Log.....	59	60.5	57.5	41.5	38	55.5	53.5	40	48.5	26.5	32	52
Mouse–Chicken...	59	60.5	52.5	22.5	51.5	40.5	44.5	57	58.5	32	49	36
B. Wind.–Dog.....	59	23	20	58.5	60	55.5	60	57	48.5	43.5	49	52
Books–Hat.....	61	46.5	52.5	41.5	56.5	55.5	53.5	57	48.5	56.5	49	52

the total group. They answer the question as to the relative difficulty of the moves for each age-group as compared with the total group. These correlations, as computed by the Spearman Foot-Rule method, are given herewith:

Age	r
6	.80
7	.79
8	.84
9	.90
10	.82
11	.87
12	.80
13	.89
14	.79
15	.74
Ad.	.84
Average	.825

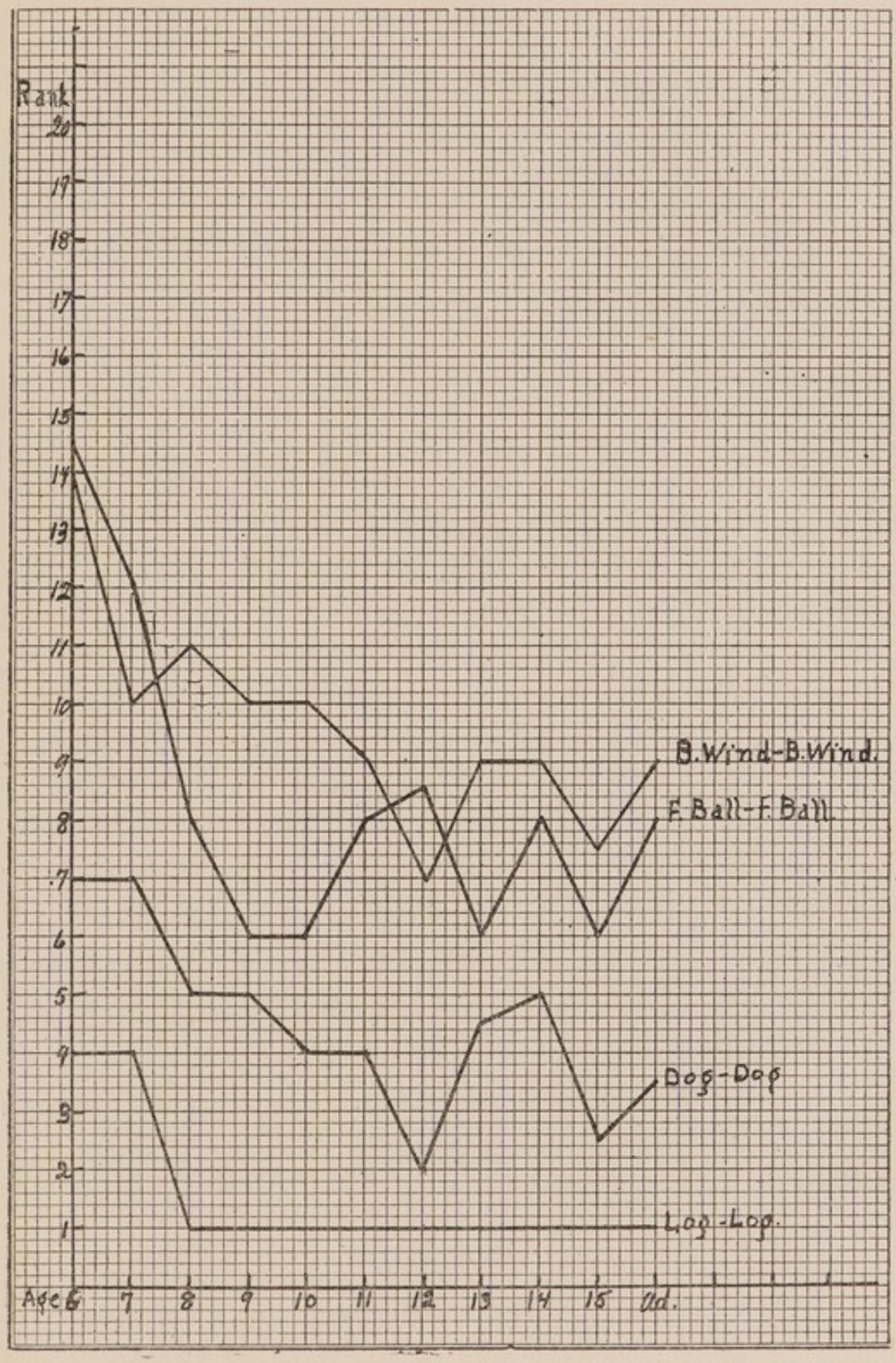
Rank
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
B. Wind-B. Wind.
F. Ball-F. Ball.
Dog-Dog
Log-Log.
Age 6 7 8 9 10 11 12 13 14 15 Ad.

FIGURE 11

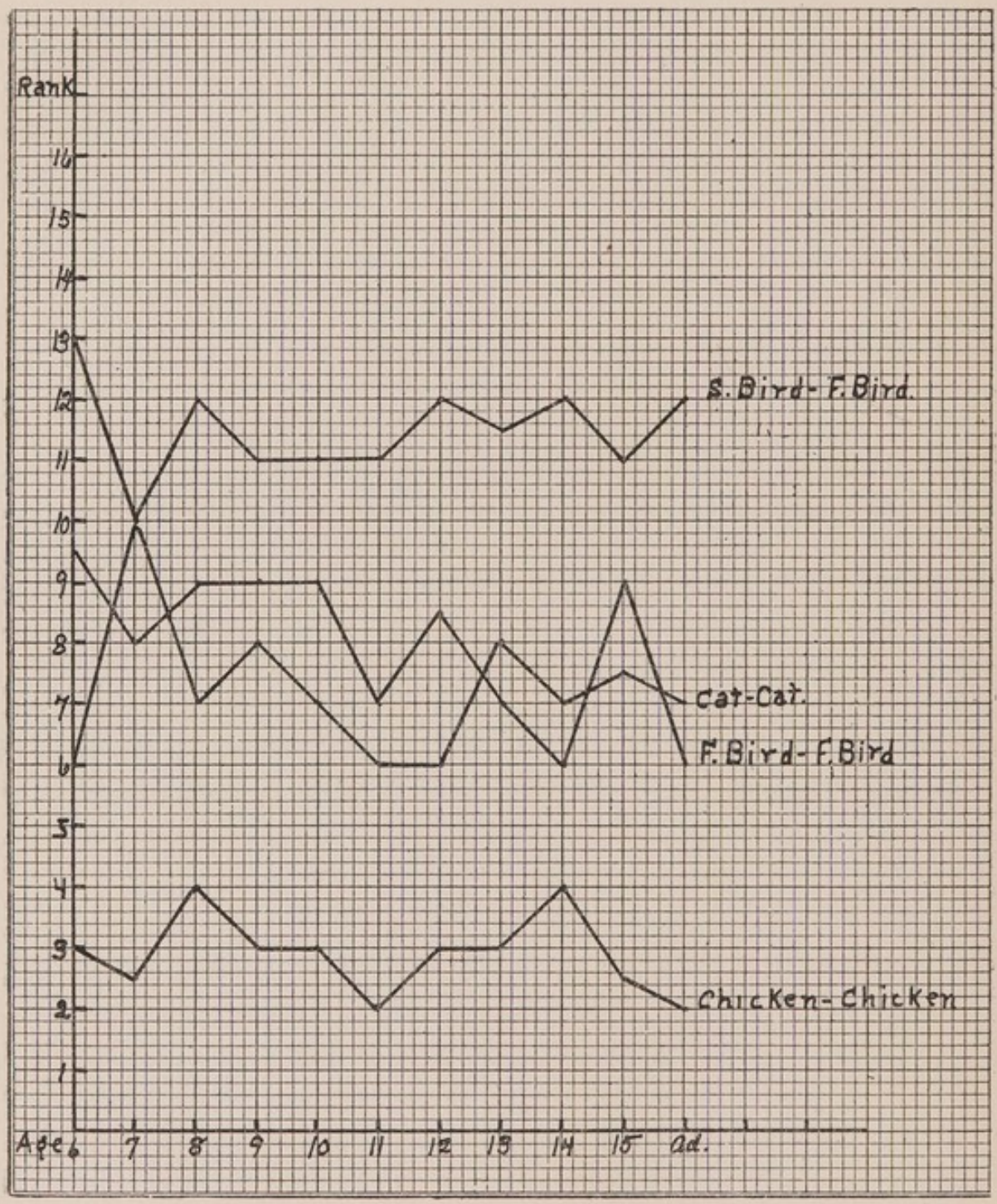
Rank
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
S. Bird - F. Bird.
Cat - Cat.
F. Bird - F. Bird
Chicken - Chicken
Age 6 7 8 9 10 11 12 13 14 15 Ad.

FIGURE 12

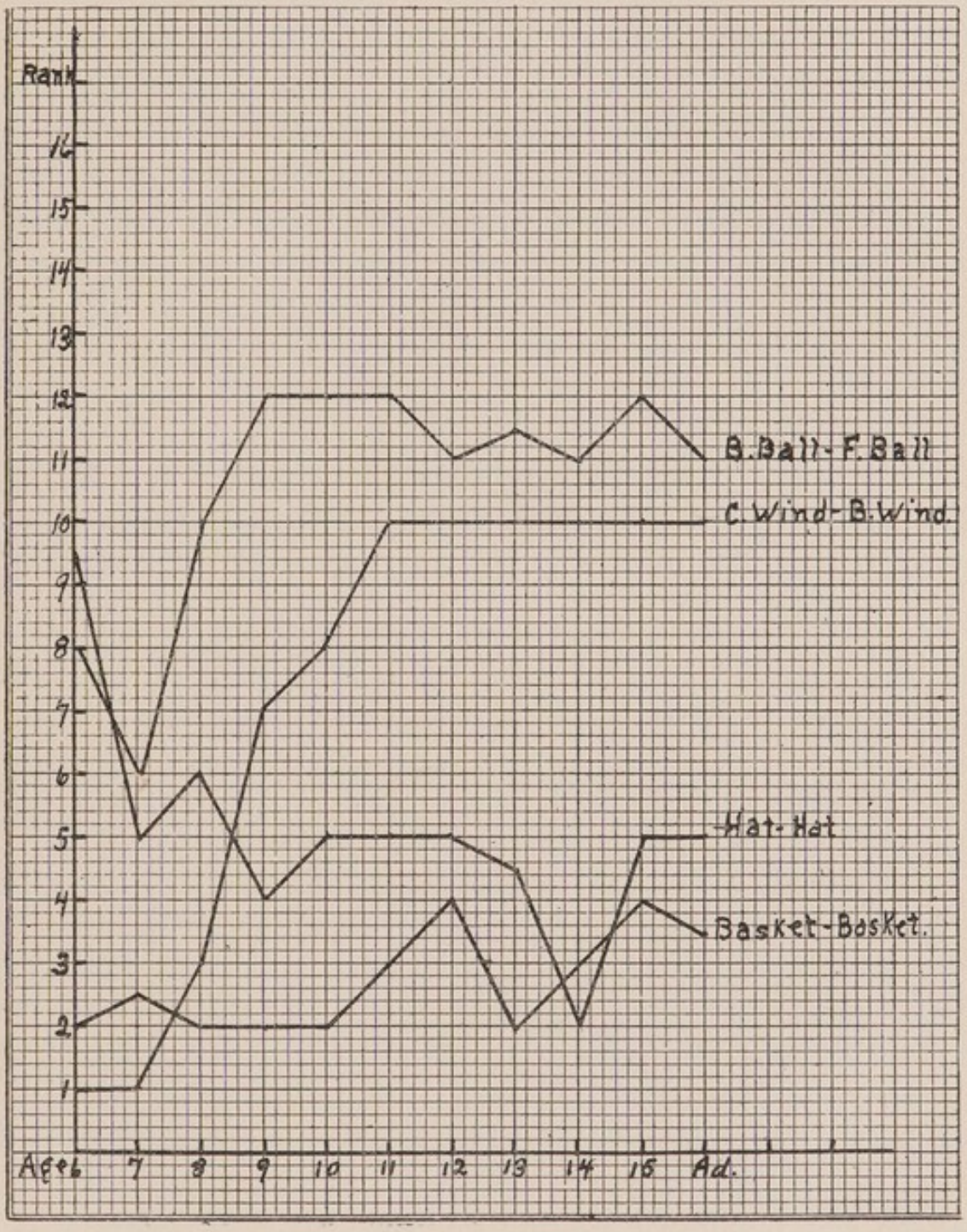
Rank
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Ages
7
8
9
10
11
12
13
14
15
Ad.
B.Ball-F.Ball
C.Wind-B.Wind.
Hat-Hat
Basket-Basket.

FIGURE 13

The P. E. varies from .03 to .04. These correlations are high and range only from .74 to .90. These high coefficients and their uniformity at every age justify the use for subjects of any age of the scoring values determined by the total group. They show that, on the whole, the relative ease or difficulty of the moves is pretty much the same for any age-group.

In addition to these correlations, we have computed by the same method others between each age and every other age for the ranking of these 61 moves. These correlations are shown in Table XLVI. It will

TABLE XLVI

Correlations

Age	6	7	8	9	10	11	12	13	14	15	Ad.
6.....		.80	.66	.72	.62	.62	.55	.73	.55	.57	.67
7.....	.80		.71	.67	.61	.69	.61	.76	.61	.62	.72
8.....	.66	.71		.78	.73	.71	.69	.66	.69	.59	.79
9.....	.72	.67	.78		.72	.77	.79	.77	.82	.66	.72
10.....	.62	.61	.73	.72		.80	.77	.67	.67	.72	.74
11.....	.62	.69	.71	.77	.80		.73	.80	.76	.82	.81
12.....	.56	.61	.69	.79	.77	.73		.74	.77	.69	.78
13.....	.73	.76	.66	.77	.67	.80	.74		.79	.71	.72
14.....	.55	.61	.69	.82	.67	.66	.77	.79		.72	.75
15.....	.57	.62	.59	.66	.72	.82	.69	.71	.72		.74
Ad.....	.67	.72	.79	.72	.74	.81	.78	.72	.75	.74	

be seen that for the 61 moves under consideration there is at all ages a high correlation. The coefficients fluctuate between .55 and .82. This means that for the 61 moves under consideration the relative difficulty at all ages is much the same. In other words no age or group of ages is strikingly different from the others, and therefore we may conclude that no injustice is being done to any particular age by our method of scoring. Before computing these coefficients it was thought that there might be an increasing difference between the ages as we proceed from the lower to the

higher ages. For example, Age 6 might be thought to correlate most highly with Age 7, less with Age 8, and so on up to the adults, with which it might be expected to correlate least. An inspection of the table shows that this tendency is present, but only to a very slight degree. We cannot find any very uniform decrease. Looking at the first line of the table, we note that Age 6 correlates most highly with Age 7, then with ages 13, 9, adult, 8, 10, 11, 15, 12, and 14, in the order named. An inspection of the other ages, taking care to begin with the ages closest to the age under consideration, shows much the same results. On the whole, then, the correlations seem to show that no particular injustice is done to any age by the method of scoring adopted.

CHAPTER VI

Norms

By the foregoing method the 1520 cases were scored, and a table of distribution for all the cases by age was made. This table is too extended to give here; only a summary can be shown. Table XLVII shows the actual number of cases distributed by age and by score in units of fifty points. A perfect performance receives a score of 646. Table XLVIII shows the same facts as Table XLVII, except that percentages are used in place of numbers, thus making possible a direct comparison from age to age absolute. Without going into detail, we see that the larger percentages in the table tend to run diagonally from the upper left-hand corner down to the lower right-hand corner. At no age-group does the largest percentage occur in the 600 to 646 score. The largest single percentage of adults and fifteen-year-olds lies in scores between 551 and 600. It is interesting to note that even adults do not find this test easy to complete perfectly. A percentage of 3.3 adults falls below a score of 251. The greatest number at any age-group receiving a very high score, above 600, is found in the fifteen-year-old group. From this group down, there is, for this very high score, a steady decrease in percentage to zero at Age 6. Similarly, with the very low scores we find the largest percentages at the lower ages and a more or less steady diminution in percentage as we proceed to the higher age-groups.

Percentiles

From the extended table of distribution not included here, percentile scores for every ten per cent were cal-

TABLE XLVII.

Distribution of Scores

NUMBERS

Score	5	6	7	8	9	10	11	12	13	14	15	Ad.
0– 50...	8	25	11	6		1		1	1			
51–100...	3	35	17	4	3	2						
101–150...	2	12	16	8	1	2	2	1		1	2	
151–200...	2	25	21	11	1	2	2	2	3	1		2
201–250...	2	18	20	13	12	6	6	1	3	1		1
251–300...	1	12	13	20	14	11	7	6	6	2	1	
301–350...		7	15	17	20	14	8	11	5	2	3	4
351–400...	2	8	15	25	22	19	20	22	10	12	5	5
401–450...		3	3	23	32	26	29	21	20	16	7	10
451–500...		4	7	8	15	11	21	14	17	8	2	11
501–550...		1	4	11	13	31	24	26	39	32	8	21
551–600...			7	4	11	17	25	32	27	22	15	29
601–646...			1	2	6	8	11	13	19	12	9	9
Total...	20	150	150	152	150	150	155	150	150	109	52	92

TABLE XLVIII.

Distribution of Scores

PERCENTAGES

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.
0– 50	40.0	16.6	7.3	4.0		0.7		0.7	0.7			
51–100	15.0	23.3	11.3	2.6	2.0	1.3						
101–150	10.0	8.0	10.7	5.3	0.7	1.3	1.3	0.7		0.9	3.8	
151–200	10.0	16.6	14.0	7.2	0.7	1.3	1.3	1.3	2.0	0.9		2.2
201–250	10.0	12.0	13.3	8.5	8.0	4.0	3.9	0.7	2.0	0.9		1.1
251–300	5.0	8.0	8.7	13.1	9.3	7.3	4.5	4.0	4.0	1.8	1.9	
301–350		4.7	10.0	11.2	13.3	9.3	5.2	7.3	3.3	1.8	5.8	4.3
351–400	10.0	5.6	10.0	16.4	14.7	12.7	12.9	14.7	6.6	11.0	9.6	5.4
401–450		2.0	2.0	15.1	21.4	17.3	18.7	14.0	13.3	14.7	13.5	10.9
451–500		2.6	4.7	5.3	10.0	7.3	13.5	9.3	11.3	7.3	3.8	12.0
501–550		0.7	2.6	7.2	8.7	20.7	15.5	17.3	26.0	29.4	15.4	22.8
551–600			4.7	2.6	7.3	11.3	16.1	21.4	18.0	20.2	28.9	31.3
601–646			0.7	1.3	4.0	5.6	7.1	8.7	12.7	11.0	17.3	9.8
Total	100.0	100.1	100.0	99.8	100.1	100.1	100.0	100.1	99.9	99.9	100.0	99.8

culated for each age-group. These are shown in Table XLIX.[1] The fifty percentile or median gives the age-norm for the test. The median scores for children show a steady increase from age to age, and would seem to denote sufficient difference from age to age to make this an excellent test for diagnostic purposes. The drop of ten points in the median of the adults as compared with the fifteen-year-olds raises the question whether the test is adapted to adult

TABLE XLIX.

Percentile Distribution

Percentiles	5	6	7	8	9	10	11	12	13	14	15	Ad.
Highest.....	394	525	646	646	646	646	646	646	646	646	646	646
90.....	259	354	463	507	577	578	583	583	646	646	646	646
80.....	207	260	364	446	499	522	578	578	581	578	583.5	583
70.....	169	219	318	422.5	450	509	519	547	566	570	577.5	578
60.....	126	185	263	381	440	478	501	509	515	521.5	567	569
50.....	89	153	239	328	407	435	455.5	493	505	515	525	515
40.....	49	99	189	296	372	411	443	445	494	501	501	509
30.....	28	76	153	261	325	367	411	407	446	444	444	469
20.....	5	62	107	201.5	297	313	369	369	417	415	380	441
10.....	2	14	60	129	240	251	296	313	310	366	329	360
Lowest	0	0	0	3	62	35	122	36	47	106	144	162
Number	20	150	150	152	150	150	155	150	150	109	52	132
75 %ile.....	207	245	348	439	477	515	534	570	578	578	583	583
Median.....	89	153	239	328	407	435	455.5	493	505	515	525	515
25 %ile.....	5	71.5	131	235	310	339	380	382	436	437	435	453
Quartile....	101	87	108	102	83	88	77	94	71	70	74	65

intelligence. As noted in another chapter, Healy reports a poor performance with adults. In explanation: it may be that a far greater number of possibilities occur to them than occur to children, or it may be, that they do not try as hard as the children to do their

[1] The quartile on this and other tables is the semi-interquartile range. We have followed Thorndike in calling it the quartile for purposes of brevity.

best, although this was not obvious from their behavior. Or it may simply be that our group of fifteen-year-olds did actually possess slightly more intelligence than our group of adults, if this test is a good test of intelligence.

The other percentiles show an almost steady increase from age to age, although this increase is not as uniform as the increase of the medians. The curves of the percentiles for each age are shown in Figure 14. From this graph we note that the 30 percentile, the 40 percentile, the 60 percentile, the 70 percentile, the 80 percentile and the 100 percentile as well as the 50 percentile (median) show no decided breaks from age to age, whereas the curves for the lowest score, the 10 percentile, and the 20 percentile do show very decided breaks at certain ages. For example, the 10 percentile of the thirteen-year-olds drops slightly below that of the twelve-year-olds; similarly, the fifteen-year-olds at this percentile drop 37 points below the fourteen-year-olds. In the same way, the 20 percentile shows a distinct drop at fifteen years. It is to be noted that this lack of a uniform increase in the percentiles is characteristic of the upper ages. It is most marked at Age 15 where there was the fewest number of cases. None of the breaks occur below the age of eleven. It is to be noted in reference to the 100-percentile curve (i. e., the best score at each age) that this reaches the maximal score at Age 7 and remains at this point for all successive age-groups. This means that at Age 7 and above there is always some individual who can complete the test perfectly. The curve showing the lowest score at each age is decidedly irregular, and no individual in any age-group above seven makes a zero score as in Ages 5, 6, and 7. The curve attains its highest point in the adult group.

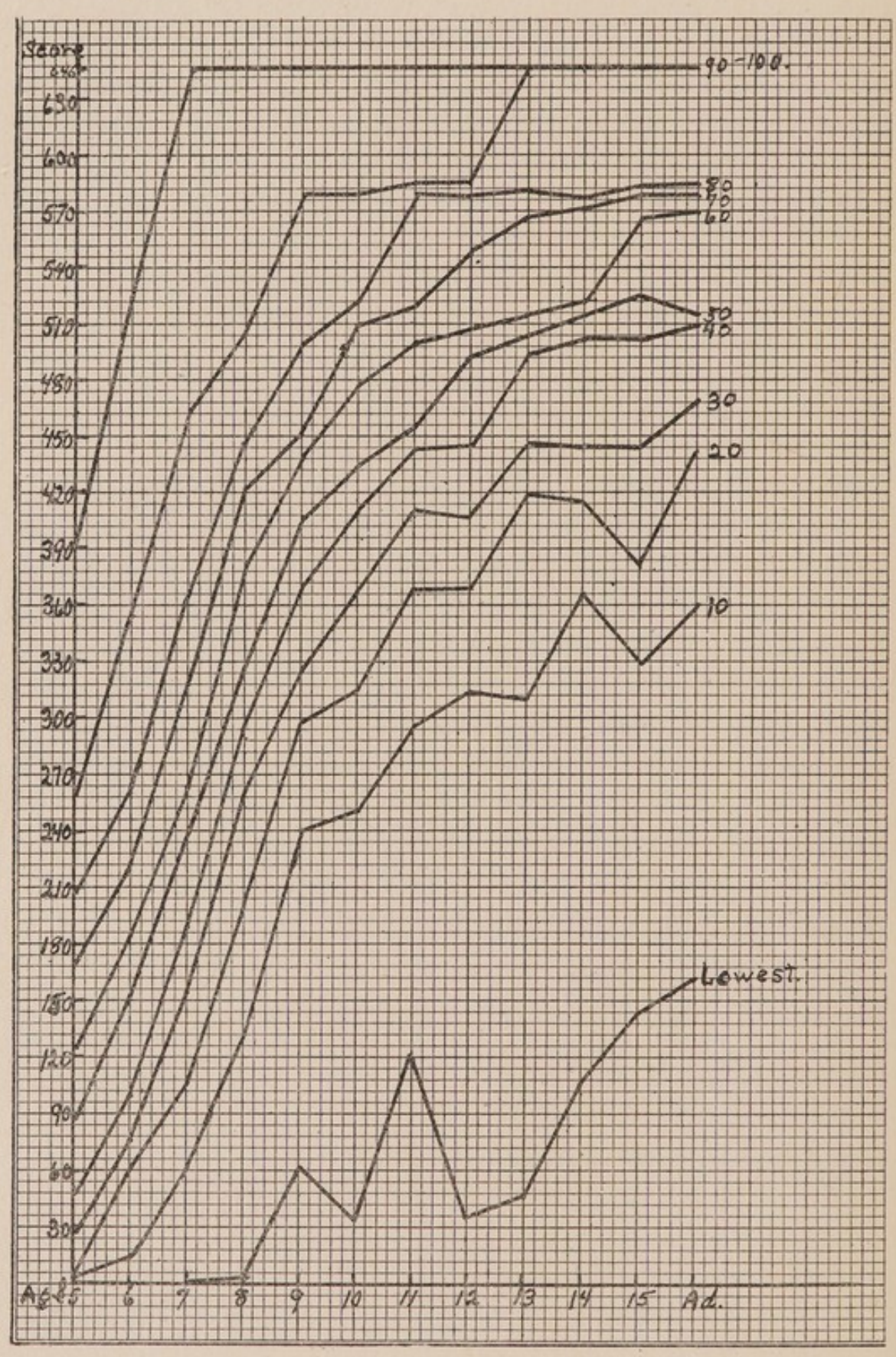
Score
650
600
570
540
510
480
450
420
390
360
330
300
270
240
210
180
150
120
90
60
30
90-100.
80
70
60
50
40
30
20
10
Lowest.
Age 5
6
7
8
9
10
11
12
13
14
15
Ad.

FIGURE 14

The greatest irregularity occurs at Age 11, where the lowest score is 122 points. The distance between the curves on this graph is interesting: in general, the curves of the higher and lower percentiles are farther apart than those representing the middle group of percentiles. This is to be expected in a normal distribution, and indicates a normal sampling of our individuals in each age-group.

Figure 15 shows the increase in score for each percentile at each age. From Ages 5 to 11 the curves are fairly distinct, with no overlapping, but from Age 11 onwards there is considerable overlapping at the upper and lower ends of the curves, *i. e.*, the difference in score from age to age is becoming increasingly less. From this graph we can compare the percentile performance at any age with that of any other age. For example, a 90-percentile child of five years makes a score that is about equal to an 80-percentile child of six years; both of them are equal to a 58-percentile child of seven or a 30-percentile child of eight, a 15-percentile child of nine, a 10-percentile child of ten, and a child below the 10 percentile in all the higher ages. This kind of comparison can be made by reading horizontally across the graph at any height.

If the results of other tests were to show the same general tendencies, it might be possible to make generalizations about intelligence of this nature, *e. g.*, a very bright five-year-old child has the intelligence of an average seven-year-old child or a dull nine-year-old child, etc. Obviously, a single test is not sufficient to allow of this type of generalization, but merely points the way in which such generalization might be made.

This presentation of the results in percentiles will permit the incorporation of this test into any scale based on the percentile method.

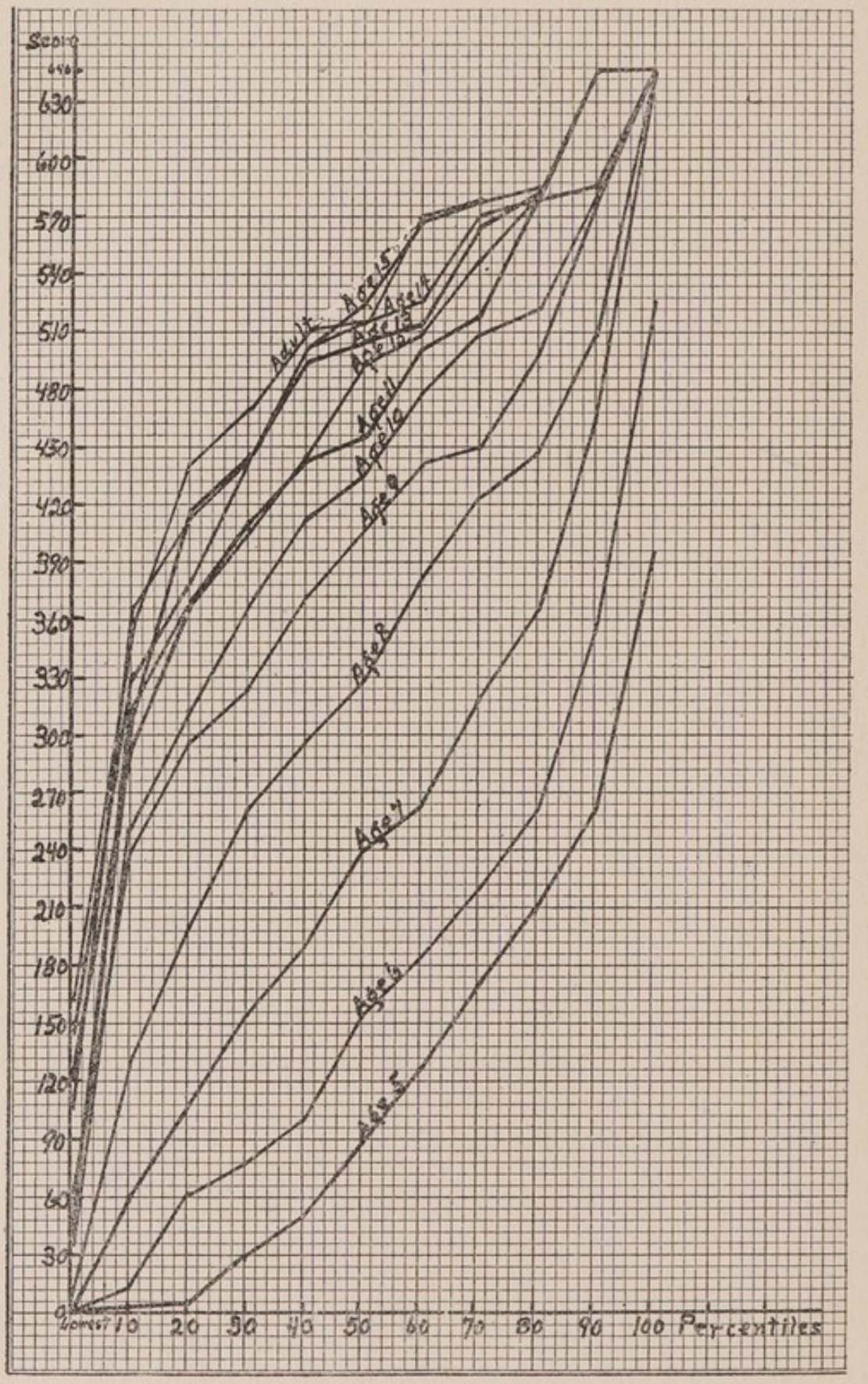
Score
640
630
600
570
540
510
480
450
420
390
360
330
300
270
240
210
180
150
120
90
60
30
0
Adult
Ages 15
Ages 14
Ages 13
Ages 12
Ages 11
Ages 10
Age 9
Age 8
Age 7
Age 6
Age 5
Lowest 10 20 30 40 50 60 70 80 90 100 Percentiles

FIGURE 15

Year-Scale Norms

In case the test might prove suitable for inclusion in a year scale, we present below the necessary values. We have taken the arbitrary 75 per cent standard for a year scale—a standard which we believe the best in dealing with a test of this type.[2] The lowest score made by the upper 75 per cent is taken as the year scale value and the age interval for any one age extends from a point midway between this score and the score of the age below to a point midway between this score and the score of the age above. These intervals have been determined from the 25 percentile column in Table XLIX. These limiting scores, or age intervals, are as follows:

Age	5	6	7	8	9	10
Score	5–38	39–101	102–183	184–272	273–324	325–359

Age	11	12	13	14	15	Ad.
Score	360–381	382–409	410–436	437–441	442–449	450 and over

That is to say, all children who make scores of from about 5 to 38 are to be given five-year-old credit; all children making scores from 39 to 101 are to be given five- and six-year-old credit; those between 102 and 183 receive five-, six- and seven-year-old credit; and so on up to age fifteen, where those who make 442 or better receive a "pass" at each year from five to fifteen, inclusive.

The presentation of our results in the form of medians, percentiles and year intervals makes possible the incorporation of this test into any type of scale or group of tests in general use at the present time.

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[2] For a discussion of standards for year scales and of the way in which a test of this kind can be incorporated into a scale, see Pintner, R., and Paterson, D. G., A Scale of Performance Tests, D. Appleton and Company, 1917.

CHAPTER VII

Sex, Social Status, and School Standing

The differences in the scores of the children according to their sex, according to the social status of their parents, and according to their school standing have been briefly investigated. It is not the intention of the writers to enter into an exhaustive study of this question, but it seemed desirable to study the influence of these three factors, particularly of the last two. There are an increasing number of studies showing the difference in general intelligence between children from better class homes and children from poor homes.[1] If the same difference were to be found in this one test, it was felt that it would give added reliability to the test as a test of intelligence. In the same way, some idea of how the accelerated and the retarded pupils performed the test might increase our confidence in it, if the test showed a difference in the performances of these two groups.

Sex Differences

No minute analysis was made of the sex differences in this test; it was deemed sufficient to find the medians for the boys and the girls at each age.

The median scores are presented in Table L, and Figure 16 shows the same facts graphically. From the table we see that the median for the boys is greater than the median for the girls for Ages 5, 7, 8, 13, and for adults, while the median for the girls is higher at the remaining ages. From the graph it will be seen

[1] Yerkes, R. M., Bridges, J. W., and Hardwick, R. S., A Point Scale for Measuring Mental Ability. Warwick and York, 1915. Also, Bridges, J. W., and Coler, L., The Relation of Intelligence to Social Status. Psych. Review, 24, 1917, 1–31.

TABLE L.

Sex Differences

MEDIAN SCORES

Age	5	6	7	8	9	10	11	12	13	14	15	Ad.
Boys.....	180	140	250	354	396	434	448	503	514	515	509	546
Girls.....	34	173	229	322	425	473	455	512	503	515	567	515

that the two curves cross and re-cross each other several times, showing no constant and uniform sex difference. The slight variations of the medians at each age are evidently not due to sex. We may, therefore, conclude that the test is equally well adapted to boys and to girls.

Differences in Social Status

The schools in which the tests were made were divided into a good, a medium and a poor school. The good school, however, was not very superior to what we have called the medium school in regard to the social status of the childrens' parents. The poor school contained children from the laboring classes, but could not by any means be considered the poorest school in the city. There are relatively few children in the medium school, so few in fact that at some ages we omitted the median as being too unreliable.

The median scores according to age for the three types of school are shown in Table LI. It will be noted that the medians for the good and medium schools are very much alike. In fact at three ages the median for the medium school is slightly above the median for the good school. There is, then, no radical difference between these two schools on this

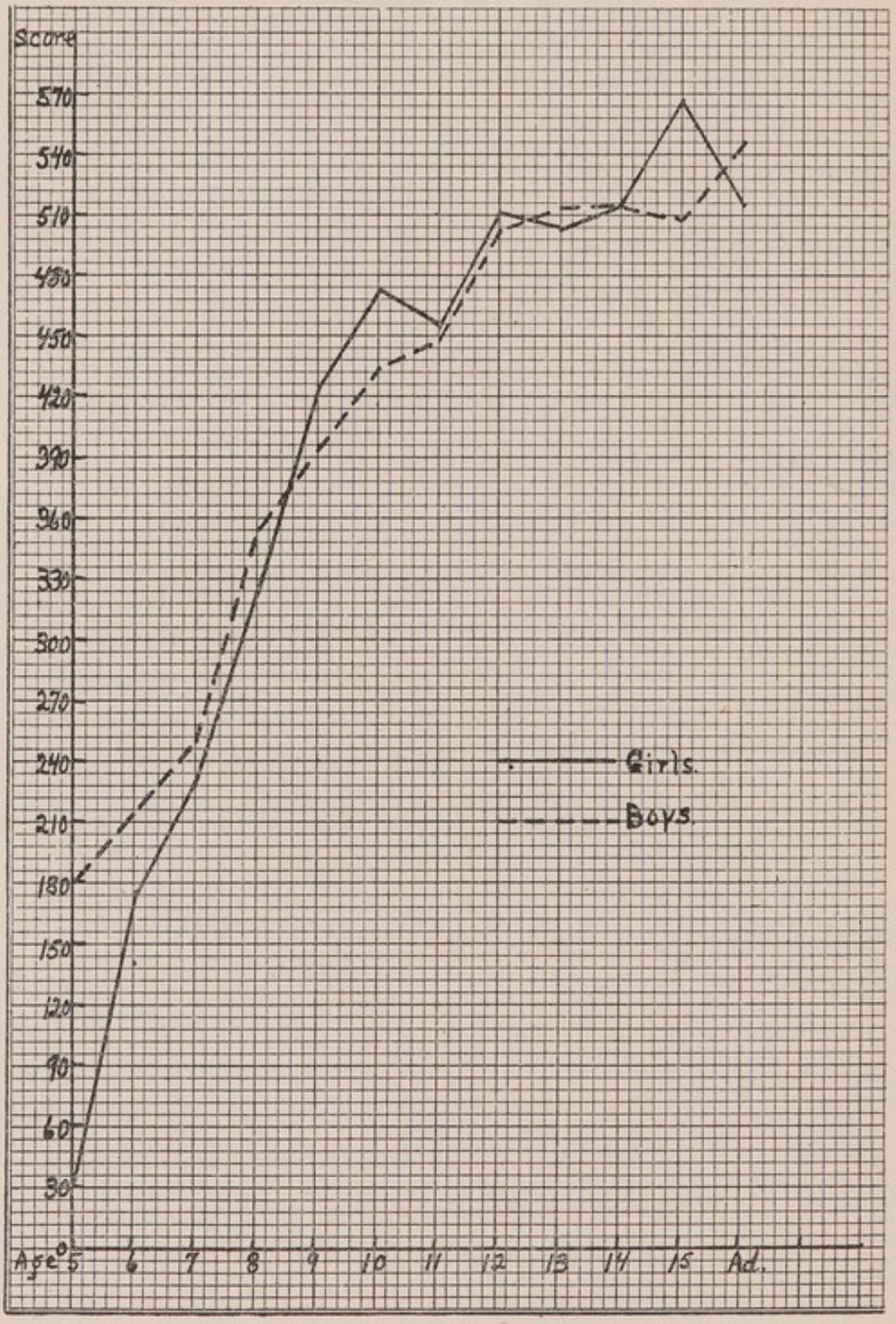
Score
570
540
510
480
450
420
390
360
330
300
270
240
210
180
150
120
90
60
30
Age 5
6
7
8
9
10
11
12
13
14
15
Ad.
Girls.
Boys.

FIGURE 16

TABLE LI.

Social Status

MEDIAN SCORES

Age	5	6	7	8	9	10	11	12	13	14	15
Good	113	174	259	355	430	435	457	509	514	515	527
Medium		176	195		386	497	460	436	448	464	
Poor		76	159	270	380	379	435	401	430	441	440

test. On the other hand, a comparison of the poor with the medium or good school shows a decided difference in medians. At every age the medians of the poor school are below the other medians. This is shown strikingly in the curves on Figure 17. At no age does the curve for the poor school reach the curve for the good school. The difference is uniform over the whole curve and fairly well marked at all ages.

Racial Differences

It was thought that the difference between colored and white children might be shown by means of medians at each age. In our records, however, there were only 36 colored children and, therefore, age medians would have had no value. The small number of colored children does not allow of any important conclusions. We have presented the facts, however, for what they are worth. Table LII shows the number of colored children above or below the median for

TABLE LII.

Racial Differences

COLORED CHILDREN—NUMBER ABOVE AND BELOW MEDIAN

Age	6	7	8	9	10	11	12	13	14	15	Total
Above	0	0	1	3	0	1	1	0	1	0	7
Below	2	8	1	4	4	3	4	1	1	1	29

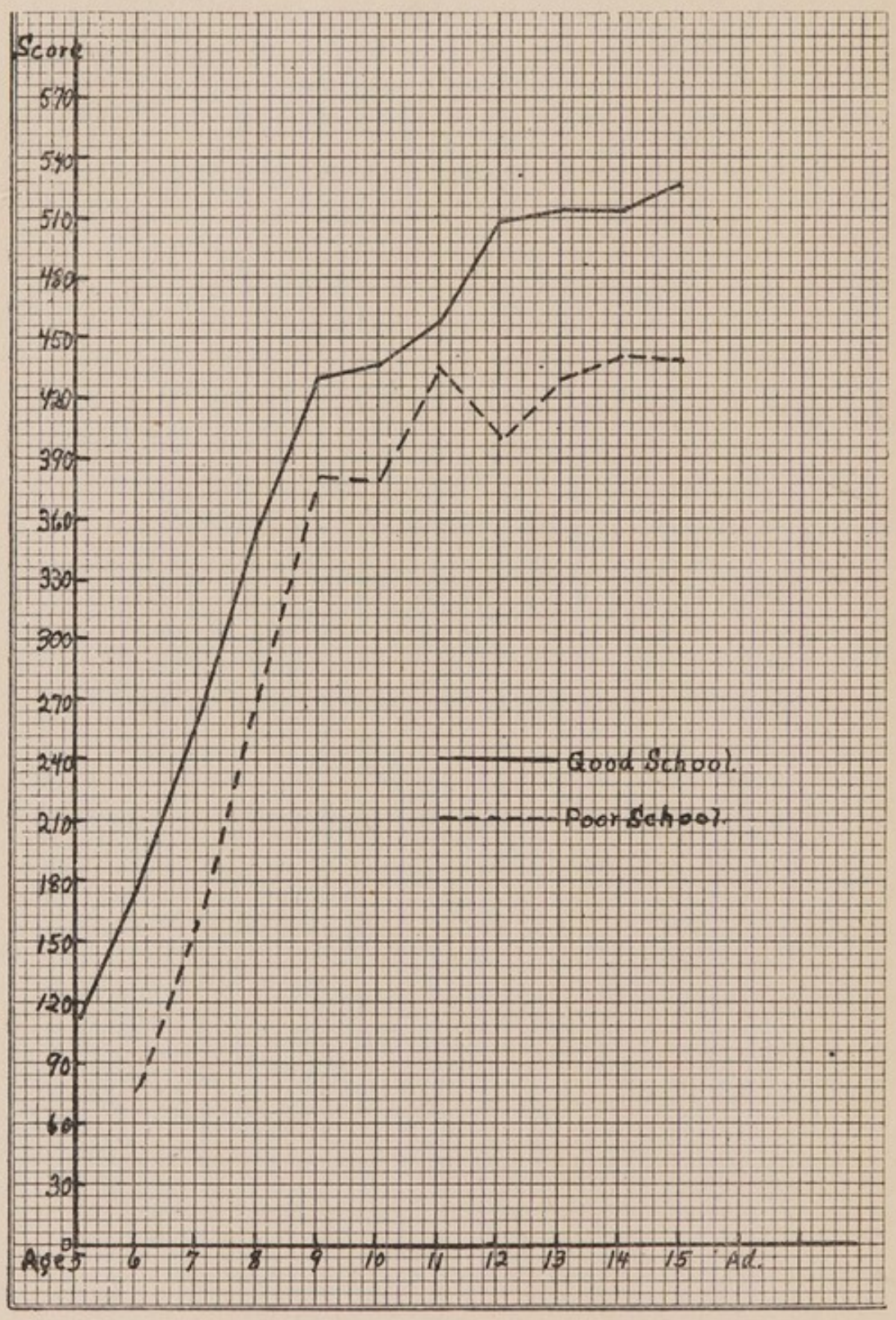
Score
570
540
510
480
450
420
390
360
330
300
270
240
210
180
150
120
90
60
30
Age 5
6
7
8
9
10
11
12
13
14
15
Ad.
Good School.
Poor School.

FIGURE 17

their age. At no age is there a greater number of colored children above the median than below the median. Of the 36 colored children tested, 29 fell below the median for their respective ages and only 7 made scores better than the median. On the whole, therefore, the colored children are inferior to the white, but the extent of this inferiority has not been exactly determined.

School Standing

On the whole, we may say that the child who is older than the average age for his grade is duller than the average of his age and that the child who is younger than the average age for his grade is brighter than the average. We shall call the former class of children retarded and the latter accelerated. It is by no means a foregone conclusion that the retarded child is mentally slow. Some retarded children have been found to test mentally bright. And similarly, some accelerated children are by no means mentally bright. The grade of a child cannot with any certainty be taken as an accurate index of his intelligence. There are other factors entering into a child's rate of progress in school beside his native ability. But on the whole, the accelerated pupils represent the brighter, and the retarded represent the duller pupils.

If this test is testing something that enters into the complex known as general intelligence, then we should expect on the whole to find the accelerated doing bettter in it than the retarded. We have presented our results by showing the number of accelerated or retarded at each age who make scores above or below the median for the age. We have counted as normal, or "at age," for the grade as follows: Grade I, Ages 6–7, Grade II, Ages 7–8, and so on to Grade X, Ages 15–16. All

children in grades above the corresponding ages have been counted accelerated; all children in grades below the corresponding ages have been called retarded. The results are presented in Table LIII.

TABLE LIII.

School Standing

NUMBER OF ACCELERATED AND RETARDED ABOVE AND BELOW MEDIAN

Age	6	7	8	9	10	11	12	13	14	15	Total
Accelerated											
Above.....	7	7	18	10	14	11	14				81
Below.....	3	2	9	4	4	5	2				29
Retarded											
Above.....				2	3	8	11	11	9	14	58
Below.....			2	5	7	12	19	22	19	19	105

The table is to be read as follows: At Age 6 there are 7 accelerated pupils who made scores on this test better than the median score for six-year-olds; there are 3 accelerated pupils who made scores below that median and there are no retarded pupils. Under Age 10 we find 18 accelerated pupils, of whom 14 made scores above the median for ten-year-olds and 4 made scores below the median. Of the 10 retarded pupils at Age 10, 3 made scores above and 7 below the median. Examining the results for the accelerated pupils, we note that at every age a decidedly greater number make scores above the median than below. The total shows 81 making scores above and only 29 below the median. That is, out of a total of 110 accelerated pupils 74 per cent make scores above the median. Turning now to the retarded pupils, we note that at every age a greater number score below than above the median for their age. The total shows 105 below and only 58 above the median. The total number of retarded is 163, 64 per cent of whom score below the median.

In general, therefore, we find that there is an agreement between performance in this test and school standing, and it is an agreement such as one might anticipate in view of what we have said of the differences between the intelligence of the accelerated and the retarded pupils in our schools. An absolute agreement between the results of the test and the school standing was not to be expected, and would have been suspicious if it had occurred.

$$\frac{\sqrt{81 \times 105} - \sqrt{29 \times 58}}{+} = \frac{186 - 97}{+}$$

$$= \frac{89}{283}$$

$$\therefore r < .3 !$$

CHAPTER VIII

Other Methods of Scoring

Two other methods of scoring have been used for this test in work already published. These we have mentioned in Chapter II and we now propose to present our results worked out according to these two methods, both for purposes of comparison with the work already done and for a critical inspection of the methods. These two methods are (1) Healy's Method and (2) The Method of Right and Wrong Moves, used by Hall.[1]

Healy's Method

Healy's norm for children above ten years is: not more than one logical and two total errors with a time limit of five minutes. His list of logical errors has been given in Chapter IV. In another place he says: "At eleven years this test should be readily accomplished with not more than one or two final errors, and certainly not more than one illogical error. The median or average performance for all in the group of those ordinary in ability above ten years, is one final error and no illogical error."[2] The latter sentence would seem to make his norm even a little higher than before.

We have worked over our results in the light of Healy's norm, considering as passed all who made not more than one logical and two total errors (logical in this connection means the particular moves so designated by Healy). As the results were being compiled,

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[1] Hall, G., Eleven Mental Tests Standardized, *Eugenics and Social Welfare Bulletin*, No. V, State Board of Charities, N. Y., pp. 74–78.

[2] Healy, W., *The Individual Delinquent*, Boston, 1915, Chap. VII, p. 83, p. 111.

it became obvious that Healy's norm was much too severe. It occurred to us that the time limit of five minutes might be one of the reasons. Therefore, we present the results with and without the time limit of five minutes suggested by Healy.

TABLE LIV.

Number and Per cent. Passing at Healy's Standard

	Time Limit		No Time Limit	
Age	Number	Per Cent	Number	Per Cent
5.....	0	0	0	0
6.....	0	0	0	0
7.....	7	4.6	12	8.0
8.....	5	3.2	17	11.2
9.....	23	15.3	35	23.3
10.....	48	32.0	55	36.6
11.....	54	33.9	59	37.1
12.....	72	47.3	76	50.6
13.....	78	52.0	84	56.0
14.....	65	59.4	65	59.4
15.....	31	59.6	34	65.4
Adult..	79	59.8	87	65.9

Table LIV shows the number and per cent at each age who pass the test according to Healy's norm. The left half of the table gives the results with the five-minute time limit, the right half with no time limit. The table is to be read as follows: At Ages 5 and 6 no children passed the test; 7 children, or 4.6 per cent, of the seven-year-olds passed if a time limit is adhered to, and 12 or 8 per cent if no time limit is used, and so on with the other ages. It will be noted that disregarding the time limit increases the percentage of passes only slightly.

According to Healy's standard all normal children should pass the test at Age 11 and above. At Age 11 our table shows only 34 per cent (time limit) or 37 per cent (no time limit) passing the test. It is, of course, impossible to conceive of about 60 per cent of our eleven-year-olds as below normal. Continuing to

the twelve-year-olds, we find 47 per cent (time limit) or 51 per cent (no time limit) passing the test. Healy's norm is obviously too high for twelve-year-olds. Continuing up to the 13, 14, 15, and adult age groups, we find much the same state of affairs. Healy's norm is much too severe for all ages. It is an example of inadequate standardization leading to the establishment of a spurious norm. The danger of this in actual clinical work is obvious and real. That the danger is real can be shown from certain conclusions drawn by Porter,[3] who evidently has Healy's norm in mind. We shall reserve a discussion of these cases until we have presented the results for the other method of scoring, so as to be able to interpret Porter's results in the light of our norms.

Method of Right and Wrong Moves

In this method of scoring, suggested by Hall, only the nine correct moves are taken into account. A move is either right or wrong. The results for our own data according to this method are shown in Table LV. This table shows a distribution of the cases according

TABLE LV.

Percentage Distribution of Number of Correct Moves

	Number of Correct Moves									
Age	0	1	2	3	4	5	6	7	8	9
5..	35.0	15.0	15.0	15.0	10.0	10.0				
6..	18.6	24.6	22.0	16.5	8.0	6.0	3.3	0.7		
7..	8.0	18.6	18.0	17.3	13.3	10.0	5.3	4.0	4.7	0.7
8..	3.9	7.2	10.5	11.8	17.8	16.4	18.4	9.2	3.3	1.3
9..	...	2.7	2.7	10.6	19.3	14.6	25.3	12.7	8.0	4.0
10..	0.7	2.0	2.0	9.3	10.6	16.6	18.7	23.3	12.0	5.3
11..	...	0.6	1.9	4.4	8.2	17.0	28.3	15.7	17.6	6.3
12..	0.7	...	2.7	3.3	10.0	13.3	19.3	20.0	22.8	8.0
13..	0.7	...	2.0	2.0	6.0	8.7	18.7	28.0	21.3	12.7
14..	...	0.9	0.9	0.9	3.7	12.0	16.5	33.0	22.0	10.0
15..	...	...	1.9	1.9	5.8	11.5	13.5	21.0	27.0	17.3
Ad..	...	..	1.5	3.0	3.8	6.8	15.2	23.4	35.6	10.6

[3] Porter, F., Difficulties in the Interpretation of Mental Tests—Types and Examples, *The Psych. Clinic*, 9: 1915.

to the number of correct moves. It is to be read as follows: At 5 years 35 per cent of the cases made no correct moves, 15 per cent made one correct move, 15 cent made two correct, 15 per cent three correct, 10 per cent four correct, 10 per cent five correct, and no child made more than five correct moves. The other ages are to be read in a similar way. The table shows the natural tendency for the number of correct moves to increase with the higher ages. The percentage of persons at each age who made a perfect performance can be seen in the last vertical column. It is interesting to note that Ages 15 and 13 show the highest percentages for absolutely correct performances.

Table LVI presents the medians and 25th and 75th percentiles for our data for this method of scoring.

TABLE LVI.

Number of Correct Moves

Age	Number of Cases	25%ile	Median	75%ile	Quartile
5.....	20	0	1.5	3	1.5
6.....	150	1	2	3	1.0
7.....	150	1	3	4–5	1.75
8.....	152	3	4	6	1.5
9.....	150	4	5.5	6–7	1.25
10.....	150	4–5	6	7	1.25
11.....	159	5	6	7	1.0
12.....	150	5	7	8	1.5
13.....	150	6	7	8	1.0
14.....	109	6	7	8	1.0
15.....	52	6	7	8	1.0
Adult.....	132	6	7	8	1.0

The first vertical column gives the age, the next the number of cases, the next the 25 percentile score, the next the median, the next the 75 percentile score and the last the quartile, *i. e.*, the semi-interquartile range, which gives an indication of the amount of variation among the middle fifty per cent. The median shows

a steady increase from 1.5 (interpolated) correct moves at age five to 7 correct moves at Ages 12 to adult, inclusive. For a rough method of scoring these medians will suffice, but they cannot compare with the system adopted in this work, since no regard is paid to the type of errors made. Two children, both of whom get seven moves right and two wrong cannot be differentiated by this method, whereas the two wrong moves in each case may be indicative of very different types of ability.

Our data may now be used for a comparison with Hall's results. Hall presents her results in number of errors. Subtracting our medians from nine, we get the median number of errors and we can compare our median errors with Hall's median errors for the six age-groups tested by her. This comparison is as follows:

Age	Hall's Median	Our Median
7	7	7
8	5	5
9	3	3.5
10	4	3
11	3	3
12	3	2

The similarity of the results is striking; the only difference occurs at Ages 10 and 12, where it amounts to one error. It is to be remembered that Hall tested only 30 children at each age and that her twelve-year-old children are notably poor on all the tests reported by her. We think we may say that our median is a better index of twelve-year-old ability in this test.

In the light of these two methods of scoring, we may now examine Porter's special cases, which were evidently published before any other norms, with the exception of Healy's, were obtainable. We are able

to criticise the results of Porter only from the point of view of number of errors, since we have made no separate tabulation for the number of logical and illogical errors as defined by Healy. We have chosen examples showing close agreement and great disparity with our interpretation.

Case 3. Chron. Age 14. Completion Test—7 errors. Porter—"exceedingly stupid performance." Our standard—Six-year-old ability.

Case 8. Chron. Age 12. Binet—fails on one twelve-year test. Completion Test—0 errors. Porter—"rather a slow performance." Our standard—better than fifteen-year-old abilitv. This is a surprisingly good record for a twelve-year-old, of which fact Porter seems to take little account. The record puts the case among the highest 8 per cent of our twelve-year-old children.

Case 9. Chron. Age 10. Binet 9.2, "almost up to age." Completion Test—3 errors. Porter—"done rather slowly." Our standard—ten- or eleven-year-old ability. This is exactly what we should expect from a boy of this age.

Case 10. Chron. Age 16. Binet 10. Completion Test—1 error. Porter—"distinctly well done." Our standard—above fifteen-year-old ability, up to expectation for a boy of his age. Note discrepancy between Binet test and Picture Completion test.

Case 11. A deaf boy. Chron. Age 17. No Binet. Completion Test—0 errors. Porter makes no comment. Our standard—above fifteen-year-old ability. A remarkably good performance for a seventeen-year-old deaf boy.

Case 17. Chron. Age 11. Binet 7.8. Completion Test—6 errors. Porter makes no comment. Our

standard—7-year ability. Just what we should expect in a boy of that mentality according to the Binet.

Other cases show a similar agreement or discrepancy between our interpretation of the result of the test and the comments offered by Porter. At times we feel that her interpretation of the result of the test is totally inadequate and wrong, and all the way through at best we can have little better than good guess-work without an adequate standardization for purpose of comparison.

This discussion of other methods of evaluating performances in this test leads us to the conclusion that they are lacking in many respects in comparison with the method of scoring proposed by the authors. Both Healy's norm and the evaluation by number of errors are too crude for a complex test of this nature. There are so many possibilities that we ought to score these according to their ease or difficulty, and thus differentiate between many different types of performance.

CHAPTER IX

The Time

As stated previously, a record was kept of the exact time taken by each observer to complete the test. The time was taken for the first period, *i. e.*, until the observer had signified that he had finished, and also for the second period, *i. e.*, at the completion of the entire performance after he had been asked by the examiner whether he wished to change any of the blocks. In this work the results for the complete performance only have been used.

For each age a distribution of time in minutes was made. A summary of this distribution is given in Table LVII. In this and in Table LVIII the time

TABLE LVII.

Percentage Distribution of Cases for Each Period of Time

Time in Minutes

Age	—1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16–17	18
5		5.0	30.0	25.0		20.0		10.0	10.0									
6	1.3	6.0	12.6	23.3	16.6	14.0	5.3	6.7	2.7	2.7	3.3	1.3	2.0		0.7	0.7		0.7
7		4.7	8.7	17.3	18.0	13.3	10.0	12.6	5.3	6.0	3.3	1.3	0.7					
8		2.0	11.8	19.8	15.1	16.5	13.8	7.2	5.9	1.3	1.3	2.0	2.6		0.7			
9			16.6	28.0	17.3	12.0	8.7	6.0	4.0	2.0	2.7	1.3	0.7	0.7				
10		5.3	22.0	29.3	22.0	10.0	6.7	2.0	2.0	0.7								
11		3.8	28.4	30.8	18.2	11.3	3.1	2.5	1.3		0.6							
12		6.7	31.3	30.0	21.3	6.7	3.3		0.7									
13		10.0	38.0	28.7	16.6	2.0	3.3	0.7	0.7									
14	0.9	1.8	35.9	30.2	10.1	2.7		1.8										
15		11.5	50.0	27.0		3.8	5.8		1.9									
Adult		14.1	49.0	17.4	8.7	7.6	2.2						1.1					

intervals are all expressed in minutes. Minus one means all fractions of a minute from 0 seconds to 59 seconds; one means all records from one minute up to

one minute and 59 seconds, and so on. It was deemed unnecessary, as the results will show, to give fractions of a minute.

In Table LVII the percentage of cases at each age is shown according to the time taken. Glancing down the vertical columns it will be noted that practically no observers finished before one minute, and not more than 14.1 per cent in any one age-group finished within one minute and 59 seconds. In the third column (2 minutes to 2 minutes and 59 seconds) we note at each age a fairly large percentage of cases; the lowest is 8 per cent at Age 7 and the highest 50 per cent at Age 15. In the 3-minute column we find again a large percentage of cases at each age; the lowest is 17 per cent at Age 7 and adults, and the highest 30 per cent at Ages 11, 12, and 14. In the 4-minute column the percentage on the whole drops off as compared with the two preceding columns. In the five minute column the percentages are on the whole still lower. In the remaining columns the percentages continue to decrease very rapidly. From this point on, there are always zero percentages at each age.

There is therefore little difference in the time taken to complete the test at each age. The table shows us that in general there is a slight tendency for longer periods of time among the lower ages. This tendency is by no means uniform. The largest scattering of cases occurs at Age 6. The general impression obtained from the table is the close similarity of the time period required to complete the test from age to age. The number of the cases in the 2- and 3-minute columns seems greater at all ages than the number in the other columns. This can be seen from the following summary. Taking the cases that took from 2 to

3 minutes and 59 seconds at Age 5 to Adult, we have the following series of percentages: 55.0, 35.9, 26.0, 31.6, 44.6, 51.3, 59.2, 61.3, 66.7, 66.1, 77.0, 66.4.

These figures show the greater uniformity in time period as we proceed to the upper ages. Age 5 is represented by only 20 cases and this suggests that the relatively large percentage shown in the figures above is probably due to chance. These figures indicate the greater scattering of cases over the longer time periods in the lower ages. A glance at the first two columns of Table LVII will show that the scattering is in the main over the longer time periods and not over the shorter, since a very small percentage of cases at any age complete the test within two minutes.

Table LVIII shows the medians and percentiles for the time at each age. Column 1 gives the age, Column

TABLE LVIII.

Medians and Percentiles for Time at Each Age

TIME IN MINUTES

Age	Number	Median	25%ile	75%ile	Total Range
5.....	20	3	2	5	1 to 8
6.....	150	4	3	6	—1 to 18
7.....	150	5	3	7	1 to 12
8.....	152	5	3	6	1 to 14
9.....	150	4	3	6	2 to 13
10.....	150	3	2	4	1 to 9
11.....	159	3	2	4	1 to 10
12.....	150	3	2	4	1 to 8
13.....	150	3	2	4	1 to 8
14.....	109	2	2	3	—1 to 7
15.....	52	2	2	3	1 to 8
Adult.....	92	2	2	3	1 to 12

2 the number of cases, Column 3 the median time in minutes, Column 4 the 25 percentile, Column 5 the 75 percentile, and the last column the range in time from shortest to longest. The medians vary from

age to age very slightly. Again we see the tendency for the median to decrease as we approach the higher ages. The percentiles bear out what was noted in the table of distribution, that the greater number of cases lie within relatively narrow limits of time. The range indicates the extreme variations.

It is obvious from this discussion that we cannot take the length of time as a measure of the individual's excellence in the test. The distinct differences in score denoting the excellence of the performance as we proceed from a lower to a higher age-group are so marked as to make any difference in time of no consequence in this test. It would seem to be entirely unjust to penalize a performance because of the length of time taken or to award more credit for a performance somewhat quicker than the average. The differences in time from age to age are not sufficient to warrant this. It may be desirable for practical purposes to limit the time to eight or to ten minutes. This limitation is to be recommended in the use of the test in a scale of performance tests. It would be a justifiable procedure, since we must remember that the examinee is doing many other tests and is not to be fatigued by any one test. If a limit of 10 minutes were imposed very few of the cases would be affected by it, since never more than 5 per cent of the cases at any age took more time.

If we examine a little more closely the cases that took ten or more minutes to complete the test, we find that the majority of these occur in the lower ages. All but two occur at nine years or below. The excellence of the performances taking ten or more minutes is as follows: At Age 5 there were no cases; at Age 6 there were 13 cases, of which 10 scored above average

for that age and 3 below; at Age 7 there were 8 cases, 4 above and 4 below the average score; at Age 8 there were 10 cases, 6 above and 4 below the average score; at Age 9 there were 8 cases, 6 above and 2 below the average score; at Age 10 there were no cases; at Age 11 there was one case below the average score; at Ages 12 to 15 there were no cases; among the adults there was one case, and it fell below the average score.

This seems to indicate that there is little relation between the long time taken and the score made. Most of these long-time cases scored somewhat better than the average for their age. This fact again emphasizes the uselessness of the time taken as a measure of the excellence of the performance. The conclusion is, therefore, that time should not be taken into account in evaluating the excellence of a performance in the test. The only restriction in regard to time that might arise would be a practical one, and, if a time limit of 10 minutes were imposed, some slight penalty would attach to those taking too long a time.

CHAPTER X

Conclusions

The justification for this lengthy and minute analysis of one test lies, we believe, in the increasing demands made by clinical psychology for more effective and reliable measuring instruments. It seems to the authors that these demands cannot be met except by very detailed studies of individual tests. Studies of this sort are beginning to appear on all sides. The time of rough and ready standardization is passed, because we are beginning to realize its dangers and because we are expecting a test to give us more than a vague indication of a child's ability.

It ought not to be necessary to say that this test as standardized by us must take its place simply as one among a group of tests used for clinical purposes. No child's mentality can be described on the basis of a single test, however accurately standardized.

A summary of the chief results of this study follows:

(1) The test has proved to be excellently adapted for children at all ages and to some extent for adults.

(2) The method of presentation used by Healy has been found to meet fully the requirements of practical testing.

(3) The 1520 subjects tested have proved sufficient to determine a method of scoring and to arrive at reliable norms for Ages 6 to 14, inclusive.

(4) The method of scoring has been determined from a purely objective standpoint. It depends upon the relative ease or difficulty of any of the 369 possible moves. The ease or difficulty of a move is determined by the number of individuals that make that move.

(5) Age-norms and percentile norms for each age have been established, and the number of subjects tested at each age is large enough to insure their reliability. These norms can be used for purposes of a year scale, a point scale, or a percentile scale.

(6) The test is equally well adapted to boys and to girls. Neither sex shows decided or consistent superiority over the other in the performance of the test.

(7) Children from a good or medium social environment are able to perform the test somewhat better than children from a poor environment. This corresponds to the difference in general intelligence between such groups shown by other tests.

(8) The accelerated pupils did better than the retarded pupils, which shows that the test is differentiating between good and poor pupils.

(9) The other methods of scoring that have been proposed up to the present time do not do adequate justice to the test. They are too rough for the finer differentiations that are possible with it.

(10) The time taken to perform the test has been found to be relatively unimportant as a measure of ability, so much so as not to have been taken into account in scoring the performance.

(11) The method of scoring is justified by the high correlations between the rank in order of difficulty for each age and the rank for the total group of subjects tested.

(12) Correlations between the performance at each age and that at every other age show that the difficulty of the various moves is roughly the same for children of all ages.

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