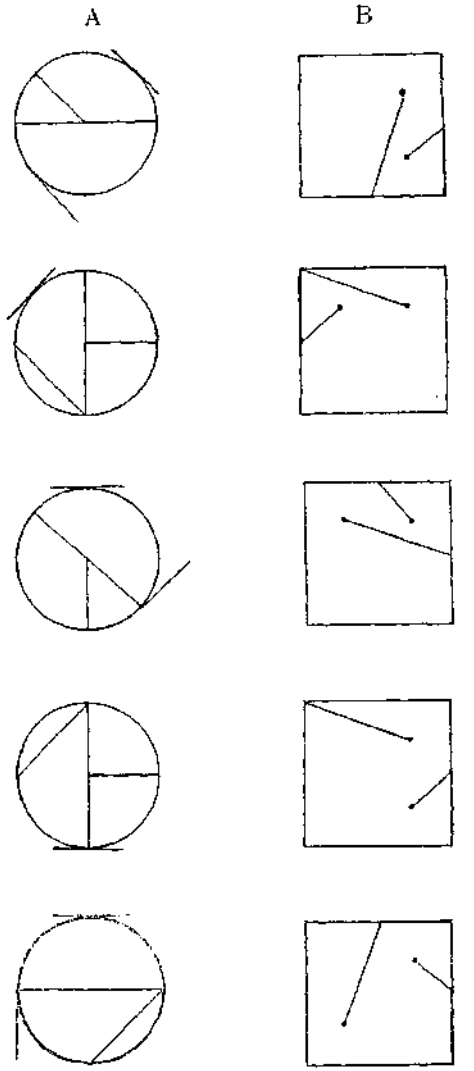
crimination by noting carefully the characteristics of the object was common to both Eights and Tens. Rut the Tens exercised more control than did the Eights. The experiment calls for perceptions of relations, capacity for forming clear-cut distinctions, and a certain small amount of reasoning. While it is not an absolute certainly, there are certain strong indications that it requires some mental effort to make the transfer from a touch-kinaesthetic imagery to visual, and that this experiment reveals the process in an elementary way. The experiment as a whole was more interesting to the subjects than Experiment No. 9, and for this reason is superior as a mental test.

Experiment II. Memory for Geometrical Forms.

As a test of simple visual memory, ten cards, each containing a geometrical form were used. Each form consisted of a circle two inches in diameter, with the diameter drawn through it horizontally, vertically, or at 45 degrees from either horizontal or vertical, one or two one-inch lines lying outside the circle as tangents, and one or two one-inch lines lying inside as chords, there being always four such lines in all to a circle, as shown in Plate III, A. Since each drawing was entirely different, by turning a card in each of the four possible positions, forty instead of ten variations of form were produced. The cards were placed in two parallel rows on a table at which the subject sat. the order being a definitely planned irregular one, to avoid the factor of place memory. A cloth curtain hung before the subject to conceal operations. The subject was told, "I am going to show you a card with a drawing on it, study it, and after ten seconds I shall take it away, and you must pull the curtain aside and point to the one you have been studying." The card was slipped under the curtain and shown to him for the ten seconds, and immediately put back into place, when he tried to pick it out from the other drawings. After the ten cards had been exhibited, they were placed in the second position, then in the third and fourth, thus making forty trials in a day's work. Three days' work of 120 trials for each subject constituted a complete series.

Plate III



be the most difficult task of all and only two of the Sixes succeeded in doing so, even after the tenth day. Half of the Eights managed it, with considerable difficulty, but all of the Tens were using four fingers by the end of the second day's work. Of course, this was a more economical method if it could once be acquired and resulted in a quicker mechanization of the process and a more rapid rate of work. For half of the Eights and all but two of the Sixes, it was too complicated a matter to distinguish the proper one of the four fingers and use it when required, and no results would have been possible had they not been allowed to use only the index finger of each hand.

Sixes with one exception were careless in their work, and many times they would push any key which happened to be the easiest, until urged to be careful. Three of the Eights were faulty in this respect, but rather on account of confusion resulting from effort at high speed at the expense of correctness, while Tens were all anxious to make a high score, all were noticeably more careful than the Sixes, or the average run of the Eights.

There were varying degrees of interest on the part of the subjects in the problem itself, in the subject's own progress, both in respect to his own record and his relation to others. Sixes were all working only because they were told to, and any effort exerted was merely for the sake of approbation. Eights were interested at first and glad to work, but toward the end of the time became tired of the experiment and wanted to quit, or take up something new, yet when once at work they all seemed to put forth considerable, if not maximum, effort. One exception to the Eights is to be classed with the Tens. The Tens from the first were interested. There was a high degree of self rivalry, and of rivalry with each other. Each child knew his score, and remembered it to compare notes with the others later. Among the Ten boys this was very pronounced; so great was their desire to excel that all practiced the finger movement, whose sequence they easily learned in the first and second day's work, and when in their playroom one used a table top, two a piano, one an organ, and one drummed in the air. The practice of the girls was all confined to work in the laboratory.

Only one Six was able to work with the keys and small colors concealed. One Eight managed it on the second day; five on the third; one on the fifth; one on the sixth, and two not at all, while all of the Tens succeeded by the beginning of the third day—five on the first day, four on the second and one on the third.

The experiment is a valuable one for indicating the ability of an individual to comprehend a simple explanation of details, his power of motor coordination, capacity for voluntary effort and sustained interest. It might be used as a simple test of intelligence if ten trials were taken at one sitting. When according to our results a Six should comprehend the experiment, be able to use two fingers and have a record averaging about 20 correct strokes, with a moderate increase in his curve from first to last. An Eight should comprehend that he is to use four fingers and make some attempt to do so and reach an average of about 50 correct strokes. A Ten should use four fingers correctly by the tenth trial and make an average of at least 75 correct strokes.

Experiment 13. Ink Blot Test.

As a study of imagination an ink blot test was used, the ink blots being the first ten in the series of twenty described in Whipple's manual of Mental and Physical Tests.

A card was shown to a subject to whom it was explained that "This blot was made by dropping a blot of ink and smearing it around. What do you think it looks like? Of course it is not exactly like anything, but what does it make you think of?" After giving all he could see in one position, the card was changed until it had been in all four positions. Two minutes were allowed, but most subjects refused to look longer than a minute and a half, and many would use less than one minute. This was particularly true of the Sixes and least true of the Tens.

Naturally the experiment does not lend itself well to numerical classification, but we find, in a rough way, that the average number of objects seen to a card are :

TABLE XX Sixea Eights Tens

1.6 2.8 3.2

This shows an increasing superiority in wealth of imagination from the lowest to the highest grade. Reduced to terms of per cent of difference, it stands:

Sixes 50
Eights 87
Tens 100

The Sixes found difficulty in seeing a different object in an ink blot once where it had suggested anything to them, and no matter in what position this card was turned, the picture was apt to remain the same. The blot was to them not so much a suggestion of an object as an actual picture of that object. To a less extent this tendency existed among the Eights, but was hardly noticeable in the Tens. An occasional Six enumerated objects which the blot could not have suggested and which they could not point out when asked to do so. To all children the blots suggested mainly people and animals, but the Sixes only name the object, the Eights add some description and qualifying terms, while the Tens both describe and attempt to interpret and give a somewhat subjective character to their report. Thus a Six would say: "That's a lady, here is her shoe and here is her hands." An Eight would state: "That is a lady with her hair all tumbling down, and holding her foot in her hand," while a few Tens would say: "She is all excited, and she is kicking up her feet and her hair is tumbling down and she is angry." Tens were the least concrete and limited in their range of objects suggested by the pictures, such as "dead leaves blowing across a ravine," and situations occasionally being given instead of definite well-known animals, persons or common objects. Eights possessed a very little of this tendency, but Sixes none at ail-

Since the work had to be discontinued before the experiment could be carried further, the above account is given rather to indicate the possibilities of the "ink blot test" as applied to the feeble-minded than as an attempt to show anything conclusive. A more careful study along this line would be well worth while.

Experiment 14. Drawing Designs From **Memory in Inverted** Position.

The material used in this experiment consists of twenty 2 by 2 inch squares drawn on a pasteboard card 3 by 4 inches. In each square were drawn two lines projecting inward from the middle of the sides or from the corners as is shown in Plate III, B. Sheets of paper containing twenty blank squares of the same size were supplied. The subject was presented with the designs one at a time with the following instructions: "Study this design until you can see where these lines would be if the square were turned around until the bottom is where the top is and the top is where the bottom is. As soon as you can see where both lines should be, and can remember, start to draw them in this blank square and I will take this one away." It was necessary to say "turn around," otherwise the subject might conceive the card as "turned over" and would conceive it as transparent, and draw the lines accordingly. The subject was allowed as much time as he needed. If attention appeared to wander, the experimenter would say: "Just as soon as you have it, I will take the card away." Each subject was put through the series of twenty once each day for five successive days. The results are given in Table 21. The score is obtained by counting the number of lines correctly placed. It would therefore be possible to score forty at each trial.

TABLE XXI

Daily average of correct cases

	1	2	3	4	5	Gen. Av.	A.D.
Six	0	0	0	0	0	0	0
Eight	1.4	5.4	11.6	10.7	16.0	11.02	9.7
Ten	13.3	19.7	19.2	22.0	27.6	20.36	3.7

This table shows the average number of correct cases for Eights to be 4.56 out of a possible 40, and for Tens 10.18 out of 40. The score is too low to indicate any adequate comprehensions on the part of either the Eights or Tens. But the daily averages show the learning in both cases to be rapid The Eights rise from 1.4 on the first day to 16.0 on the fifth day. The Tens increase from 13.3 to 27.6 in the same time. This is

sheets of paper; (2) a number of circles one inch in diameter with a dot in the center printed on sheets of paper; (3) a series of directions, as follows.

A

1. Show me the center of that square.
2. Show me the middle of the upper side.
3. Show me the lower left corner.
4. Show me the middle of the right side.
5. Show me the upper left corner.
6. Show me the middle of the lower side.
7. Show me the upper right corner.

B

8. Draw a line from the center of that square to the upper left corner.
9. Draw a line from the center of that square to the middle of the left side.
10. Draw a line from the center of that square to the lower right corner.
11. Draw a line from the center of that square to the middle of the upper side.
12. Draw a line from the center of that square to the upper right corner.
13. Draw a line from the center of that square to the middle of the right side.

C

14. Draw a line from the middle of the right side to the upper left corner.
15. Draw a line from the lower left corner to the middle of the upper side.
16. Draw a line from the middle of the left side to the lower right corner.
17. Draw a line from the upper right corner to the middle of the lower side.
18. Draw a line from the middle of the left side to the middle of the upper side.
19. Draw a line from the middle of the lower side to the middle of the right side.

D

20. Draw a square on that circle so that the upper left corner of the square will be at the center of the circle.
21. Draw a square on that circle so that the middle of right side of the square will be at the center of the circle.
22. Draw a square on that circle so that the lower left corner of the square will be at the center of the circle.
23. Draw a square on that circle so that middle of upper side of the square will be at the center of the circle.
24. Draw a square in that circle so that the upper right corner will be at the center of the circle.

Series A was intended to be preliminary only, but the Sixes found great confusion here. A few succeeded in getting half of the directions correctly, but even when they could find the right point with urging, there was no certainty they would do so again within the next few minutes.

Great care was taken to secure the utmost attention on the part of the subject while giving the directions. After Series A was completed no direction was repeated. Three trials were given on three successive days and the average taken of these three trials. There was practically no average to take since the subjects all stopped at the same point each day. There was no evidence of learning for the three trials given. The results are given in Table 22.

TABLE XXII

Series—	A	B	C	D
Six	0	0	0	0
Eight	10	10	4	0
Ten	10	10	7	4

Table 22 shows the number of cases that comprehend and execute the different series of commands. All of the Eights and Tens pass Series A and B, four Eights pass C and none of the Eights pass D. Six Tens pass C and four Tens pass all four series.

A common error in Series C, the one made by six Eights and three Tens, was always to draw the line through the center of the square, no matter from what point the line started or terminated. For example, if the direction was No. 19, "Draw a

line from the middle of the lower side to the middle of the right side," the subject would draw his line to the center, then to the middle of the right side. This may have been because of a habit established in executing the commands of Series B, but even so, it is an error caused through superficial attention and inability to control more than one idea at a time.

The errors made in Series D were various. The characteristic mistake was to interchange the part of the square mentioned with the part of the circle, e. g., for direction No. 20, "Draw a square on that circle so that the upper left hand corner of the square will be at the center of the circle," the subject would draw a small square in the upper left portion of the circle.

The experiment does not at first notice appear to be difficult, but it is probably the best test of the fifteen for the control of ideas, and comes more nearly to being an elementary test in the higher thought processes. The errors made already indicate the difficulty the Tens had in keeping ideas distinct and clearly in mind when there is more than one. It also indicates a looseness of association, and reveals likewise an indisposition to mental effort, and a tendency to be satisfied with superficial observation and any kind of an execution. On the other hand, the fact that four typically feeble-minded children of the mental age Ten can comprehend the directions and make the executions readily, indicates a certain individual difference in the higher thought processes of the feeble-minded. It is quite possible that persons may be capable of exercising a relatively high degree of control of the associative process and yet be sufficiently defective in other ways to make him feeble-minded.

In summarizing the per cent difference between the age levels for the fifteen experiments, we find in Table 23, that the Tens are 100 per cent., the Eights 74 per cent and the Sixes 29 per cent. Since one experiment is not directly comparable with another in numerical terms, their averages are not an absolute measure, but from all evidence they are a reasonable indication of the psychological difference between the mental levels studied.

TABLE XXIII

Experiment	Ten	Eight	Six
1	100	98	84
2	100	36	24
3	100	85	28
4	100	89	82
5	100	84	45
6	100	86	07
7	100	90	45
8	100	78	20
9	100	77	07
10	100	71	21
11	100	68	21
12	100	36	13
13	100	87	50
14	100	54	0
15	100	78	0
Average	100	74	29

If the experiments are grouped according to the main psychological process involved, the various levels are related as indicated under the following heads.

TABLE XXIV

	Ten	Eight	Six
Sensory Discrimination (Experiments 2 and 6)	100	61	15
Attention (Experiments 5, 3. 4, 1)	100	89	62
Memory (Experiment 11)	100	68	21
Learning (Experiment 12)	100	36	13
Judgment (Experiment 7, 8, 9, 10)	100	79	23
Imagination (Experiment 13)	100	87	50
Reasoning (Experiment 14, 15)	100	66	0

This grouping has seemed justified from what could be learned in observation of the subjects at work. Each experiment involves a varying degree of complexity, but for the subjects of this experiment the above named processes seem to be the chief ones involved.

In all experiments attention is involved and it is probable that this is the psychological process in which the levels of intelligence differ. The Sixes seem to have a consciousness qualitatively different from Eights and Tens It may be characterized as an inconsistent shifting blur. Sensory discrimination is low for this reason. For this same reason memory is feeble and association irrelevant. Learning is a slow process and because

of their wavering attention and inability to perceive essential differences, their judgment is defective, and their imagery indefinite and limited. They are practically unable to perform the simplest problem involving reasoning. The zero score in the last column holds true for all experiments where reasoning is involved.

There is sufficient difference between the score of Eights and Tens to indicate that the Eights differ likewise in a qualitative way from the Tens, but it is not so apparent from their general behavior in the laboratory. They fall behind the Tens in every case involving a complex situation, or where two or three ideas are concerned, thus indicating a difference in power of perceiving relations and making logical associations. Indications are that the Eights would have appeared different from the Tens qualitatively in making relevant associations, could further experiments have been made involving higher thought processes. The Tens are superior in every process involved in the fifteen experiments, but they fall short of normal in purpose, genuine interest and ability to see the meaning of things.

Sex Differences.

Data as to sex differences are, of course, only of general value in this experiment owing to the limited number of cases chosen. However, the results for the different sexes are given, because of what they show in regard to the children studied. In comparing the sex differences, the relationship was reduced to a percental basis in each experiment, and each age, by considering the actual score of the higher ranking sex as 100 and dividing the lower score by this to get its per cent. Thus, in memory with immediate recall the Ten girls scored 68, the Ten boys 87. Hence, the boys were valued 100 per cent and the girl 78. In experiments 11, 14 and 15, the Sixes did practically nothing, and hence are not considered in the comparison, but are valued at zero.

TABLE XXV

		Six		Eight		Ten		Sex Superiority		
		Girls	Boys	Girls	Boys	Girls	Boys	Six	Eight	Ten
1.	Strength of grip	88	100	80	100	79	100	B	B	B
2.	Judgment of movement	100	79	100	66	100	94	G	G	G
3.	Simple reaction time..	66	100	100	89	89	100	B	G	B
4.	Tapping test	73	100	85	100	98	100	B	B	B
5.	Attention span A	100	74	100	99	79	100	G	G	B
	Attention span B	100	82	100	74	90	100	G	G	B
	Attention span C	100	80	100	80	70	100	G	G	B
6.	Discrimination of grays	92	100	93	100	100	83	B	B	G
7.	Judgment of forms, two dimensions	86	100	100	100	65	100	B	O	B
8.	Judgment of form....	95	100	79	100	10	100	B	B	B
9.	Judgment of size	77	100	100	85	100	86	B	G	G
10.	Judgment of forms, three dimensions	77	100	69	100	10	100	B	B	B
11.	Memory of geometrical forms:									
	Immediate	0	0	100	95	78	100		G	B
	10-second	0	0	100	95	90	100		G	B
	1-minute	0	'0	100	97	81	100		G	B
12.	Modified typewriting..	100	91	100	91	67	100	G	G	B
13.	Ink blot test	77	100	100	91	64	100	B	G	B
14.	Drawing designs inverted	0	0	100	84	46	100		G	B
15.	Comprehension of direction	0	0	85	100	100	100		B	
	Average	88	93	94	84	62	98			

Table 25 given the relative difference for each age and experiment. Under the columns headed "sex superiority" are given letters "B" and "G" indicating whether the boys or girls are superior for that age and experiment. Here we see that on the average for the Sixes and Tens the boys rank higher, and for the Eights the girls rank higher The greater superiority of the Ten boys is partly due to the fact that the boys average a little higher according to the scale of intelligence than the Ten girls, and that one of the Ten girls was handicapped by a visual defect. Further than this there seems to be no explanation for the sex differences.

Individual Variations.

In many of the experiments there were individuals of one mental age whose results resembled more nearly those of the higher or lower group. For example, if the averages of the thirty individuals are arranged in order of rank with respect to the others in that experiment, one of the Sixes ranked up somewhere between the tenth and twentieth, two of the Eights around

twenty-second or twenty-third, and two of the Tens down among the second ten subjects. But it was the same individuals who ranked above or below the others of his mental age. One superior Six was a girl of exceptionally good physical endowment, who had the advantage of a naturally good motor coordination and freedom from physical fatigue. One of the Eights who out-ranked her fellows was also thus favored physically, besides being interested in the tasks and having an eagerness to succeed which made her put forth her best efforts. The other Eight who excelled was infinitely patient, and made up in effort and pains for what he lacked in intelligence. The two Tens who fall below do so because of an indisposition to try, and in the case of one an eye defect which hindered in some experiments. One was indifferent and careless, and the other sometimes hostile to the work, but when they could be induced to put forth effort they ranked well up among the Tens. Despite these variations it is interesting to note that in the experiments of a more difficult character involving more complex mental processes, such as the comprehension of directions, drawing reversed designs, and memory, the classes are distinct and separate, with no overlapping.

Summary and Conclusions.

Certain general facts stand out in regard to the findings of the different experiments. Experiment I shows that in strength of grip the feeble-minded children, while physically they may be as strong as the average normal individuals of the same age, fall below because of inability to make the voluntary effort necessary to produce their best results. Feeble-minded children show a decided difference in the results for the two hands, and are therefore not ambidextrous as has often been supposed. There is a slight difference in the three mental ages, Sixes ranking lowest and Tens highest.

Experiment 2 shows that in a test so simple as judgment of extent of movement there is little difference in the three mental levels, the superiority of the Tens over the Eights and the Eights over the Sixes being due rather to more intelligent behavior in following the instructions of the experiment on the part of the upper grades of intelligence.

Experiment 3 shows that a simple reaction experiment is, for the feeble-minded, more than a simple voluntary process; what would be marginal or reflex for normal subjects are for these distinctly conscious processes, so that reacting to a stimulus involves holding several factors in consciousness before reacting to them. The lower the mental level the more this is true and the harder the task is.

In Experiment 4, the curve of tapping shows the greatest lack of voluntary effort on the part of the Sixes, and least on the part of the Tens, who are still slower and show a different curve from what we would expect for normals. Pounding the key and waste of energy by the Sixes evidences their lack of judgment-

Experiment 5, which is a real attention experiment, shows more difference in the results of the three levels, the score being proportional to the mental age, and the more complex the series, the greater the difference in the results of the three groups. Here we find a difference in the power of comprehending the demands of the problem and adjusting to them, and a difference in attention span varying directly with the mental age, the Sixes being the weakest.

Experiment 6, discrimination of grays, seems to indicate that as far as brightness discrimination itself is concerned the three levels are about equal, the differences that the results show being due to the fact that the lower levels are sometimes careless in making their decisions. Any variation is rather a matter of attention than of discriminibility.

Experiments 7 and 8 show that an experiment should be difficult enough to require some effort on the part of feeble-minded subjects, for they are too easily satisfied with moderate success; if they get things "almost right," they cease to try when perfection would be possible with a little extra effort. Experiment 8 was too difficult for the Sixes because there was too much to hold in consciousness at once and too much sustained attention demanded. Experiment 9, the judgment of size and form, is not an immediate process. It is an association of imagery of different

sense realms, which is not spontaneous, but constructive, and involves some reasoning. Hence the greater difficulty for the lower levels of intelligence.

Experiment 10 on the judgment of forms of three dimensions is a better test for comparing the three levels of intelligence than the preceding tests because of its complexity. It is a severe task for the Sixes, easier for the Eights and least difficult for Tens-

Experiment II on the memory of complex geometrical forms involves so much discrimination of difference in form and so much attention that it is more than a test of retentiveness. In fact, it is difficult to determine in how far demands made on these higher mental processes hinder it from being a memory experiment for the Sixes, for the distinguishing of the forms themselves is an almost impossible task.

Experiment 12 on the modified typewriting varies in difficulty with the different mental ages, both as to speed, accuracy, and rate of learning. This difference was due to the greater unity of consciousness of the higher levels, since for them some factors were from the start marginal, while for a Six, and to a lesser degree for an Eight, all factors were apt to be of equal value in consciousness, with a resulting confusion. Rivalry was characteristic of the Tens, Eights showed little rivalry, but a pleasure in a good record, while Sixes worked because they had to, but enjoyed the approbation of the experimenter.

Experiment 13, the ink blot test, gave higher results in proportion to the height in intelligence. This is due to the greater wealth of imagery the brighter subjects possessed, owing to their capacity for taking in more ideas with a resulting richer mental content than lower grades.

Experiment 14, on comprehending directions, shows a decided lack of reasoning ability on the part of the Sixes. They have difficulty in holding details in mind long enough to relate and compare them. It means a degree and duration of attention and voluntary effort not possible for the Sixes, difficult for Eights, but relatively easy for the Tens.

In general, results of the above experiments and impressions made during the study show the following.

(1) There is a noticeable lack of energy and capacity for voluntary effort on the part of the feeble-minded, and Sixes stand the lowest, Eights next and Tens highest among the subjects in question.

(2) All are weak in degree, duration and span of attention, the Sixes being lowest and Tens highest. So characteristic is this feebleness of attention, that experiments dealing with other mental processes are difficult to interpret, since every task requires more or less concentration.

(3) Probably all ages would be equal in sensory discrimination, if the factors of attention and voluntary effort could be eliminated, but since the simplest sensory experiment involves attention, it is doubtful whether the feeble-minded can be justly compared as to these simple processes.

(4) The lower the feeble-minded person in the scale of intelligence the less unified his consciousness. There do not seem to be two levels of attention where one group of perceptions is in the focus and the rest in the margin, but all factors in consciousness seem to be of about uniform importance. This lack of unity makes it difficult for the feeble-minded to perceive the real meaning of a life situation and leaves him without sufficient stability of purpose to direct his own activities.

(5) The three levels of intelligence differed as to their emotional attitude toward the experiments. A Six was capable of amusement, but had no genuine interest in the work. There was no desire to succeed other than that provoked by the pleasure of approbation by the experimenter. An Eight took pleasure in the actual performance of the work, but not from any personal or social interest. A Ten showed general interest in his success, wished social approval and was actuated by the spirit of rivalry.

(6) Lower grades are more pronounced in their inability to comprehend directions and to hold them in mind long enough to act on them ; also in their difficulty of adjusting themselves to the conditions of an imposed task. Eights suffer less from this inferiority and Tens least.