in only two cases have those working with the chi agreed with the findings of this department, and th cases where I believed the girls were of higher men should be held more responsible. In our school, we h while our principal has never used any kind of me that our children of the several mental ages are fo grades corresponding to that age.

I had the opportunity of testing sixty girls, who role from one of our last State institutions. This done two years ago. Of those sixty girls, only fo the Binet tests successfully. At that time, we were quite severely for saying that those girls were fee girls. However, it has been our privilege to follow carefully since that time. Some of them have bee but we have a record of what those girls have done, they are today. None of these girls can be said to made good. We believe that these girls represent average of the girls to be found on parole from any St atory.

Our physician, Dr. Alice Weld Tallant, in an the Bulletin of the American Academy of Medicin 1912, reports venereal disease to exist in from thir per cent. of our cases, while sixty-five per cent. of the been immoral. We also find that immorality is tw quent in the low-grade girl. Our problem is also o lation, to get suitable provision for cases of such low that they will be able to become self-supporting or society. We hope that this may be accomplished t establishing of colonies.

14-ETB-FNK
Prior to 1920 - JPA; State Inst. Gen - Kuhlmann

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ESULTS OF EXAMINING A THOUSAND PUB-HOOL CHILDREN WITH A REVISION OF INET-SIMON TESTS OF INTELLIGENCE BY UNTRAINED EXAMINERS

SECOND ARTICLE.

BY F. KUHLMANN, *Faribault, Minnesota.*

ssumption That the Majority Must Pass at Age.
as been much theoretical discussion in regard to the uency of occurrence of different grades of human in- If we could divide off the whole range of intelli- lowest to highest into equal steps, or grades, what f individuals would belong to each grade, or how distribution curve run? Empirical data to show ct facts are are not yet at hand, and theoretical ave brought us to no concensus of opinion on this It should follow from this much alone that we have sume that the majority of children tested with the tests must test out at age in order to show the curate, or that when the majority do test out at age the tests' accuracy. Known empirical facts give indication that the distribution curve for the dif- of intelligence runs more or less parallel to the bution curve in which a majority belong to a mid- an equal number deviate in each direction from rade. But this is entirely too indefinite. If the urve is to be used at all to show the range and fre- or in the mental ages obtained, we must have ex- n the correct, the real distribution curve as well ribution curve for the mental ages as we get them e. However, granting that the real distribution

lly Bobertag's discussion in article referred to before.

curve for the different grades of intelligence correspond
to the normal distribution curve and that we have exa
on it, we may point out three other matters to be co

The first is that whether or not the majority of c
measured by the tests will belong to the middle grad
in the first place on the unit of measurement used.
mental development is the unit of measurement that
used, and a child has been called mentally at age wh
retarded or advanced by less than a year. This give
of variation in mental age of approximately two year
dren classed as testing at age. But the allowance of
in years is entirely arbitrary, as is the amount of men
opment taken for the unit. It would be quite simpl
as justifiable to allow only a half year, or two years
tion or advancement for the at-age class. Whether
jority pass at age or not is therefore directly depende
arbitrary procedure, and ceases to have any meaning
curate indication of the degree of accuracy of the te
make the distribution curve for mental ages as obtain
tests correspond exactly to the real distribution curv
in the first place that for both curves the whole rang
ligence be divided into the same number of equal steps
and that the same number of these steps or fractions
allowed for the middle class for both curves. It is ob
we can in any case make any proportion of the whol
that we wish belong to the middle class according t
limit the range of variation from this middle class.
IX it was seen that for my results, when fractions of
taken into account for both the ages and mental ages,
ably over a bare majority pass at age when allowing
nearly two years for the at-age group in using the who
the unit of measurement. If now we use the half y
unit, and call all at age only those who are retarded or
by less than half a year, we get the following figures.

TABLE XI

Age	6	7	8	9	10	11
% At Age	39	49	33	29	35	43

considerably less than the majority pass at age. Hence, o have a bare majority pass at age the unit of measure- have to be somewhere between that of a year and a . From this follows a further important deduction. t the middle or at age group in the distribution curve over nearly one-third of the whole range of intelli- ce the mental ages of adults may range from less than hirteen years. Suppose that the unit of measurement to make a bare majority pass at age were exactly hs of a year, and suppose that we had examined a ber of twelve-year-old children with mental ages from elve years and over. The mental age of the middle ld then range from 11.25 years to 12.75 years, or over 1.5 years. But the range from one to 11.25 is seven alf times this. Using the amount of mental develop- ng a year as a unit for measuring brings us to the nt to be considered.

econd point is that the amount of mental development ear can not be taken as an accurate unit of measure- telligence. I have pointed out in other places that of mental development during a year decreased with rn,[1] Bobertag,[2] Chotzen,[3] and others have noted the s at the age of twelve a retardation of a year repre- ctual retardation than it does at the age of six. The retardation represented by a year being less for the it occurs more frequently than it does for the lower hereby reduces the percentage that pass at age for ges. The magnitude of this factor can not be shown rom present results because the scale measures too higher ages and too high for the lower ages, thus cting too much the percentages that pass at age for t ages. But perhaps its presence may be said to

Binet and Simon Tests of Intelligence in Grading Feeble-Minded Journal, 1912; and "A Revision of the Binet-Simon System for Intelligence of Children," this Journal, Monograph Supplements,

ychologische Methoden der Intelligenzpruefung und deren Anwend- dern. Bericht, ueber den V. Kongress fuer experimentelle Psycho- 12.

e quoted above.

lligenzpruefung's methode von Binet-Simon bei Schwachsinnigen chrift fuer angewandte Psychologie, 1912.

be indicated somewhat in the figures in table XI, reme
that in my results on the accuracy of the scale as a wh
scale is shown to become gradually more accurate from th
to the eleventh year. Even when the number passing a
reduced more by this inaccuracy of the scale for the low
than it is for the higher ages, an average of 40.3 per ce
at age for the ages of 6-8, as compared with 35.6 per c
the ages of 9-11. That the rate of development increas
age is shown more directly by other results. Bobert
puted the percentage of increase in the number of sev
old children who passed certain of the Binet-Simon tests o
year-old children who took the same tests, and compared
cent. difference between six and seven-year-old childr
the difference between eleven and twelve-year-old child
another group of tests. Table XII gives these results.

TABLE XII

Tests	VII 3	VII 2	VII 4	VII 5	VIII 1	VII 1	VI 5	VI 1
6	52	35	39	42	32	60	45	53
7	93	76	77	77	61	85	69	74
% Increase	41	39	38	35	29	25	24	21
Tests	?	XI 4	XI 1	XI 3	XII 2	X 4b*	XI 2	X 4
11	41	58	59	56	34	64	60	53
12	63	78	78	75	50	78	70	62
% Increase	22	22	19	19	16	14	10	9

The test numbers are given in the first horizontal
and correspond to those of my revision. The other fig
the percentages of the number of children who pass
tests. It is seen that on the average for the eight tes
31.5 per cent. more of the seven-year-old children p
the six-year-olds. But only 16.4 per cent. more of the
year-old children pass another group of eight tests
eleven-year-olds. This is a striking difference. It wo
been of much interest to have had Bobertag's result
other ages and tests also to see how uniformly this differ
present. My own results give equally striking evid
decreasing rate of mental development with increase in

*Test X4b of the 1908 series, which my revision omits.

of individual comparisons, but there is considerable
n and there are many exceptions. They are given in
XIII. The Roman numerals give the age-groups of the
The ages are given in the first vertical column on the
he other figures give the per cent. difference for the five
each age-group between one age and the next following.

TABLE XIII

VI	VII	VIII	IX	X	XI	XII	XV	Av.
2.2	12.6	14.0						9.6
5.6	4.2	23.8	14.4					11.1
	5.0	18.2	20.8	8.4				13.1
		3.0	6.2	6.4	16.6			8.1
			10.6	12.4	14.8	9.4		11.1
				1.8	3.8	-1.0	-2.4	.6
					12.8	6.6	12.6	10.6
						0.2	—.8	—.3
							5.6	5.6

the average for the five tests in age group VI, 2.2 per
of the seven-year-old children passed these tests than
ar-olds. The general average differences are given in
vertical column on the right. These last averages
ress best the amount of decrease in the rate of mental
nt with increasing age, and a marked decrease is
The average of these figures again is 10.4 for
ur, 9.6 to 8.1, and only 4.1 for the last four, .6 to 5.6.
further analysis shows that there is an important
g factor. It is noticed that the increase in the per-
children passing an age-group of tests with increas-
the greater the more difficult the tests are for the
questiton. Thus, comparing six and seven-year-old
increase in the percentage of seven-year-old pass-
er for the tests in age-group VII than it is for age-
nd greater again for age-group VIII than for age-
There is a general tendency for the figures to in-
read from left to right. Since the tests are too easy
age-groups, the amount of decrease in rate of men-
ment with increasing age is not brought out fully

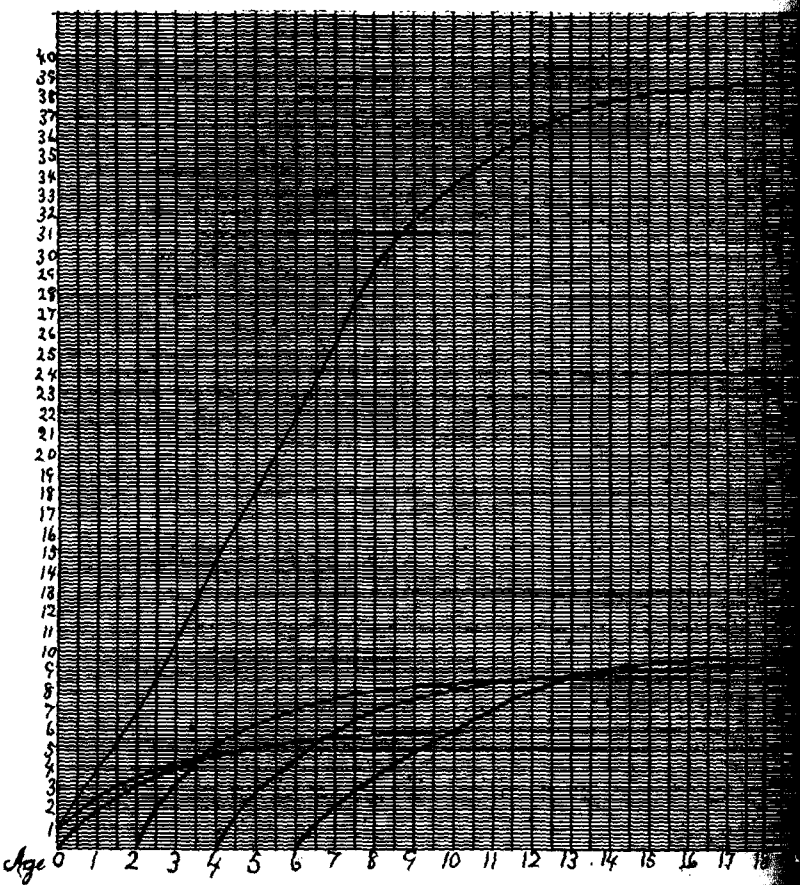
by the figures in Table XIII. A re-arrangement of ... will show this more clearly. This is done in Table ...

TABLE XIV

	1—30	No.	31—64	No.	65—100	No.	Av.
6—7	14.3	3	23.7	3	3.4	8	13.8
7—8	20.3	7	19.0	2	3.6	11	14.3
8—9	14.0	2	18.2	11	6.0	8	12.7
9—10	18.0	2	12.3	6	5.4	12	11.9
10—11	13.5	2	15.5	8	8.0	10	12.3
11—12	—5.0	5	3.4	5	1.4	9	—.6
12—13	13.6	5	10.0	3	5.1	8	9.6
13—14	9.0	3	—1.7	6	6.0	2	4.9
14—15	6.7	3	6.0	3	—	—	6.4
Av.	11.6		11.9		4.9		

For this table the tests were first divided into th... according to the percentage of children passing the... pair of consecutive ages. Thus, as seen in the table, ... three tests which were passed by 1-30 per cent of six ... year-old children. There were three tests that were ... 31-64 per cent. of six and seven-year-old children, and ... were passed by 65-100 per cent. of these children. ... thus divided into three classes according to their de... ficulty for the children, we can note the increase fro... to the next in the percentage passing, comparing the ... the higher ages. The other figures in the table giv... centages of increase. Thus, for the three tests that ... by 1-30 per cent. of the six and seven-year-old ch... per cent. more of the seven-year-olds pass than ... year-olds. This table shows better than the preced... (1) the older the children get the less progress they ... ing a year in the ability to pass given tests; (2) that ... made during a year decreases with the increase in the ... test in the first place. This last fact means that ... the ability to do the tests is at first rapid and decr... child grows older. It is quite analogous to the ... law of practice, but should not be confused with it ... progress in ability with which we are here concer...

ect, but is due to progress in mental development. further that we can not view mental development mainly in some one general function such as we us- t to describe by the term "general intelligence." at mental development consists of the successive and taneous development of a number of mental func- nbined activity of which is required for the perform- rete tasks, seems to fit the present facts much better. a small percentage of a given group of, let us say, children will pass the tests of age-group six, and ss the tests of age-group eight. At the age of five ge for these same children has increased much for ge-group six, and a very few may pass some of the group eight. At the ages of six and seven this amount rease has fallen for the tests of age-group six, and is year's increase in the percentage passing the tests eight, and so on. Now, the tests in these age- be quite different in character, so as to involve quite tal functions or new combinations of their activity. t the rule in the Binet-Simon system. Four-year- do not pass the tests of age-group eight at all be- ntal functions required in them have not yet ap- in the form necessary. When they begin to ap- ge of five to six, they develop rapidly at first and afterwards. Perhaps this view may be expressed ly. In the following figure the increase in age is n the horizontal line and the degrees of develop- vertical. The different curves from "a" to "f" courses of development of different mental func- appear one after the other. They all show rapid irst and then more gradually come to their maxi- of development. They do not all have the same or general mental development, and therefore do the same height. "S" is the summation curve and may be regarded as representing the course



of progress of so-called "general intelligence." This
not intended to show just when each mental function
appearance and how its progress runs. This we are
knowing at present, nor is it likely that they have such
beginnings and independent courses. It is intended
merely that the different mental functions appear suc
in a more or less definite order; that their rate of dev
changes from a rapid start to a gradual finish; that th
pear several years before the approximate intellectual
at the age of about fifteen; that as a result, the gener

ent, as represented by the summation curve, progresses
h more uniform rate than is true of any individual
nction. The last of these is the one of chief import-
nnection with our present question as to the amount
progress a child makes in a year and the percentage
d pass at age with the tests. If this general progress
niform than we might suppose it to be if there were
general function developing at a changing rate the
of children passing at age will not be affected so
re fact that the amount of development during a year
with age. No more definite conclusion is at present
this point.

is a third factor that very probably enters and affects
r passing at age in different degrees for the lower
ages. This is the likelihood that mental retardation
d by a difference in age and mental age is usually due
ed rate of mental development. Thus, a child below
elligence from the start and developing at a slower
e average normal rate would fall behind the normal
ore as he grew older, when this deficiency is meas-
ns of number of years of development. This would
independently of whether the normal rate of de-
is uniform from year to year or is a decreasing rate.
here discussed the evidence for this assumption that
dation is chiefly a matter of a retarded rate of devel-
will not go into further details here.* It will be
must directly and very seriously affect our present
to the percentage of children that should pass at
arded rates of development are of all degrees. For
the slightly retarded rates will give no appre-
ce between age and mental age, but for the higher
erences will have accumulated. Thus, with any
ren, whose rates of development are not alike,
outside the limits of what we call normal, the
l ages would be the same at first, but would drift
hildren grew older. The great majority would

* "Degree of Mental Deficiency in Children as Expressed by the Relation to the Mental Age," this Journal, 1913.

pass at age at first, and later some would be retarded a
two, and others equally much advanced.

It should be clear when these various matters a
into account that the percentage of children who pa
with the Binet-Simon tests can have in itself no parti
nificance with reference to the frequency and range o
the mental ages obtained. We can not say that the te
ure correctly when a majority or bare majority pass at
that they measure incorrectly when less than a majori
age. The first of Binet and Simon's assumptions, ac
others, is untenable. It does not, however, follow from
evidence that the second, namely, that the number o
should equal the number of advanced, is also. We
consider this second assumption next.

3. The Assumption That the Number of Retarded M
the Number of Advanced.

Before we discuss this assumption let us
as to just what feature of the scale would be
it, supposing the assumption to be correct. The p
passing at age, if we knew exactly what percentage sh
at age at every point, might be an indication of the
frequency of error in the mental ages obtained. Lik
percentage of retarded or the percentage of advanced
But the mere equality of the latter two percentages
no proof at all, necessarily. The scale might measu
frequently and too high frequently for any age and
equality of the percentages of retarded and advan
turbed, analogous to what we found true of the scale a
When the results for all ages are taken together the p
retarded approximately equals the percentage of adva
the scale is inaccurate at both ends. The scale migh
to be inaccurate on the whole if this equality were
If the retarded exceeded the advanced in number, fo
it would show that the scale measured too low on
It would in no case indicate the range and frequenc
We have already considered the accuracy of the scale
and have used the comparison of average age with av
tal age as a method to decide this question instead

e number of retarded and advanced. But it is more
to discuss the correctness of the assumption itself
at.
nit of measurement used, whether a whole year, frac-
ear, or more than a year, the uniformity or non-uni-
the rate of normal mental development, and the course
development in mental retardation, all do not seriously
present question. Each affects the percentage of
as well as the percentage of retarded, and leaves the
heir equality mostly undisturbed. The most impor-
on here is for what children this assumption is sup-
old true. We may divide them into three classes.
y non-selected children. (2) Children of the public
(3) Normal children. We have a rough idea as to
ge of the general population, class "1," that is feeble-
We also know that public school children are in a
lected children. Low grade defectives are excluded.
de defectives are excluded more and more as we
wer to the upper school grades. We know, thirdly,
its between the normal and feeble-minded are still
ned. It is obvious that if the present assumption
exactly of one class of individuals it can not hold
of the other. The second and third classes are
ill-defined as regards exact grades of intelligence
uded. Hence, we can not really carefully test out
ion for these two classes. No large group of en-
lected individuals has ever been examined with the
tests. We have, therefore, no empirical results
be regarded as adequate to solve this problem.
I am inclined to the opinion that the real distri-
for the different grades of intelligence for non-
iduals is not entirely symmetrical, but that it is
ly skewed on the side of the lower grades of in-
If this opinion is correct, it follows, of course, that
e of retarded must exceed the percentage of ad-
scale of tests that measures absolutely correctly.
certain grade of intelligence for which there are
ls than for any other grade, it does not seem prob-

able that the variation above this grade can cover
range as we know the variation below this grade d
To be more concrete, seven-year-old children may b
seven years, but we do not as a matter of fact find s
old children who are advanced seven years in their m
The limit of variation in this direction, as found by th
authors seems to be about half this much. There se
a natural limit beyond which nature does not go in
high grades of intelligence, but in the other direction
is total absence of intelligence. This much seems to
lished fact, as a result of the Binet-Simon tests.
tion remaining is whether the larger degrees of retar
frequent enough to seriously disturb the symmetry
tribution curve. This question we can not answer
from any known facts, but one would be inclined
that where a large range of variation in one direction
compared with a much smaller range in the other di
the degrees of variation in the former direction woul
cur more frequently than the corresponding degrees o
in the latter direction. If four or more years of r
are possible while four or more years of advancemen
it seems that two or three years of retardation sho
more easily than two or three years of advancement
reasoning is correct, the real distribution curve may
erably skewed on the side of the lower grades of inte

Thus, we must come to the final conclusion th
tribution curves on the mental ages *can not* at prese
as a method of testing the range and frequency o
these mental ages in any but a very rough way.
granted that these curves show that the scale measures
within certain rough limits. But we know from oth
that the tests are much more accurate than we can p
to be by these distribution curves. It is very q
whether the latter could be of any further service
knew the exact nature of the real, true distribution o
intelligence. For, besides the various factors discu
that have to be taken into account, in choosing an
individuals for examination we always have to rely up

me that the distribution of the grades of intelligence particular group is just as it would be for all human aken together. To make such an assumption at all le we would have to have a group of many thousands duals. For supposing that one per cent. of the general n is feeble-minded, for example, which is putting it indeed, we would need to examine 10,000 individuals to get a hundred feeble-minded. If we had a thou- viduals it would not be permissible at all to assume of them were feeble-minded. Chance might easily uded all, or included three times as many. Likewise, ther grades of intelligence, in proportion to their gen- ency.

Comparison of Pedagogical and Mental Progress.

ter way of testing the accuracy of the scale of tests eans of the distribution curves is to test children with egrees of intelligence when the relative grade of in- is known in each individual case. This is the only in which the range and frequency of the errors made ts can be determined. But since this assumes that already some other entirely reliable way of knowing grades of intelligence of the children to be tested, d is as yet unattainable. For we have no entirely y of knowing the exact grade of intelligence of any can be applied to any considerable group of children that any single or several investigators together can We have an approximation to this in the quality of work done by the child. We might assume that the e child makes in his school work is determined di- he degree of his intelligence and then grade the ligence by his school work. This assumption, how- erally recognized as only approximately true, true in the great majority of cases, but still with so wide exceptions as to render it inadequate for the testing the accuracy of intelligence tests. I shall to analyze here the reasons why there is no com- tion between quality of school work and grade of For our present purposes the fact and not the

reason for it are alone of importance. But even if we
accept this assumption as approximately correct, a furt
ficulty lies in our way. This is an inadequate means o
ing the quality of the child's school work. It is equa
recognized that school grades or school standings are
fallible indications of quality of work. The grades g
the teachers must, under present circumstances, be pa
roneous, even when the effort is made to grade acco
quality of work alone. But grades are usually based on
ber of other considerations than that of quality of work
suggestion, therefore, that has been made by some writ
carried out by a few that in selecting normal children
taining test norms we choose only those who are in the
grades in which they belong according to their ages ca
garded only as a small step in the right direction and
means as a solution of the difficulty of selecting chil
approximately the same grade of intelligence. Within
its of the normal there is a considerable range of g
intelligence. But even if we took only children who ar
grade in their school work we would include occasio
feeble-minded child, especially in the case of the lowe
grades.

In our present results we can compare the men
obtained with the school grades of the children to de
the degree of correlation between pedagogical retarda
mental retardation, or we might compare the mental a
the average school standing in the different subjects
school grade. But for the reasons just given the freque
range of disagreement between the mental ages and th
results can not be taken as a correct measurement at a
frequency and range of error in the mental ages alone.
ever, we should expect a close correlation between aver
tal age of children doing the same quality of work
work, if the tests measure correctly. The following tab
the decrease in the amount of mental retardation for t
dren of each chronological age with their advancemen

TABLE XV

e	1st	2nd	3rd	4th	5th	6th	7th
	60	22	1				
Dif.	+2.9	+8.5	+17.8				
	31	40	20	4			
Dif.	−3.1	+1.1	+11.2	+28.3			
	1	19	56	12			
Dif.	−14.4	−6.3	+8.9	+12.2			
		9	25	33	11	1	
Dif.		−21.3	−6.0	+7.9	+6.7	−6.6	
		3	11	32	29	9	1
Dif.		−27.4	−12.1	−5.4	+1.0	+10.3	+12.4

ades. This amount is given in terms of months, the ing preceded by a minus sign if there is a mental re- and by a plus sign if the mental age exceeds the age. are given in the first vertical column on the left, and l grades in the first horizontal column. Thus, the ental age of the 60 seven-year-old children in the l grade is 2.9 months larger than their average age. 22 seven-year-old children in the second grade this vancement is increased to 8.5 months, and so on.

figures show a consistent increase in mental age with school work, with no other exception than the ten- ildren in the fifth and sixth grade. Considering the e number of children for the individual comparison l, this close correlation must be regarded as an ex- good showing. It gives a much better idea as to tely the tests are probably working than can be ob- the distribution curves.

D. The Individual Tests.

ccuracy of the mental ages obtained depends of the final analysis on the accuracy of the individual re are three demands to be made of the individual A certain definite percentage of normal children of ge should always pass a test of the corresponding It is recognized that we can not expect absolutely esults with the individual test. That is, we can not

expect, for example, that all normal six-year-old chi pass a test in the six-year-group, and that no five or old children will, and so on. If this were not the should need only one test for each age instead of a grou (2) The percentage of children passing one test in a group should be approximately the same for the othe that age-group. (3) The percentage passing any te rapidly and regularly increase with the age of the chil will discuss these questions in the order given, but b ing up the first we must consider another question stil the percentage of normal children that should pass a order that the system of tests may give correct ment

1. The Percentage That Should Pass a Test.

Binet and Simon do not make any definite state what this percentage should be, but place it somewhe sixty and ninety per cent. Goddard places it at seven cent. and over. Terman and Childs regard sixty-six as the correct percentage. Bobertag discusses this que finds roughly that seventy-five per cent. of the childr age that he tested pass the tests of the corresponding Also, he finds that according to the teachers' judgm seventy-five per cent. of the children of the school factory work, or better. He concludes from these that seventy-five per cent. is about the correct perce which normal children of a given age should pass a corresponding age-group. Stern, also, places it at a per cent.

My present results indicate a considerably lo sixty to sixty-five per cent., as correct on the whole other facts already brought out above into considera comes evident, further, that this percentage should with the age-group. It should be higher for the groups than for the higher age-groups. We may consi percentages of the children that pass the tests of group as a whole, as Bobertag has done. These a Table XVI.

TABLE XVI

7	8	9	10	11	12	13	14	15
94	96							
87	91	96						
40	64	82	85					
25	39	60	66	77				
	51	60	66	79	80			
		37	54	69	72	85		
			48	57	56	63	83	
				17	14	27	26	32

table the first horizontal column of figures from 6 the chronological ages. The Roman numerals in on the left give the age-groups. The other figures rage percentages with which the children of the dif- passed the five tests of the different age-groups. e, 92 is the average percentage for the five tests of I with which six-year-old children pass them. For ld children this percentage is 94, and so on. From we see in the first place that where the tests meas- whole a fraction of a year too high (see Table I) the rcentage passing the individual test is much above t where the tests measure on the whole a fraction o low this percentage is much below 75. If no other ing factor entered, it should be valid to conclude e age-groups for which the tests measure correctly percentage with which normal children should pass d be given in the percentages of the children that tests of these age-groups. In the present instance age-groups come closest to measuring correctly on Averaging the figures of Table XVI again for the VIII to XI, inclusive, gives the following:

tests one year above the age of the children equals ent.

for tests for the figures in "Italics" equal 65 per

Average for tests one year below the age of th
equals 75 per cent.

Since the tests for these middle age-groups measu
average still just slightly too high, we should infer tha
centage of children that should pass the individual tes
slightly below 65 per cent. We might say, roughly,
correct percentage is about 60 per cent., that if 50
or less passed a test it should be shifted upwards in
and that if 75 per cent. or more passed it should b
downwards in the scale.

That the 60 per cent. is approximately correct ma
also from another set of results. These will show at
time that there is a disturbing factor, the variability
sults due to the untrained examiner, which has to be
before deciding with certainty on any definite percent
correct one. According to the rule of counting the m
a year is added to the mental age for every five tests
passes beyond the age-group in which he passes all
This makes the percentage of children that should
test dependent on the number of tests that children on
age pass beyond the age-group in which they pass al
they passed only one or two tests beyond this age-
mental age would be within a fraction of a year of th
resented by this age-group. The more extra tests th
beyond this age-group the more their mental age wo
moved from the age represented by this age-group. Con
in order that the age and mental age may be always
six-year-old children, for example, should pass a relati
number of tests in the six-year group if many tests a
beyond the age-group in which all are passed, and th
pass a relatively large number of tests in the six-yea
relatively few tests are passed beyond the age-group
all tests are passed. If 60 per cent. of normal childr
test of a given age-group, any one normal child shoul
per cent. of the five tests, or three tests of that age-gr
may, therefore, speak of the number or percentage o
an age-group that any individual child should pass in

age of children that should pass the individual test, ersa. To make this clear we may use the following chosen figures for illustration:

A	No. Passed	5	4	3	2	1
	% "	100	80	60	40	20
B	No. "	5	3	2	1	
	% "	100	60	40	20	

No. passed" means the number of tests passed in suc-e-groups. Let us suppose that we are dealing with ear-old child in both cases, A and B. In case A the s ten tests beyond the highest age group in which he ive. If his age and mental age are the same, eight highest age-group in which he passes all must in e age-group VI. Age-group VIII is then the group he passes three tests, or 60 per cent. In case B the es six tests beyond the highest age-group in which all five. Here age-group VII is the highest age-hich he passes all, making age-group VIII again the hich he passes three tests, in order to make age and agree.

y now consider the number of tests that are as a mat-passed on the average beyond the highest age-group ll are passed, and reverse the process to see what of the children should pass a test in order to give ntal ages. Table XVII gives the results on this point.

TABLE XVII

					Totals
	1.16	.23			4.80
	1.71	1.12	.34		6.02
	3.11	2.07	1.33	.07	9.90
	2.81	2.17	.08		8.53
	2.38	.28			6.06
	2.20	1.40	.44		7.20

oman numerals again indicate the different age-groups The figures following each give the average number

of tests that all the children taking the tests in questio
the following age-groups. For example, when age-gr
the highest age-group in which all the tests are pa
tests is the average number of tests passed by these
dren in age-group VII, 1.16 tests is the average numb
in age-group VIII, and so on. The general average
the last horizontal column excludes those for age-grou
is seen at once that these figures approximate those of
in the above arbirtrarily chosen illustration, where
tests passed run 3, 2, 1 in successive age-groups. H
run 3.26, 2.20, 1.40, and .44, making a total of 7.30 e
in the general averages. The empirical facts, therefore,
in Table XVII, indicate that something below 60 per ce
correct percentage of children that should pass a te
age-group corresponding to the age of the child.
tests in place of 7.3 tests as the total number of e
passed, and assuming that the 3.26 tests passed is in a
VIII, the mental age would be 7 years plus 7 tests, or e
two-fifths years, instead of eight years. Assuming no
other hand, that 2.20 tests passed is in age-group VIII,
tal age would be 6 years plus 7 tests, or seven and
years, three-fifths of a year too low; 3.26 tests equa
cent. of the group, and 2.20 tests equal 44 per cent.
the group. The correct percentage with which each te
be passed, therefore, is 44 per cent. plus three-fifth o
cent. minus 44 per cent., or 58 per cent. The results
XVII, however, tend to make this percentage slightly
because of the greater variability that we get with untr
aminers. Examiners poorly qualified to do the work
or less frequently credit the child with a "failure"
where it should be a "pass," and credit him with a "pas
it should be a "failure." In the general averages the
tend to neutralize each other, so that correct mental
still obtained for the averages. But in the individ
the highest age-group in which all are passed will oft
low because a child has been marked "failed" in a t
he should have been marked "passed." He will then g
number of extra tests passed both because the age-gr

ne *begins* to count extra tests is too low and because iner adds the opposite mistake of marking the child in a test in a following age-group when he should be "failed." Now, as was seen above, a relatively large of extra tests passed requires a relatively low percent- ay six-year-old children, passing each test in age-group der to make them test correctly in mental age. The of extra tests passed should be smaller than the results d therefore this percentage should be larger. We have s of knowing accurately how much more irregular the btained by these examiners were than they should have ut we can show statistically that they were too irregular aring them with results I obtained in examining about ndred feeble-minded children with the revised scale. inded children are supposed to give more irregular re- n normals, because of an uneven development of the ge and training influences, etc. Yet when we compare ults of the feeble-minded, which were all obtained by iner, the writer, with those of the normals, we find show less irregularity than do the results with the Table XVIII gives the results of the feeble-minded in form as Table XVII gives them for the normals. Com- e general averages in the last horizontal columns of tables, it is seen that the number of extra tests passed e age-group in which all are passed is on the whole e feeble-minded than it is for the normals.

TABLE XVIII

				Totals
3.59	1.41	.52	.20	5.63
2.74	2.20	.97	.23	6.14
2.44	2.26	.96	.39	7.05
2.75	2.10	1.20		6.25
3.13	1.99	.91	.21	6.27

difference, however, makes only a slight difference in t percentage with which children should pass each it from 58 per cent. in Table XVII to 59 per cent. VIII.

Thus, both methods of determining the correct p
of children that should pass a test of an age-group co
ng to the chronological age give approximately 60 per
should, therefore, at least be safe to conclude that the 75
assumed previously is too high. It remains to add
the extent in which it is true that the rate of mental
ment decreases with age, this percentage also decrea
age. The younger children developing much during a
pass relatively few tests beyond the highest age-group
they pass all. The older children will pass relatively m
because the following age-groups are not as much more
for them as are the following age-groups for the youn
dren. As was seen above, this percentage passing a t
be the smaller the larger the number of extra tests pass
present results are not adequate to show how much
centage has to change from the lower to the higher ages
to make the tests always measure exactly correctly.

2. The Percentage Passing Each Test.

Having come to a more definite conclusion as to
centage that should pass each test in order to make
measure correctly, we may now consider the percentag
children who do pass each individual test. In Table
gave only the average percentages for each group of five
a whole. In the figures to be considered now we meet
the influence of the examiner's errors on the results. A
a low percentage of the children will pass any individual
cording to how the test is given and the response interp
the examiner. The examiner's way of giving a test ca
make it appear too easy or too difficult for its age-grou
as a matter of fact it is correctly placed. The same is tr
roneous interpretation of responses. The results in Ta
can, therefore, not be used to show which individual
still misplaced in their age-groups. But they will be
show chiefly one very important fact. This is that the
ages that do pass the individual tests may vary very mu
what they should be in each case without causing a ve
error in the mental age. Tables I and XIV have alrea
gested this. Table I has shown that the average me

es from the average age by more than a fraction of a Table XIV has shown that on the average the tests in VI, for example, are passed by 92 per cent. of the d children. We are now prepared to show this in l.

TABLE XIX

VI

2		3		4		5		
No.	%	No.	%	No.	%	No.	%	Av. %
34	100	33	97	30	88	31	91	92
71	96	70	99	70	98	71	94	94
46	100	46	100	45	98	46	96	96

VII

2		3		4		5		
No.	%	No.	%	No.	%	No.	%	Av. %
38	58	38	55	38	89	38	89	75
83	86	83	76	83	95	83	89	87
89	82	89	93	89	99	89	92	91
53	94	54	96	53	98	54	96	96

VIII

2		3		4		5		
No.	%	No.	%	No.	%	No.	%	Av. %
34	10	34	6	34	13	34	68	26
82	22	82	21	82	29	82	73	40
93	41	93	59	93	55	93	86	64
85	71	85	79	85	76	85	94	82
62	71	62	84	62	89	62	97	85

IX

2		3		4		5		
No.	%	No.	%	No.	%	No.	%	Av. %
48	21	48	29	48	19	48	48	35
85	43	85	42	85	33	85	61	39
91	68	91	60	91	71	91	69	60
79	84	91	76	91	73	91	65	66
69	88	69	68	91	96	91	88	77

X

	1		2		3		4		5	
	No.	%	No.	%	No.	%	No.	%	No.	%
8	49	57	49	84	49	47	49	45	49	24
9	76	68	76	87	76	39	76	67	76	38
10	80	71	80	94	80	54	80	68	80	44
11	81	78	81	96	81	68	81	89	81	62
12	68	90	68	100	68	83	68	87	68	62

XI

	1		2		3		4		5	
	No.	%	No.	%	No.	%	No.	%	No.	%
9	67	40	64	67	64	20	64	28	64	31
10	69	59	69	78	69	41	69	43	69	48
11	79	76	83	83	84	58	83	61	83	69
12	74	76	74	86	74	61	74	66	74	73
13	68	90	67	88	67	76	67	87	67	85

XII

	1		2		3		4		5	
	No.	%	No.	%	No.	%	No.	%	No.	%
10	53	74	53	85	53	40	53	28	53	13
11	70	80	70	88	70	51	70	41	70	27
12	71	73	71	92	71	56	71	41	71	20
13	69	71	69	86	69	61	69	51	69	46
14	64	85	64	84	64	64	64	52	64	31

XV

	1		2		3		4		5	
	No.	%	No.	%	No.	%	No.	%	No.	%
11	45	11	37	22	30	17	24	12	23	22
12	53	17	45	13	44	20	41	5	41	17
13	58	38	56	34	54	19	49	22	51	22
14	62	23	59	34	55	25	49	14	52	25
15	36	33	35	23	35	54	34	26	35	23

The headings in this table are the same as used in
tables. The first figures, for example, mean that of th
year-old children 85 per cent. pass test VI 1, 100 per cen
2, etc. Although no one percentage for any test could
ly used to judge whether that test is correctly placed, th

neral tendency which we may note. Using the 60 per e percentage that should pass a test, it is seen that s in age-group VI may be too easy; that the same is t of the tests in age-group VII, and that beyond this ar as too easy and some as too difficult, with more as . That the tests should still measure reasonably ac- due to the great flexibility given by the rule for p the mental age. This makes it possible, in the first one error in one direction to be cancelled by another e other direction. It gives us the accuracy of aver- e individual child and largely eliminates the influence s with individual tests. It is not one test, nor even oup of tests, but usually about five age-groups of enty-five tests, that are involved in determining the of a child. Thus every test in any one age-group o easy, and yet not increase the mental age over what e by more than a fraction of a year. In the second rule for counting up the mental age reduces the in- one year to the next in the percentage passing a test ssary for obtaining accurate mental ages. Eight- ildren may fail in some tests in age-group VI and ll as in VIII, if they pass about an equal number of e-groups following age-group VIII. These facts nonstrated further in the following manner. Table irst the percentages of the children of each age that the tests of the age-group corresponding to the al age and age-groups below this. These percent- a minus sign prefixed. Immediately following these

TABLE XX

VII	VIII	IX	X	XI	XII	XV	Sum
+75	+26						+93
−13	+64	+25					+70
− 9	−36	+39	+51				+42
− 4	−18	−40	+60	+37			+35
	−15	−34	−34	+54	+48		+19
		−23	−21	−31	+57	+17	− 1

figures for each age are the percentages of the children
the tests in age-groups following the age-group corre
the chronological age. These have the plus signs pr
example, the average of the percentages of the eig
children passing the five tests in age-group VI is 96
per cent. of these failing as shown by the —4 in the t
wise, 9 per cent. fail on the average in the five tests in
VII, and so on. Let us now again substitute per
tests passed by any one child for percentages of ch
ing the tests. That is, let us assume that in the lo
one child eight years old will fail in 4 per cent. of
age-group VI, in 9 per cent. of the tests in age-grou
and pass in 39 per cent. of the tests in age-group IX
last vertical column of figures on the right gives t
sum of these percentages. They indicate the perce
five tests that a child will measure above or below
the mental age obtained. Thus, the eight-year-old
measure 42 per cent. of five tests above his age, or
mental age of 8.42 years. It is seen from this tabl
that the percentages of the children passing an ind
may vary widely from what should be the case and
sult in very large errors in the mental ages obtained.

3. Uniformity of the Tests within the Age-Grou

The tests of any age-group should be as nearly
of the same grade of difficulty and be passed by ap
the same percentage of children. The limits of varia
sible depend on how much difference there is in the p
children of one age who pass and the percentage of
the following age who pass. If this difference is large t
in degree of difficulty for the tests in the age-group
may of course be correspondingly large without seri
ing the results obtained with the tests. We have a
that the amount of progress children make from
the next in the ability to pass a given test decreases
dren grow older. To the extent that this is true it fol
tests of the higher age-group must have a greater
than the tests of the lower age-groups in orde
age and mental age agree as closely. Where

the kind and distribution of the variation is If the too easy and the too difficult are ributed over the different age-groups the re- in the average be correct again because of the of errors cancelling each other. This is true also, much smaller measure, of the mental age obtained vidual child. If an eight-year-old normal child fails age-group VI and VII because they are too difficult, e the chance to pass tests in age-groups IX and X y are too easy, and thus attain the same mental age ave reached if all the tests had been just right. The he system of tests is seen, therefore, to lie by no e in the accuracy of the individual tests, but very he general plan of the system and especially in the nting up the mental age. Table XIX showed that age of children passing the individual tests in an varied over a wide range. We have no means of much this variation is due to the tests and how e to the examiner. Errors due to the examiner n a measure be eliminated by finding first the average that pass each test for all the children that take hat is, we find in Table XIX the average percentage, for the six, seven, and eight-year-old children that I, and the same for the other tests. This will av- esults of several examiners and partly overcome the an error any one examiner may have had with a given averages are given in Table XXI, together with ns for each test, which taken together are a measure ee of uniformity of the tests of an age-group.

TABLE XXI

	3	4	5	VII	1	2	3	4	5
	99	93	94	Av.	90	80	80	95	92
	+5	−1	0	V.	+3	−7	−7	+8	+5
	3	4	5	IX	1	2	3	4	5
	61	52	84	Av.	28	61	55	58	66
	− 1	−10	+22	V.	−26	+ 7	+ 1	+ 4	+12

X	1	2	3	4	5	XI	1	2	3
Av.	73	92	54	71	46	Av.	68	80	51
V.	+ 7	+26	−12	+ 5	−20	V.	+ 5	+17	−12
XII	1	2	3	4	5	XV	1	2	3
Av.	77	87	54	43	28	Av.	24	25	29
V.	+19	+29	− 4	−15	−30	V.	+ 1	+ 2	+ 6

These variations are variations from the avera
figures in this table, the plus and minus signs indica
rection of the variation, a plus sign meaning that
easier than the average of the age-group in which
For example, the —7 for test VI 1 means that this te
by 7 per cent. less of all the children taking it than
percentage for the five tests in this age-group. Ac
these figures there is good uniformity in degree o
of the tests for age-groups VI, VII, XI, XV, and IX
exception in IX. Tests VII 5, X 2, and XII 2 seem
easy, and tests IX 1, X 5, and XII 5 seem especial
The examiner's interpretation of the child's *respons*
an unusual degree in the case of tests VIII 5, and I
IX 1 appears as too difficult largely because some
marked the child as having failed in it, not because h
name the pieces of money, but because the test was
at all. It would not be safe under the circumstanc
any of these tests into other age-groups upon the b
figures in this table.

It will be worth while, further, to compare the
uniformity of the tests of each age-group in this re
when used on normals with the uniformity found wit
scale when used on feeble-minded. In this comparis
turbing factors must be taken into account. These
ences in the children, and differences in the examin
normals examined with the revised scale should gi
uniformity for the tests because they are normals.
give less uniformity for the tests because of the man
trained examiners, the feeble-minded in the compar
all examined by the writer. The influence of the e
largely eliminated in Table XXI, as was noted.

n we also saw above that the feeble-minded examined iter using the revised scale gave more regular results ormals in the present study, indicating that irregular- ults due to feeble-mindedness of the children is less ularity due to the examiner. This comparison between d and the 1908 scale may be made by averaging the for each age-group in Table XXI and comparing these with the same averages obtained from results in ex- ,006 feeble-minded.* These figures are given in Table

TABLE XXII

VI	VII	VIII	IX	X	XI	XII
17	12	14	20	20	9	14
4	6	12	10	14	8	19

it is seen that there is greater uniformity of the tests e-group for the revised scale in every case except age- , and that the improvement is considerable in most

crease with Age in Percentage Passing Each Test.

points out that the value of a test in the Binet-Simon pends not alone on a certain percentage of normal an age corresponding to the age-group in which the ed passing the test, but also on the rate of increase centage with increase in the age of the children. Thus, own illustration, suppose we had two tests passed by ng percentages of normal nine-year-old children.

Age	8	9	10
Test a	65	75	80
Test b	45	75	90

"b" would in this case be much better than test "a," as a. From various considerations already discussed it e clear that this is not necessarily true in the case of ults from large numbers of children. The average of a large number of children would be just as nearly tests belonging to class "a" as for tests belonging to all other things being equal. But it is equally evident

with the feeble-minded are reported in "The Binet and Simon ence in Grading Feeble-Minded Children," this Journal, 1912.
om Table II in article quoted.
e referred to above.

that the more nearly all the tests approach class "b," [illegible] likely will the mental age obtained be correct for each in[dividual] child. The question as to the rate of increase in pe[rcentage] passing a test, with increase in age, that is required in [order to] make the tests give correct mental ages is complicate[d in] several ways, and the present results are inadequate to sho[w] just what this rate of increase would be with the tests as [they] if complicating factors were eliminated, or just what it [would] be. This question was approached above in different con[nections]. It has been seen (1) that the increase from year to ye[ar] per cent. passing is smaller with the older than with the [younger] children; (2) that it is the smaller the easier the test [is] first place; (3) that the proper percentage of any age pa[ssing] tests of the corresponding age-group increases with the [age] in the number of extra tests that are passed beyond [the] group in which all are passed. Now the number of ex[tra tests] that are passed beyond the age-group in which all ar[e passed] is merely the converse of the increase from year to ye[ar] percentage passing any one test, and involves no new [principle]. Substituting percentage of tests passed in an age-group [for] ber of tests passed, and assuming that six-year-old chil[dren], example, will pass 60 per cent. of the tests in age-group [V], 60 per cent. of six-year-old children would pass any [test] in age-group VI, and vice versa. Likewise, if raising [the] group by a year, or to age-group VII, would cause a [drop to] 40 per cent. of these tests passed by six-year-old child[ren]. lowering the age of the children by a year, to age fi[ve] cause a drop to 40 per cent. of these five-year-old chil[dren] ing any test in age-group VI. In more detail, we sh[all] something as follows, assuming arbitrarily certain pe[r cent.] for illustration:

	V	VI	VII	VIII	IX	X
6	100	60	40	20	0	
7		100	60	40	20	0
8			100	60	40	20
9				100	60	40
10					100	60

present question as to the increase from year to year in entage of children passing a test becomes, therefore, of fundamental importance, for this increase remains no matter into what age-group we shift the test. The to the percentage of children of any age passing a test orresponding age-group might be easily adjusted by the test into one age-group or another. But shifting an make only rough adjustments, in the case only of h different in degree of difficulty from others in their . It was seen before that with a given number of s passed beyond the age-group in which all are passed, ntage of children of any age who should pass a test of ponding age-group in order to make the tests measure is thereby fixed. It is likewise obvious now that with ate of increase from year to year in the percentage of assing any test, this percentage of children who should is fixed. This latter percentage is therefore in itself ial importance. With any group or system of tests the Binet-Simon plan, the procedure should be to he rate of increase from year to year in the percentage The individual tests should then be eliminated or n the basis of this rate of increase more than on of the percentage passing at any point.

ning now to the results to see what this rate of in- the percentage passing each individual test is, we following disturbing factors. (1) Small number of different examiners for children of different ages; f uniformity in degree of difficulty of the tests. The n again be in a measure eliminated by averaging the Table XIX. For example, we may find the average ease for a year for test VI 1, for the years six, seven, and so on, throughout. This average rate will, how- uch too low because of a very small increase for a e older children as compared with the younger chil- h case. This is done in Table XXIII, which gives rage percentage of all the children taking each test e test. This latter percentage gives again the rela-

tive degree of difficulty of each test, and where it is large
pect the average increase to be correspondingly small.

TABLE XXIII

VI	1	2	3	4	5	Av.	VII	1	2	3	4
Av. increase	1	0	2	5	3	2.2		5	12	14	8
Av. passing	87	99	99	93	94			90	80	80	95
VIII	1	2	3	4	5	Av.	IX	1	2	3	4
Av. increase	10	15	17	19	7	13.6		9	17	10	19
Av. passing	70	43	61	52	84			28	61	55	56
X	1	2	3	4	5	Av.	XI	1	2	3	4
Av. increase	8	4	4	11	10	7.4		13	5	14	15
Av. passing	73	92	54	71	46			68	80	51	57
XII	1	2	3	4	5	Av.	XIII	1	2	3	4
Av. increase	3	0	6	6	5	4.0		6	0	9	4
Av. passing	77	87	54	43	28			24	25	29	16

This table does not bring out any striking facts not
noted. It shows the decreasing rate of increase with
creasing age of the children, and with increase in eas
test. The latter makes the rate of increase very low
groups VI and VII, where it should be highest. It
a number of scattered instances where a relative gre
of a test lowers the rate of increase, as for example in
X 2, XI 2, and XII 2. Since the average percentage
table on the rates of increase are all too low, we shou
that the real percentage of increase for the ages im
above and below the age corresponding to an age-group
tion would be considerably above 15 per cent. for th
age-groups, decreasing with the higher age-groups.
derive the percentages of increase from year to yea
more closely from figures given in Tables XVII and XV
ducing the average number of tests passed in succes
groups after the age-groups in which all are passed to
ages of tests passed, give the following table.

TABLE XXIV

100	65	44	28	9
100	64	40	18	4
100	65	42	23	7

le XVII gives the results of normals examined by un- examiners. Table XVIII gives the results of feeble- examined by the writer. Since the percentage of tests successive age-groups by children of one given age is e converse of the percentage of children of successive ing any one given test, as was seen above, we need read the percentages in Table XXIV backwards, from left, in order to get the increase with age in the per- of children passing a test. In round numbers, these es would run about as follows: 0-10-20-40-65-100. In on this point it should be repeated and emphasized this rate of increase that represents the degree of gen- cy of the tests, and fixes the percentage of children of hat should pass a test of the corresponding age-group. tests from one age-group into another because they relatively easy or difficult should be done on the basis ntage that is derived from this rate of increase instead basis of some arbitrarily assumed percentage, as has heretofore. To improve the scale of tests much fur- his method along this line will require much more ex- than has yet been attempted by any investigator.

E. SUMMARY.

ber of qualifications are necessary to make a good ex- h the Binet-Simon tests. These, together with the equired to attain these qualifications, were briefly d on pages 156-157 of the previous number of this

ntrained examiner meets difficulties because he lacks ng: (a) Familiarity with the directions for giving (b) Familiarity with the rules for interpreting the f the children. (c) Ability to adapt the procedure n special instances for which directions can not be d) Ability to interpret responses in special instances

for which rules can not be given. (e) Ability to ad
in attitude to the mental levels of children of differe
as to obtain the best efforts from the child in each c
General appreciation of the absolute necessity of
strictly to all the rules of testing, and of careful, p
work.

These deficiencies are of quite different degrees o
ance. The last is, on the whole, the most serious
frequent, and can be remedied only by extended
training. A few, but rather exceptional, untrained
do not lack this qualification. The amount of error
an examiner because of his lack of training seldom e
years in the mental age; in the majority of cases it is
one year.

The revised scale measures on the whole a frac
year too high for the lower ages, beginning with the
and a fraction of a year too low for the higher ages.
ference between the average age and the average men
however, reduced as compared with what the results
show to be true of the 1908 scale, this being the case
for the higher ages. Beyond the mental age of ten
measures too low mostly because there are no tests
beyond twelve, excepting age-group XV, which fact
children of these higher mental ages getting extra c
extra tests passed beyond the age-group in which they
according to the rule for counting of the mental ages.

The chief method of determining the range and
of errors in the mental ages obtained in the results of
children has been to find the relative number who p
as compared with the number who are retarded or ad
mental age, and by comparing the nature of such a di
curve with the "normal distribution curve." Follo
method the revised scale, like the 1908 scale, shows
number of advanced exceeds the number of retarde
lower ages and the number of retarded exceeds the n
advanced for the lower ages with some improvement
the revised scale. Comparison of the present re
those of others on this point is, however, rendered di

because of the varying conditions under which the re-
thers have been obtained, and the different forms in
results have been expressed. Chief among these are:
tion or non-selection of children with reference to
nality; (b) varying qualifications of the examiners as
; (c) keeping or dropping fractions of a year in the
keeping or dropping fractions of a year in mental ages.
impossible with this method, however, to determine
and frequency of error in the mental ages obtained
sonable degree of accuracy. We do not know enough
true nature of the distribution curve for the different
human intelligence, or how closely it corresponds to
l distribution curve." The assumption made by Bi-
mon, and accepted by others, namely, that the tests
re accurately if the majority pass at age and if the
retarded equals the number of advanced, are in part
and in part probably erroneous. The question as
the majority will pass at age depends in the first
he unit of measurement used, whether it is a fraction
a year, or more than a year of mental growth. The
a year as the unit is *entirely arbitrary*; any other
d with equal claims to validity might be taken and
e majority, less than the majority, or a large majority
. Choosing the amount of mental development dur-
ven period of time as a unit for mental measurement
r, complicated and probably rendered inaccurate by
at the rate of normal mental development decreases
that when such a unit is used more will pass at age
er ages than for the higher ages. Evidence that there
e in the rate of mental development with increasing
n in the present results showing that the increase
ear to the next in the percentage of children passing
oup of tests is greater for the younger children than
r children. The number passing at age varies with
because the amount of retardation or advancement
evelopment below or above the average normal rate
s with age. Each of these two factors must result

in more passing at age for the lower ages than for th
ages.

The equality of the percentages of retarded and
has no meaning with reference to accuracy of the tes
taken in connection with the exact percentage that pa
for the scale might, with equal frequency, measure
high and much too low. It is necessary also to dete
what class of children this equality must hold true; w
is for average normal children, entirely non-selected
or for some other class. This assumption is probably
if applied to a non-selected class of children.

We know from the other sources combined that
are much more accurate with reference to range and
of error in the mental ages obtained than we can prove
be by these distribution curves.

There is a close correlation when averages are co
between retardation and advancement in school grades,
tal retardation or advancement as shown by the me
obtained.

A good test must meet three requirements: (a)
or less invariable percentage of normal children of a
should always pass it. (b) This percentage should be
mately the same as it is for the other tests in the same a
(c) This percentage should rapidly and regularly incr
the age of the children.

The percentage of children of a given age that sh
a test in the corresponding age-group in order to mak
measure correctly is determined by the rate of increa
percentage passing with increasing age of the children.
present system of tests it is 60 to 65 per cent. instead
per cent. assumed and more or less agreed upon by a
writers as a basis for shifting a few tests into other ag
For the age-groups of VIII to XI inclusive, where the t
ure quite accurately on the whole, 65 per cent. of the
pass a test of an age-group corresponding to the age o
dren; of the children one year younger 48 per cent. pa
the children one year older 75 per cent. pass. The
any individual test is indicated chiefly by this rate o

year to the next in the percentage of normal children t. The correct percentage for any given age is inci- this rate and to the rule for counting up the mental is percentage, moreover, must vary for different parts tem, being higher for the lower age-groups than for age-groups.

rule for counting up the mental age is a very important ial part of the system. This tends to correct the er- dividual tests, the error of a too difficult test in one being corrected by the error of a too easy test in a age group, and vice versa. The actual percentage of passing the individual tests varies widely above and er cent. even where the tests measure very accurately ble.

is a considerable greater uniformity as regards degree y among the tests of each age-group in the revised is true of the 1908 scale.