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THE ABILITY OF DEAF AND HEARING CHILDREN TO FOLLOW PRINTED DIRECTIONS

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The ability to carry out directions is important in almost all psychological tests. It enters into every test that is preceded by instructions to the examinee. Failure to comprehend the directions leads to failure in the test. In this sense, therefore, all tests preceded by directions measure this ability. In addition to such indirect measurement, it is possible to measure directly the ability to carry out directions in general. Tests of the ability to follow directions or commands are found in some scales of intelligence, as in the Binet scale. Such directions are given orally. A test to follow printed directions has been devised by Woodworth and Wells.¹ This presupposes ability to read and to comprehend printed language. In this it differs from orally given directions, in as much as the latter depend merely upon the ability to understand spoken language, which may be reinforced by gesture. And, keeping in mind the condition of the deaf individual, it is obvious that following printed directions differs vastly from following directions that have been given to him by means of signs or gestures. Since the work reported in this article deals with the results of Woodworth and Wells' Directions Tests given to deaf and hearing individuals, it is important to keep the above facts in mind. The comparison of the abilities of the deaf and hearing groups on these tests is not really a comparison of the ability to carry out directions in general, but rather a comparison of the ability to understand the printed language of the tests. The results give us more insight into the language development of the two groups than into the ability to do what has been comprehended.

In this study the two Easy Directions Tests of Woodworth and Wells were used. We have designated them Test A and Test B and they are reproduced here in Figures 1 and 2, with the addition of the numbers from 1 to 20 in each case. This enumeration does not appear on the original test sheet, but has been added here because frequent reference will be made to particular directions.

¹ Woodworth, R. S., and Wells, F. L. Association Tests. *The Psychological Review Monographs*, No. 57, December, 1911, p. 68 et seq.

- 1 Cross out the smallest dot : . • ●
- 2 Put a comma between these two letters; G H
- 3 How many ears has a cat ?
- 4 Make a line across this line :
- 5 Show by a cross which costs more : a hat or an orange.
- 6 Write 8 at the thinnest part of this line :
- 7 Write any word of three letters.
- 8 Put a dot in one of the white squares :
- 9 Cross out the word you know best: fish, brot, matzig.
- 10 Leave this just as it is :
- 11 Mark the line that looks most like a hill :
- 12 How many t's are there in twist ?
- 13 Dot the line that has no dot over it :
- 14 Write o after the largest number : 3 86 12
- 15 Mark the name of a large city : London, painter.
- 16 Make a letter Z out of this :
- 17 Join these two lines :
- 18 Write s in the middle square :
- 19 Write any number smaller than 10.
- 20 Put a question mark after this sentence

FIGURE 1. Directions Test A.

1 Cross out the *g* in *tiger*

2 Write 2 between the two dots: . . —

3 How many feet make a yard?

4 Write + over the longest word. It rained yesterday.

5 Put a dot below this line: —————

6 Write the sum of these numbers: $\frac{8}{4}$

7 Make a boy's name by adding one letter to Joh

8 Make a cross in the circle:

9 What comes next after D in the alphabet?

10 Write 7 in the largest square:

11 Cross out the blackest letter in TEXAS

12 Write *g* on the egg-shaped figure:

13 Make two dots between these lines:

14 Put the sign = where it belongs: 3 + 2 5.

15 Write here the middle letter of *get*.

16 Put a nose on this face:

17 Add a cross and make these rows equal: $\begin{array}{ccc} \times & \times & \times \\ \times & \times & \times \end{array}$

18 Put a dot in the circle, below the center:

19 Draw a line around the three dots:

20 Cross out the last word in this sentence.

FIGURE 2. Directions Test B.

Various groups of individuals were tested as follows: Test A, 187 hearing children in grade schools ranging in age from 9 to 16; 121 younger hearing children in grade schools ranging in age from 6 to 8; 23 unemployed adults tested at an employment bureau when seeking employment; 22 students of a business college; and 366 deaf children, pupils of a state school for the deaf, ranging in age from 9 to about 20: Test B, 190 hearing children from 9 to 16 years old; 124 younger hearing children from 6 to 8; 20 unemployed; 29 business college students, and 289 deaf pupils.²

The method of procedure differed somewhat in giving the tests to the different groups. With the deaf children the tests were given individually but no very accurate record of the time was taken, since it became obvious early in the work that the time element would be of little significance. The pupil was allowed to work at each test for as long as he wished. This same procedure was followed with the younger group of hearing children except that they were given the tests in class. With all the other groups tested the tests were given individually and an accurate record of the time kept.

Time. The results of the time taken to perform the two tests are shown in Table I. There is a very slight and by no

TABLE I

TIME, IN NUMBER OF SECONDS, FOR HEARING CHILDREN, UNEMPLOYED AND BUSINESS COLLEGE STUDENTS ON DIRECTIONS TESTS A AND B

		Age								Unem- ployed	Business College
		9	10	11	12	13	14	15	16		
Test A	Average..	168	178	177	137	127	123	133	123	309	84
	Shortest..	135	105	70	70	72	61	80	90	90	50
	Longest..	204	283	330	265	285	298	231	213	640	119
Test B	Average..	143	171	160	149	139	119	140	141	287	88
	Shortest..	100	110	87	78	64	72	72	90	105	58
	Longest..	177	360	384	315	315	247	197	230	620	183

means regular decrease in time for the children from age 9 to 16. There is, however, a very marked decrease in time for the business college students as contrasted with the children, and a very marked increase in time for the unemployed

² The writers wish here to acknowledge the assistance given them by Miss A. E. Beekman, graduate student in the department of psychology, in collecting the data for the hearing children, the unemployed and the business college students.

group. The difference between the business college students and the unemployed is very noticeable. As we shall see later this very slow performance of the unemployed is accompanied by a poor qualitative performance of the tests. If the deaf children had been timed on the tests, the average times would undoubtedly have been as long and very probably longer than the times for the unemployed.

Quality. By quality of performance is meant the number of directions correctly responded to. It is in regard to this factor that we have sought for a comparison between the deaf and the hearing. Tables II and III show the results for Test A and Tables IV and V for Test B. In the body of these tables is shown the distribution of the individuals according to the number of directions correctly answered. The total number of individuals for each age or group, along

TABLE II
DISTRIBUTION OF HEARING INDIVIDUALS ACCORDING TO NUMBER
OF DIRECTIONS CORRECTLY ANSWERED. TEST A

Number of directions correct	Age																Unem- ployed	Business College
	6	7	8	9	10	11	12	13	14	15	16							
0	0	4	1															
1	7	11	1												1			
2	2	13	2												1			
3	3	9	2															
4		7	2															
5		2																
6		1																
7			1															
8		5	1												1			
9	1	3	4												2			
10	1	4	1															
11		2	2												1			
12		8	4												1			
13		4								1					4			
14		2	3			1									2	1		
15		3	1		1	2				1					2			
16			1		1	4	1	4							1			
17		2	1		1	3	1	2			1				2			
18					2	10	14	7	8						3	5		
19					3	9	12	21	7	7	9	3			1	9		
20					2	3	5	11	9	8	5	4			1	7		
Totals.....	14	80	27	10	25	41	41	30	17	16	7	23	22					
25%ile.....	3	11	12	19-20	19	19	20	20	20	20	20	17	20					
Median.....	1-2	4	9	18-19	18	18	19	19	19	19	20	14	19					
75%ile.....	1	2	4	16-17	18	17	19	18	19	19	19	11	18					

TABLE III
DISTRIBUTION OF DEAF CHILDREN ACCORDING TO NUMBER OF
DIRECTIONS CORRECTLY ANSWERED. TEST A

Number of directions correct	Age										Adult
	9	10	11	12	13	14	15	16	17	18	
0	6	4	4	2	1	2			2	1	2
1	12	20	13	10	3	4	6	6	6		5
2	4	13	18	15	17	9	6	14	7	3	3
3	1		2	3	3	3	2	7	4	4	2
4		1		1	4	2	3	2	1	1	2
5			1	2				2	1	1	3
6					1		1	3	1	3	1
7						1	2	1	1		2
8	1			1	3	2	2	3	2	4	1
9					1		3	2	2		6
10						1	1	4		1	1
11							1		1	1	
12					1		1		1		3
13						2	1	1		1	2
14							1			1	1
15									1		1
16									1		
17					1		1	2			1
18									1		
19									1		1
20						1					1
Totals.....	24	38	38	34	35	27	31	47	33	21	38
25%ile.....	2	2	2	2	4	7	9	8	8-9	8	12
Median.....	1	1	2	2	2	2	4	3	3	6	7
75%ile.....	0	1	1	1	2	2	2	2	1-2	3	2

with the median, the 25 and 75 percentiles, is given at the bottom. An inspection of the medians for the deaf shows that in neither test does the median for any age rise above seven directions correctly answered. With the hearing children a median higher than seven is attained by every group from age 8 upwards. The median performance of the deaf child at any age never reaches the median of the eight year old hearing child. The seven year old hearing children have medians about equal to 14 to 16 year old deaf children. The median for the unemployed group in both tests lies just below the median of the nine year old hearing children. The distribution of the unemployed is the most scattered of any of the groups tested, ranging from one in Test A and 0 in Test B to a perfect performance. The deaf children show a fairly constant increase in ability from age to age. In both tests the adult group is slightly superior to any of the pre-

TABLE IV

DISTRIBUTION OF HEARING INDIVIDUALS ACCORDING TO NUMBER OF DIRECTIONS CORRECTLY ANSWERED. TEST B

Number of directions correct	Age												Unem- ployed	Business College
	6	7	8	9	10	11	12	13	14	15	16			
0	4	13	2									1		
1	1	9	2											
2	3	6	2											
3		5	3											
4		8												
5		4	1											
6	1	4	2									2		
7		5	4											
8	2	4	1											
9		5	5											
10		3	3	1								1		
11		3	2	2								2		
12		2	4	1								1		
13		2	1									2		
14		3	1	1	1	2	1		1			2		
15		2			1	1	1	1		1		2		
16		3	1			2	3	1	1	1		2	2	
17					2	4	7	6	8	1	3			
18				2	3	7	7	13	6	4	3	2	6	
19				3	4	16	8	10	5	4	4	3	9	
20				1	9	6	9	6	6	4		2	12	
Totals. . .	11	81	32	10	25	41	41	32	18	16	7	20	29	
25%ile. . .	6	9	11	19	20	19	19	19	20	20	19	19	20	
Median. . .	1	4	7-8	18	19	18	18	18-19	19	18-19	19	15	19	
75%ile. . .	0	1	3	17	18	17	17	17	18	17	18	12	18	

ceding age groups. This is in marked contrast to the inferior performance of this group as compared with the 18 year olds in other tests not involving language.³

The older hearing children, i. e. those age 9 and above, show their ability to comprehend practically all of the directions. Most of the errors made by this group are due to inaccuracy rather than to lack of comprehension. The median for this group rises from 18 to 20 and the distribution shows no paper with less than 13 correct responses. The business college students do no better than the older hearing children. Their mistakes are also due to inaccuracy. These two groups can be directly contrasted with the younger hearing children

³ Cf. the performance of these same children on the Digit-Symbol with Symbol-Digit tests. Pintner and Paterson, *Learning Tests with Deaf Children. Psychological Review Monograph Series*, Vol. XX, Whole No. 88.

TABLE V

DISTRIBUTION OF DEAF CHILDREN ACCORDING TO NUMBER OF DIRECTIONS CORRECTLY ANSWERED. TEST B

Number of directions correct	Age										Adult
	9	10	11	12	13	14	15	16	17	18	
0	2	4	9	10	7	2	2	5	8		2
1	1	1	3	5	3	6	3	5	4		3
2	1	1	1	5	8	1	2	7	5		3
3	1		1	2	3	3	3	4	2	2	4
4		2		2	3	2	3	6	2	5	3
5			1		4			1	9		3
6						3	3	1	2	2	3
7							1	3	2	2	3
8						2	4	1	2	1	
9					1			3	1	2	1
10			1	2			1	1	2	1	4
11					1		2	2		1	1
12					1			1	1	1	2
13								3			
14											2
15					1			1			1
16									3		1
17						1				1	3
18						1	1		1	1	
19							1				1
20								1			
Totals.....	5	8	16	26	32	21	26	45	44	25	40
25%ile.....	3	4	2	3	5	6	8	9	7	9	12
Median.....	1	0-1	0	1	2	3	5	4	5	4	6
75%ile.....	0	0	0	0	1	1	2	2	1	3	3

and with the deaf children. The chief factor in the poorer performance of these two latter groups is the inability to understand much of the language involved in the tests. The distribution of the unemployed cases would lead one to suspect that the group is not homogeneous and includes both types of cases, i. e. those who are unable to understand much of the language and those who are able to comprehend but make mistakes due to inaccuracy.

Oral and Manual Pupils. The comparison between the orally taught and the manually taught deaf pupils is given in Table VI, which shows the medians at each age for the two groups of pupils. The superiority of the orally taught pupils is marked at the upper ages. Up to age 14 there seems to be little difference between the two groups. After this, however, the oral pupils show decidedly higher medians. The low

TABLE VI
COMPARISON BETWEEN THE ORAL AND MANUAL DEAF PUPILS.
MEDIAN AT EACH AGE

		Age										Adult
		9	10	11	12	13	14	15	16	17	18	
Test A	{Oral.....	1	2	2	2	2	3	7	6	9	7	9
	{Manual.....	1	1	2	2	2	2	2	2	2	2	2
Test B	{Oral.....	0	1	0	1	3	3	6	7	9	8	10
	{Manual.....	0	0	0	0	0	3	3-4	2	2	4	3

medians for all the children combined, as shown in Tables III and IV, are obviously due to the generally poorer performance of the manual pupils. The superior performance of the oral pupils is perhaps in part due to the greater emphasis upon language training in oral instruction, but it is without doubt also due to the fact that the more intelligent pupils are selected for oral instruction.

Age of Deafness. The influence of the age at which deafness occurred upon the ability of the pupils in this test is shown in Table VII, which gives the average number of directions correctly answered in Test A for the different ages at which deafness occurred. The first column includes all cases where the time of onset is unknown; the second those born deaf; the third those who became deaf before the first birthday, and so on. It will be seen that the congenital and unknown groups show the lowest averages. There is a decided tendency for the averages to increase the later the age of onset of deafness. Evidently the auditory experience of the child before the occurrence of deafness may be of value for his language ability. The similarity of the averages for the congenital and unknown groups suggests again, what we have pointed out in other tests,⁴ namely, that a large proportion of the so-called unknown cases are in reality congenital.

Relative Difficulty of the Directions. An analysis of the two tests in regard to the relative difficulty of each single

⁴ Pintner and Paterson, A Comparison of Deaf and Hearing Children in Visual Memory for Digits. To appear shortly in *The Journal of Experimental Psychology*.

TABLE VII
AVERAGE NUMBER OF DIRECTIONS IN TEST A CORRECTLY ANSWERED. DISTRIBUTION ACCORDING TO AGE AT WHICH DEAFNESS OCCURRED

	Unknown	Congenital	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Age of deafness.			21	53	44	17	11	11	5	1	1	3	4	0	2	1
Number of cases.	41	151														
Av. No. of directions correct.	2.8	2.2	3.1	3.8	3.5	3.6	3.7	7.8	11.6	5.0	8.0	10.0	10.0		17.0	19.0

TABLE VIII
HEARING INDIVIDUALS. DISTRIBUTION ACCORDING TO AGE OF PER CENT CORRECT FOR EACH DIRECTION. TEST A

Age	No.	Number of Direction																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
6	14	7	0	50	36	0	0	14	0	93	7	0	21	0	0	0	7	0	7	14	0
7	80	39	4	76	50	1	32	38	24	91	30	7	43	16	1	38	22	27	30	20	
8	27	67	4	74	85	0	52	67	30	96	41	18	63	37	7	44	48	26	63	18	
6 to 8	121	41	3	73	56	0.8	33	29	41	22	93	30	9	45	19	2	36	26	25	36	17
9	10	90	100	100	100	50	100	60	90	100	90	70	90	100	90	90	100	100	80	100	100
10	25	88	100	100	100	60	96	92	96	100	100	52	100	84	80	80	100	100	100	100	84
11	41	90	88	100	100	51	98	88	93	100	90	63	95	80	78	98	100	93	100	98	98
12	41	98	98	100	100	76	98	93	100	98	100	95	76	100	83	98	100	95	100	95	95
13	30	97	97	100	100	73	90	93	97	93	100	93	70	100	63	87	100	93	100	100	100
14	17	94	100	100	100	71	88	100	82	94	100	100	88	94	94	94	100	94	100	94	94
15	16	100	100	100	100	69	100	94	100	100	100	87	100	87	87	87	94	100	94	100	100
16	7	100	100	100	100	87	100	100	100	100	100	100	87	100	87	100	100	100	100	100	100
9 to 16	187	94	96	100	100	66	96	91	95	98	100	94	72	98	82	82	98	100	94	100	97
Unemployed.... Business College.	23	65	35	91	87	43	74	65	87	65	100	74	43	83	35	39	74	96	56	87	35
	22	96	86	100	100	82	100	96	100	100	100	96	91	96	64	91	96	100	96	100	100

TABLE IX
DEAF CHILDREN. DISTRIBUTION ACCORDING TO AGE OF PER CENT CORRECT FOR EACH DIRECTION. TEST A

Age	No.	Number of Direction																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
9	24	4	0	29	4	0	4	4	0	61	4	4	0	0	0	4	0	0	0	4	0
10	38	0	0	53	0	0	0	3	0	74	3	0	0	0	0	0	0	0	0	0	0
11	38	0	0	71	3	0	0	0	0	63	0	5	0	0	0	0	3	0	3	8	0
12	34	0	0	82	3	0	3	3	0	65	9	12	6	0	0	3	9	3	3	6	0
13	35	14	0	94	20	3	6	6	9	9	23	14	6	3	3	23	20	9	9	32	6
14	27	22	11	85	15	4	7	11	22	15	74	26	19	11	4	26	22	7	11	30	15
15	31	26	3	90	26	13	13	10	16	26	71	42	35	23	3	32	42	19	26	48	10
16	47	19	4	96	19	4	13	6	15	13	64	28	19	17	4	30	30	28	19	45	11
17	33	21	12	91	27	12	18	12	15	12	64	24	21	27	6	33	30	24	12	42	18
18	21	24	14	91	19	19	19	10	14	14	71	29	38	10	0	29	43	29	24	62	24
Adult.	38	34	13	86	34	8	26	34	18	37	74	47	21	42	11	47	42	37	37	61	29
All deaf	366	15	5	80	16	5	10	9	10	11	69	21	16	13	3	21	21	14	13	30	9

TABLE X
HEARING INDIVIDUALS. DISTRIBUTION ACCORDING TO AGE OF PER CENT CORRECT FOR EACH DIRECTION. TEST B

Age	No.	Number of Direction																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
6 7 8 6 to 8	11	0	0	0	0	18	0	0	9	45	27	27	18	27	27	0	36	9	9	9	27
	81	23	36	7	4	52	4	17	11	22	61	41	33	31	40	12	63	35	17	27	30
	32	22	41	9	0	62	3	25	19	31	78	62	53	34	50	16	78	41	28	50	34
	124	29	34	7	2	51	3	18	12	23	64	45	38	31	41	12	65	34	19	32	31
9 10 11 12 13 14 15 16 9 to 16	10	90	100	80	70	100	70	80	100	100	100	100	80	80	84	100	100	100	100	70	70
	25	100	100	80	76	100	92	96	100	96	100	100	100	92	84	84	100	100	100	70	76
	41	93	98	76	80	95	85	98	95	98	100	93	93	85	90	93	100	100	98	78	66
	41	88	93	88	83	95	76	95	98	95	100	100	100	90	90	90	98	98	95	73	73
	32	97	94	84	63	87	87	84	94	100	97	100	94	84	90	97	100	100	97	78	87
	18	89	100	89	72	100	72	100	100	95	100	95	83	89	100	100	100	100	100	89	83
	16	100	87	87	81	100	62	100	94	100	100	100	94	100	94	87	100	100	94	62	81
	7	100	100	100	72	100	72	87	100	87	100	100	100	100	100	100	100	100	87	100	72
	190	94	96	84	76	96	80	94	97	97	99	98	96	88	91	93	99	99	97	78	76
	Unemployed, . . . Business College.	20 29	70 93	80 90	50 97	50 83	60 100	50 97	75 93	70 100	75 86	95 100	85 97	75 97	90 97	55 97	70 100	95 100	70 97	75 93	65 100

TABLE XI
DEAF CHILDREN. DISTRIBUTION ACCORDING TO AGE OF PER CENT CORRECT FOR EACH DIRECTION. TEST B

Age	No.	Number of Direction																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
9	5	0	0	20	0	0	20	20	0	0	0	0	0	0	20	0	40	0	0	0	0
10	8	0	0	0	0	0	50	12	0	0	12	0	0	0	12	0	37	12	0	0	0
11	16	0	0	6	0	6	31	12	0	0	12	6	6	0	12	0	31	6	6	0	0
12	26	0	4	0	0	0	42	19	8	8	15	8	4	4	19	0	46	4	0	0	0
13	33	0	9	12	0	6	45	24	9	15	24	18	12	9	27	0	73	15	6	3	0
14	21	10	10	43	0	14	62	43	10	33	14	10	24	14	38	5	71	14	10	14	10
15	26	15	8	46	12	8	54	58	19	23	54	35	27	4	54	27	85	27	15	12	8
16	45	18	9	22	13	9	62	44	22	31	44	31	33	7	49	13	80	18	13	11	2
17	44	5	9	41	5	11	70	41	20	25	32	18	25	11	34	16	75	18	14	5	9
18	25	12	20	68	16	16	60	56	32	28	68	28	32	8	48	16	100	16	12	12	0
Adult.....	40	25	15	57	7	30	50	52	27	47	47	42	37	27	67	22	87	35	32	27	12
All deaf.....	289	11	9	33	6	11	54	39	17	24	35	23	23	10	40	12	73	18	13	10	5

direction was undertaken. Such an analysis brings out the specific difficulties of each of the groups tested and may suggest an answer to the question as to whether the language which is difficult for the deaf child is also the language which is relatively difficult for the hearing.

The relative difficulty of any one question as compared to any other can be determined for each group by the percentage of correct answers for each direction. These percentages for both tests are given in Tables VIII to XI. Each table shows the percentage of correct answers for each of the 20 directions for each of the age groups. In addition the percentages for the younger children (ages 6 to 8), and for the older children (ages 9 to 16), and for all the deaf are given, allow-

FIGURE 3.—Directions "A." Per Cent Correct.
 I Business College. II Hearing Children 9-16. III Unemployed.
 IV Deaf. V Hearing Children 6-8.

ing comparisons between these groups. The unemployed and business college students have been kept as groups without any division into ages. Tables VIII and IX give the results for deaf and hearing for Test A. Tables X and XI give similar results for Test B. The ranking of the questions in order of difficulty can easily be found for any age or any group from the percentages given in the tables. A cursory inspection will show that it is roughly the same for all groups at all ages, except that there seems to be a greater uniformity of the hearing groups among themselves than of the deaf as contrasted with the hearing groups.

The comparison of the relative difficulty of each direction for certain groups comes out more clearly from an inspection

FIGURE 4.—Directions Test "B." Per Cent Correct.
 I Business College. II Hearing Children 9-16. III Unemployed.
 IV Deaf. V Hearing Children 6-8.

of the curves shown in Figures 3 and 4. The five groups compared on each test on the curves are the younger hearing, the older hearing children, the deaf, the business college students and the unemployed. Along the abscissae the number of each direction is shown (as enumerated in Figs. 1 and 2), and along the ordinates the percentage of correct responses is given. The curves for the deaf and the younger hearing children keep remarkably close together showing that the difficulty of the directions is almost the same for the two groups. The curves for the business college students and the older children are also remarkably close together. Midway between lies the curve for the unemployed. The shape of all the curves is very similar. All show a decided tendency to rise or fall at the same point, although the relative amount by which they rise or fall is by no means always the same.

The similarity of the curves is more marked for Test A, Figure 3, than for Test B, Figure 4. On Test A there are some few exceptions to the general statements made above. At direction 13 the curve for the deaf drops slightly, whereas all the other curves show a decided tendency to rise. This means that direction 13 is relatively hard for the deaf, but easy for the hearing. At direction 15 the curve for the younger hearing children drops, while the other curves tend to rise. This is one of the few places at which the curve for the younger hearing children is decidedly below the curve for the deaf. On Test B there are a great many more discrepancies to be noted. At directions 3 and 6 the curve for the younger hearing children drops decidedly, whereas at these two places the curve for the deaf rises very markedly. The converse is true at directions 7 and 19, where the "deaf" curve drops while the "hearing" curve rises. These discrepancies might suggest that there are some slight differences in the language development of the deaf as contrasted with the hearing child. The three most marked discrepancies between the deaf and all the hearing curves occur in Test A, direction 13, which the deaf find relatively hard, and in Test B, directions 3 and 6, which the deaf find relatively easy. Direction 13, Test A, is, "Dot the line that has no dot over it" (See Fig. 1). In two other directions, number 8, Test A, and number 13, Test B, the word dot also occurs and in all these three cases the percentage of correct answers for the deaf is very low, owing to the fact that few of them understand the word "dot." The peculiar difficulty for the deaf of number 13, Test A, as compared with the hearing individuals might arise from the added fact that they are unfamiliar with the word "dot" used as a verb. Directions 3 and 6, Test B, which the deaf find relatively easy are both

matters of school knowledge. "How many feet make a yard," and "the sum of two numbers," are obviously things which have been taught in school and taught in exactly the language used in the tests. The language of these directions is, therefore, relatively easier for them than the language of the other directions, as contrasted with the relative ease and difficulty of the language of the tests for the hearing individuals.

These differences between the deaf and the hearing are relatively slight and are not to be overemphasised in view of the great amount of similarity existing in the language ability of the two groups.

This latter fact may be further emphasised by the coefficients of correlation. We have correlated the degree of difficulty of the twenty directions by the Spearman Footrule method between the younger hearing and the older hearing children and arrived at a coefficient of .64 for Test A, and .43 for Test B. The correlation between the younger hearing and the deaf children gives coefficients of .54 for Test A and .38 for Test B. The younger hearing children are somewhat more similar to the older hearing children, than the deaf are to the younger hearing children, but the difference is very slight. The interesting fact is that all the groups are so much alike.

In light of the close correspondence between the curves for the younger hearing children and the deaf, and of the similarity of these two curves with the other curves for hearing individuals, it would seem safe to conclude that the language development of the deaf, as far as we can judge from these two tests, is very similar to the language development of the hearing, and further that the average language ability of all the deaf children on these two tests is about equal to the ability of hearing children of the ages from 6 to 8.

The curves for the unemployed show a very marked similarity to the curves for the hearing children. Their language ability lies somewhere between that of the younger and that of the older hearing children. The curves for the older hearing children and for the business college students are very much alike in both tests.

Language Comprehension. The age at which the average deaf child reaches the ability to comprehend the language involved in the tests can be roughly determined from a study of Tables IX and XI. If we run down the columns of percentages for each test we may note the increase in ability to answer the direction correctly. It will be seen that some directions are never answered correctly by a third of the pupils at any specific age, e. g. directions 2, 5, 14 of Test A and many others. These are clearly beyond the ability of the deaf at all ages.

Other directions are answered by about a third or more at all ages, e. g. direction 3 of Test A, and 6, 14, 16 and perhaps 7 of Test B. These are obviously well within the ability of the deaf. Direction 3, Test A, "How many ears has a cat?" involves the very simplest language possible, using in "how many" a very common type of interrogation. Directions 6, 14 and 16 of Test B can almost, if not entirely, be comprehended without an understanding of the actual printed words. Number 6 shows two digits in the usual position of an addition sum, and probably called forth the right response in a great many cases without any comprehension of the language preceding the digits. Many papers showed a line drawn under the digits in the conventional manner and the sum written below. In the same way direction 14 shows the blank space waiting for the equal sign to be supplied, and the sign of equality is itself given among the wording of the direction, serving doubtless as an adequate stimulus. The face without a nose in direction 16 impels the observer almost instinctively to supply the missing feature. In one paper the ear is also supplied. All the directions, therefore, that are within the ability of the deaf child at any age demand a very low degree of language ability.

A few words are necessary in regard to direction 10 of Test A, which from the percentages in Table IX would seem well within the ability of the children at all ages. Direction 10 is, "Leave this just as it is," and then follows the picture of an arrow and a target. We have credited as correct all papers where this remained untouched by the observer. Obviously this does not mean that all those who left it untouched comprehended the direction and carried it out. In the lower ages the majority certainly did not understand the language, and the surprising thing is that the percentages are not higher at all ages. It is interesting to note that this direction ranks second in order of easiness for the deaf, more children (80%) being able to answer how many feet make a yard, than to leave something alone (69%). It is obvious, therefore, that the percentages in this case do not denote ability to comprehend language.

In addition to these two groups of directions that are either not understood at any age, or are understood by almost all at all ages, we have a third group where about thirty per cent are able to answer correctly at some age above age nine. Without going into detail it would seem that ability to comprehend such language as is involved in these tests comes somewhere between the thirteenth and fifteenth year. It is about this period that most of the questions that are answered correctly by the majority of the older pupils jump from a

low to a relatively high percentage. Our data are not sufficient to warrant any general conclusions, but merely suggest the desirability of further study of the language development of the deaf child.

Characteristic Reactions of the Deaf. The most characteristic difference between the papers of the deaf and the hearing children lies in the number of wrong responses called forth by the printed directions. The deaf child will make some kind of a response more often than the hearing child, when neither of them is able to understand the language of the directions. Again and again the deaf child will cover the paper with some kind of response to every question even although he is unable to understand the language. The hearing child is more apt to leave the question alone if he fails completely to understand the language involved. His errors are mainly due to partial understanding or to carelessness. Otherwise the question is passed over. This comes out characteristically in direction 10 of Test A. Of the younger hearing children 93 per cent have left it alone; of all the deaf only 69 per cent have desisted from making some kind of a response. This is true of many other questions, although we cannot see that from the percentages as tabulated.

A perseverative tendency is noted in some papers where a number is written after each one of the directions, either the same number throughout or a sequence of numbers.

In many cases the response called forth by the direction is in the nature of an association connection with some one word of the direction. In at least two cases, the direction, "Write any word of three letters," called forth the response "postcard." Again "fish" in direction 9 of Test A gave rise to the association, "gold-fish." After direction 15, Test A, we find in one paper, "Groydon, Boston, Mass.," obviously stimulated by the word "city" or "London." Again after direction 1 of Test B we have the response "in a cage." In other cases the connection between the response and the direction seems to lack any definite connection, as in the response "Mt. Healthy," to direction 4, Test A, or in the response, "Mr. Jones," to direction 9, Test B.

Direction 20, Test B, often calls forth the construction of a sentence. The word "sentence" acts as a cue to the common school exercise of constructing sentences. This tendency to make sentences of the words is also shown in other papers, where the child has obviously taken the test as an exercise in the construction of sentences. One child has made a sentence beginning with "I have" for each direction, utilising in each case some one word out of each of the directions.

A very common type of response among the deaf children

is the copying of the printed words. A tendency to do this was found in only one of the hearing children's papers. Obviously this tendency among the deaf is due to the fact that a great part of their language instruction necessitates the constant repetition and copying of words.

Conclusions.

1. These directions tests as applied to deaf and young hearing children are mainly tests of the comprehension of the language in the tests.

2. The average deaf child's ability to comprehend the language involved in these tests is about equal to that of the average hearing child between the ages of six and eight.

3. The orally taught deaf pupils show marked superiority to the manually taught pupils in the higher ages. This is probably due in large part to the greater intelligence of the former group.

4. Children who become deaf later in life show on the average a better comprehension of language than those who become deaf early or are born deaf.

5. The general language development of the deaf and hearing as measured by the ability to respond correctly to these directions seems to proceed along the same lines.

6. The deaf child seems more inclined than the hearing child to respond in some overt fashion to a situation that is not understood.