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# A study of the free association test with deaf children.

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A STUDY OF THE FREE ASSOCIATION TEST  
WITH DEAF CHILDREN

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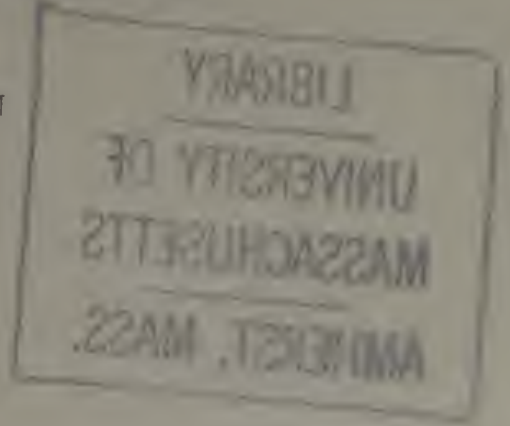
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A STUDY OF THE FREE ASSOCIATION TEST

WITH  
DEAF CHILDREN



by  
THOMAS KLINE

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE MASTER OF SCIENCE DEGREE IN THE GRADUATE  
SCHOOL OF THE MASSACHUSETTS STATE COLLEGE

Amherst, Massachusetts  
1938

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## THE PROBLEM

Psychological tests show that deaf children when compared to hearing children are retarded in educational achievement, especially in the mastery of language. Reamer and Pintner found that the average deaf child from 12 to 15 achieves on the educational tests what the 8 or 9 year old hearing child achieves (Guilmartin, 1). These quantitative results, however, tell us nothing of the quality of the retardation. That is, they do not tell us whether the older deaf children are like younger hearing children on the same educational age in their language and thinking habits, or whether there exists differences between deaf and hearing children which do not show in educational achievement tests.

One approach to this problem is the free association test which seems to give information about important language habits of children and adults. Woodrow and Lowell (4) found that the responses of hearing children in a free association test differ from the responses of hearing adults.

The purpose of this study is to investigate the responses of deaf children in a free association test and compare them with the responses of hearing children and hearing adults. As a result of this comparison we expect to answer the questions: Is there a difference in the responses of deaf and hearing children of the same age? And, if there is a difference, do the deaf children show a retardation in regard to responses in a free association test? What kind, qualitatively determined, of differences exist?

## LITERATURE

The free association test consists of presenting subjects with a list of words one by one. The subjects has to respond with the first word which occurs to him. For example: A word, called the stimulus word, is pronounced to a subject who has been instructed to respond with the first word that the stimulus word brings into his mind. The word responded with is called the reaction word or the response. The same stimulus word is given, say, to a thousand individuals. These thousand individuals will not all respónd with a different word, but with one of a comparatively small number of words.

The association test has been used as a tool in the diagnosis of conduct. It is effective in the discovery of guilt, although certain difficulties in its use with sophisticated subjects has prevented its practical application. The association method also is helpful in the diagnosis of insanity and milder psychopathic states, although it cannot be used as the sole criterion. Attention is a very important factor in this test. In scoring the test both the response and the reaction time have been used. By reaction time is meant the interval between the instant the stimulus word is presented and the instant the response word is given by the subject. This reaction time may be long or short. For instance: If an individual has committed a crime--a theft, say--words bearing upon the circumstances of the crime will elicit responses which will serve to "give the subject away." If the subject tries to



"beat the game" by giving some foolish or irrelevant association, the time of the responses will ordinarily be lengthened. (Garrett and Schneck (2), and Symonds (3)).

Kent and Rosanoff compiled a list of 100 common stimulus words, which were given to 1000 normal adults by the individual oral method. They did not record the time of responses. Frequency tables were drawn up by Kent and Rosanoff, based upon the responses to their 100 words given by 1000 adults. From these tables it is possible to compare the responses of an individual with those given by Kent and Rosanoff's standard group.

The most important study of this test concerning age differences has been made by Woodrow and Lowell. The method used by Woodrow and Lowell was the oral method for the stimulus. That is, the stimulus word was given orally to the children and then the responses were written. They did not record the response time.

Woodrow and Lowell used 1000 school children of ages 9 to 12. They studied the responses of these children by comparing them with adult frequency tables of Kent and Rosanoff. The purpose of Woodrow and Lowell's study was to make a comparative study of the associations of children and adults, also to secure data which may serve as a standard in the studies of the associations with children.

When Woodrow and Lowell compared the results of the children with those of the adults they obtained very striking and very important results. They found, in general, that the

children's associations differ from those of adults. Marked differences exist between children and adults in the frequency of the various types of association. The types which occur more frequently with adults than with children are the following: contiguity, superordination, coordination, part-whole, noun abstract attribute, participles, and cause-effect. The types which occur more frequently with children than with adults are verbs, verb-object, noun, adjective, adjective-noun pronouns, sound similarity, contiguity, whole-part and less definitely subordination, and word-compounding. No reliable difference was found between the groups with respect to the following types: similarity (in meaning), material, effect-cause, non-specific reaction and a miscellaneous group. With only 39 percent of the stimulus words is the most frequent response the same for both children and adults. The frequency of the favorite or most frequent response is about the same for both groups, as is also that of the three most frequent responses. Children gave fewer individual responses than adults. The number of different words given in response to any stimulus word is less with adults. The adults more frequently gave children's response words than the children do of the adults. The children's favorite response is more apt to be given frequently by the children. Thus the favorite adult response is one of the children's three most frequent in 59 percent of the cases while the children's favorite response is one of the adult's three most frequent in 74 percent.



PROCEDURE

For this experiment the written method was used exclusively both in giving the stimulus word and collecting the response. The written method was used in giving the stimulus word to the children so that the deaf child would receive the stimulus under the same conditions as the hearing child. If the oral method had been used in giving the response there was the possibility that the deaf child might not have gotten the correct stimulus word through lip-reading or signs, and thus giving the hearing child an unfair advantage. The written method for the response commends itself in statistical investigations because of the great saving in time and the greater uniformity of conditions. If a child hesitates there is no extra waiting and suggestive questioning. (Cp. Woodrow and Lowell p. 24)

The stimulus words were printed on cards four by nine and one-half inches with one and one-half inch lettering. Corresponding number cards (3 inches by 3 inches) were used to avoid any confusion as to the correct number of stimulus word that was shown. The lines on the blanks, that were used to collect the responses, were numbered from 1 to 55. (50 stimulus words were used in the experiment with 5 additional in the beginning; see later.) Thus, for example if you gave number 5 stimulus word the child would know immediately that he would write his response in the 5th space of his paper. Also on these blanks were spaces for the children to write their names, ages, and the name of their school.

## Instructions

Each experiment was preceded by a practice period. The instructions were given orally to the children by the respective teachers. The instructions were as follows:

"I shall show you a card with one word on it (show) and I want you to look at the word and tell me the first word you think of --- quickly." (Show card again). "What does this word make you think of?" (For deaf children this was repeated and the teacher gave an example) Instantly hands went up and samples of the response words were written on the blackboard to show the children that all responses to the stimulus words would not be the same. Four or five stimulus words were given and a few of the response words for each that the children had given were written on the blackboard. If each child understood what you wanted him to do, the instructions for the experiment proper were given. They were: "For the test proper I shall show you a number (show) and then a word (show). I want you to think of one word. (For the deaf this was indicated by holding up one finger or "one word" was written on the slate) Think quickly and give one word----not two, not three, but write the first word you think of."

"On your paper you will find numbers from 1 to 55. For word number 1 that I shall show you, you will write the first word that this word makes you think of after number one on your blank. (For the deaf this was pointed out on one of the blanks) For word number 3, you will write the word you think of after three on your blank, and etc. through the 55 words."

"Perhaps I may show you a word that doesn't make you think of anything---in that case just draw a line after the number of the word on your paper and go on to the next word. (Repeated for the deaf) If you think of a word and don't know how to spell it, spell it by sound."

"Now remember I only want one word and that is the first word that you think of. If you can't think of a word, draw a line. Do not write the word that I show you but the first word that you think of." (Repeated for the deaf)

The same instructions were given to the hearing and deaf. For the deaf, great care was taken in giving the instructions; that is they were given more slowly and repetition was frequently used to stress the important points. The blackboard was used to jot down the important points.

If no further questions were asked the experiment was started.

Since 5 additional words were added to the beginning of the list of the 50 stimulus words, it was possible to make a check on the children's responses after the first 3 or 4 words had been given to see if they had understood and had followed instructions.

In the experiment proper the number was held up first for approximately 2 or 3 seconds, after which the stimulus word was held approximately 20 to 22 seconds. To complete the entire experiment 23 to 25 minutes were required. The approximate size of a group tested was usually 25 to 30 children.



### Choice of stimulus words

Fifty stimulus words were used for this experiment and as it was desired to compare the results with those of Woodrow and Lowell, naturally the 50 stimulus words were chosen from their list of 100 that they had used in comparing the responses of children with the responses of adults. In selecting the stimulus words from the 100 words of Woodrow and Lowells, they were not picked at random, but the stimulus words that were chosen were those that gave the widest range of differences in responses between the children and adults. This was done because the purpose of this experiment was to find out how the differences of responses of deaf children, hearing children and adults compared. A check was made with the instructors of the deaf to be sure that the words chosen were used and understood by the younger deaf children. For the practice period ten words were used. They were the following: store, jump, walk, season, door, baby, thief, street, and river. To the 50 experimental stimulus words 5 additional words were added to the beginning of the list which made it possible to check the children's responses to these 5 preliminary words. The five additional words added were the following: slate, fish, run, car, and apple. These words and the ten of the practice period were picked at random, but making sure that the children were familiar with them.

### Subjects

The children used in this investigation were all from 11 to 17 years of age inclusive. Table I shows the number of

children in each age group. In selecting the deaf children, no children were taken that had become deaf after the age of five. No mentally retarded classes of hearing or deaf children were taken.

Fifty of the deaf children were from the Clarke School for the Deaf, Northampton, Massachusetts and the remaining were from the Illinois School for the Deaf, Jacksonville, Illinois.

The age 11 was used for the youngest because the deaf child younger than this did not know how to carry out the directions that go with the free association test and it was also found that they did not know the words that had been selected. The age 17 seemed to be a logical age to set the upper limit and thus make a wide enough variation for a good comparison between the deaf and hearing and for determining the age trends.



Table I

Number of children used in this experiment, by age groups.

Age	No. of deaf children	No. of hearing children
11	24	27
12	28	33
13	29	32
14	33	42
15	34	27
16	30	22
17	<u>29</u>	<u>24</u>
Total	207	207

### Handling of the data

Frequency tables were made to show the frequency with which each of the responses was given in each age group to each of the 50 stimulus words. From these were made tables in which classificatory categories were used.

Due to the fact that a comparison was to be made with the results that Woodrow and Lowell found for adults and children, naturally, the same classification of the stimulus and response words were used; however, a few of the classifications were omitted because the number of stimulus words used for the hearing and deaf children were too few to make a comparison. Also, in the selection of the stimulus words we chose those that had a wide range in responses (adults and children) and thus the categories, in which this range was not great, were eliminated.

The following categories were used:

- I. Superordination. (table-furniture; man-male)
- II. Coordination. (table-chair (s); window-door)
- III. Contrast. (dark-light; sickness-health)
- IV. Similarity. (black-dark; chair-seat)
- V. Whole-part. (table-leg; hand-finger)
- VI. Contiguity. (needle-thread; girl-dress)
- VII. Verbs. (slow-walk; boy-play)
- VIII. Participles. (scissors-cutting; eating-drinking)
- IX. Adjective-noun. (swift-horse; salt-meat  
-water)
- X. Noun-adjective. (sheep-white; bread-good)
- XI. Miscellaneous. (white-color; blue-color)

Under these headings the responses for Woodrow and Lowells' children and adults, and our own responses for deaf and hearing, for age groups, 11 to 13 and 14 to 17, were recorded in separate columns. The age groups 11 to 13 and 14 to 17 for the hearing and deaf children were chosen because an older and a younger group were necessary in order to make a comparison of the age trends, and to make a comparison in the difference of responses between the younger and older groups of deaf and hearing.

In this study we were not able to have 1000 actual responses but the responses of hearing and deaf were expressed in terms of 1000 actual responses, and recorded in separate columns in the categories. In order to express the responses in per mille we made the following computation: in the category superordination, out of the 90 actual responses given to the stimulus word "man" by the younger hearing children the response word "male" occurred 4 times. Therefore, to express this in terms of 1000 responses, we divided 4 by 90 and multiplied the result by 1000, which gave us 44.

Number of failures of response. (FR'S)

When checking over the number of failures of response, it was found that the number of FR's for the deaf and hearing was large. Table II shows the absolute number of FR's that occurred in the age groups of deaf and hearing children and the average number of failures of response in the age groups per child.

For instance, the 27 eleven year old hearing children failed to give a response in 62 cases to the 50 stimulus words. Therefore, the average number of FR's given per child is 2. Figure I shows the average number of failures of response to 50 stimulus words per child, by age groups. The average number of FR's per child for the hearing, including all ages, range from .575 to 4.41. For the deaf we find this range to be from 3.14 to 14.6. In the case of the deaf we find the average number of FR's to be most for the 11 year old and the least for the 17 year old. For the hearing we find the number of FR's to be rather evenly distributed through out the age groups. The number of FR's decrease sharply with deaf children as we go from the 11 year old children to the 17 year old. At the age of 15, 16, and 17 we find that the number of FR's for the hearing and deaf are nearly equal. The curve for the hearing remains almost at the same level as we go from the younger group to the older groups.

Thus, these results show first, that the deaf gave more FR's than the hearing; second, that the deaf gave the more FR's in the younger groups 11, 12 and 13 while in the older groups 14, 15, 16, and 17, the number of FR's is nearly the same as the

Table II

Number of failures of response (FR's) to each stimulus word  
for deaf and hearing children by age groups

	<u>Hearing</u>						
	11	12	13	14	15	16	17
Act. No. of failures of response.	62	19	50	128	119	58	70
Ave. No. of failures of response per child.	2.3	.575	1.6	3.05	4.4	2.6	2.9

	<u>Deaf</u>						
	11	12	13	14	15	16	17
Act. No. of failures of response.	350	164	261	191	130	120	91
Ave. No. of failures of response per child.	14.6	5.9	9.	5.8	3.8	4.	3.14



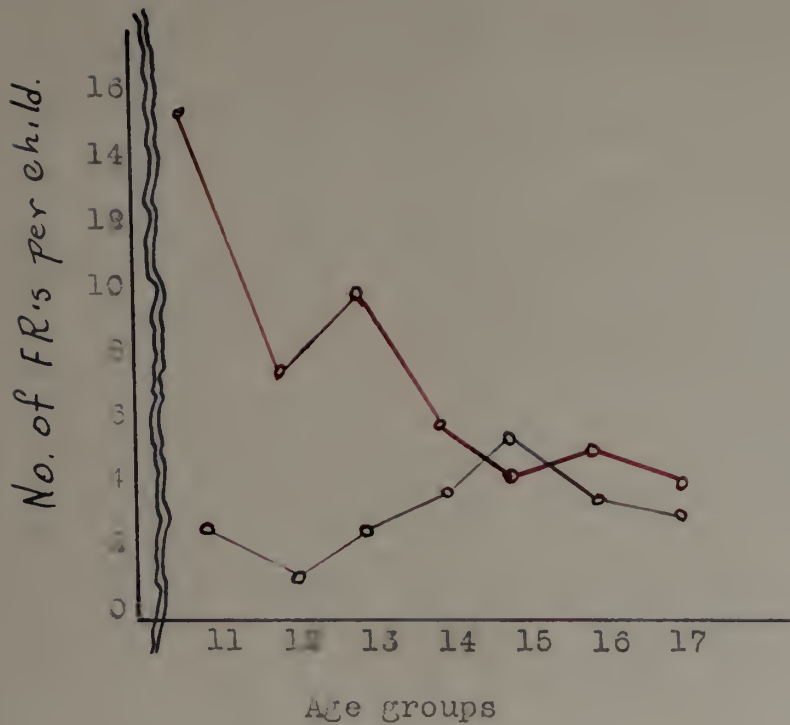


Figure 1

Average number of failures of response to 50 stimulus words per child, per age groups.

— Hearing — Deaf

number of FR's for the hearing 14 to 17; and third, that with the deaf there is a sharp decrease in the number of FR's with age.

The question is "Why did the deaf give more FR's than the hearing?" A simple interpretation of the findings which might answer this is that the deaf children as a group have a smaller stock of words on which to draw their responses. Also it may be that the time allotted for each stimulus word was not sufficient for the deaf children to think of a response word.

The frequency of the commonest (most frequent) response.

Woodrow and Lowell found that the frequency of the favorite, or most common response (4), was about the same for both groups (children and adults). We want to know if the frequency of the commonest response is the same for deaf and hearing or if there is a difference.

Table III shows a comparison of the frequencies of the commonest response for the two age groups of deaf and hearing children. The first line shows the sum of frequencies of the commonest response. The second line shows the average number of children who gave responses. The third line shows the percent of children who gave the commonest (most frequent) response. For instance, for the younger group of hearing we see that the sum of frequencies of the commonest response is 1299 which were given by the average number of the younger children (89.4) to the 50 stimulus words. Thus the average percent of the younger hearing children who gave the most frequent response was 29.1.

From this Table we see that with hearing children, the percentage of children who gave the commonest response is smaller than with deaf children. That is true for both groups.

Table III

Number of responses with the greatest frequency

	Hearing		Deaf	
	(11-13)	(14-17)	(11-13)	(14-17)
Sum of freq. of the commonest response.	1299	1419	1248	2020
Ave. No. of children who gave responses	89.4	107.5	65.5	115.4
Percent of children who gave most freq. response	29.1	26.4	38.	35.

The most important difference which Woodrow and Lowell found between the responses of children and adults were in regard to the number of responses belonging to the different categories of response. Our next task will be to find out whether there are differences between deaf and hearing children in this respect, and how our results compare with the results obtained by Woodrow and Lowell.

Table IV, V, and VI summarizes the data which are relevant for this comparison. Table IV gives the data for the deaf, Table V for the hearing children obtained from this study, and Table VI gives the data obtained by Woodrow and Lowell for children and Kent and Rosanoff for adults.

The first column of Table IV shows the number of stimulus words to which response words of the type in question occurred; the second column shows the number of different response words belonging to the category. For instance, we see that the number of response words belonging to this category is equal to or greater than the corresponding number of stimulus words of the same category. For example in superordination to the 17 stimulus words, there are 23 response words. This difference occurs in some categories because to one stimulus word there might be one, two, three, or more responses depending on the stimulus word and the particular category in which it belongs. In the category superordination for example, to the stimulus word "house" there were 3 response words (building, dwelling, and home). The next two columns show the absolute number of response words which were given by the younger and older groups of deaf children.



For instance, in superordination to the 50 stimulus words used in this test, 17 were in relation to superordination and to these 17 stimulus words there were 23 response words. The total frequency of the 23 response words given by the younger deaf children was 120 and by the older deaf was 228. In the next two columns, 5 and 6, we find the percent of children who gave responses to the stimulus words belonging to category. The percent of children who gave responses is not the percent of the whole group of deaf children but the number of children in the younger or older group. For instance, in order to find the percent of the younger group of children who made responses to category superordination, we made the following computation: we multiplied the stimulus words times number of children in this group, who gave the actual number of responses. This product gives us the total number of response words which were given to these 17 stimulus words that occurred in superordination (for younger deaf children this was 1105). 120 responses of the whole of the 1105 responses belong to the category superordination. Therefore the average percent of children who gave these responses was 10.8. In the same way the percent for the older and whole groups was computed. The last column shows the percent of all the children who gave responses to the stimulus words belonging to category.



Table IV

Summary of data on association types for deaf arranged according to different response categories

	No. stim. words	No. resp. words	Resp. words in categories		percent		percent whole-group
			11-13	14-17	11-13	14-17	
1. Superordination	17	23	120	228	10.8	11.65	11.3
2. Coordination	31	41	353	655	16.7	18.4	17.8
3. Contrast	25	31	606	968	37.1	33.8	35.
4. Similarity	19	26	51	217	4.1	9.7	7.8
5. Whole-part	9	10	83	162	14.2	15.5	15.
6. Contiguity	20	32	146	227	11.2	9.7	10.4
7. Verbs	28	35	192	248	11.2	7.6	8.5
8. Participles	5	5	6	24	1.8	4.2	3.3
9. Adjective-noun	16	47	106	213	10.4	11.6	11.
10. Noun-adjective	13	19	37	40	4.4	2.7	3.3
11. Miscellaneous	11	15	72	126	10.1	9.7	9.9

Table V

Summary of data on association types for hearing arranged according to different response categories

	Hearing		Percent		Percent whole group
	Responses in categories 11-13	Responses in categories 14-17	11-13	14-17	
1. Superordination	200	293	13.2	16.1	14.7
2. Coordination	236	199	8.5	6.	7.1
3. Contrast	306	280	13.7	10.5	11.9
4. Similarity	299	312	17.5	15.3	16.3
5. Whole-part	124	122	15.3	13.	13.3
6. Contiguity	373	362	20.1	16.9	18.6
7. Verbs	308	347	12.3	11.6	11.5
8. Participles	31	71	6.9	13.3	10.3
9. Adjective-noun	365	452	25.3	26.2	26.
10. Noun-adjective	80	90	6.9	6.5	6.7
11. Miscellaneous	170	170	14.8	14.5	14.5

Table VI

Summary of data on association types for Woodrow and Lowell adults and children arranged according to different response categories

	Responses		Percent	
	ch.	ad.	ch.	ad.
1. Superordination	1326	2937	7.8	17.3
2. Coordination	2104	3684	6.5	11.8
3. Contrast	881	7642	3.5	30.5
4. Similarity	3022	2501	16.	13.1
5. Whole-part	1548	857	17.2	9.5
6. Contiguity	4285	2300	21.2	11.5
7. Verbs	6067	2584	21.	8.7
8. Participles	153	507	2.5	10.1
9. Adjective-noun	4180	2706	26.	16.9
10. Noun-adjective	1367	856	10.5	6.6
11. Miscellaneous	1800	1280	16.3	11.6

Comparison between the differences between adults and children (Woodrow and Lowell) and the differences between deaf and hearing for the different categories.

On the basis of these data we can now compare the differences in responses between the adults and children (Woodrow and Lowell) and the differences in responses between deaf and hearing. From this comparison we expect to find out if the responses of the deaf children are more like the responses of the hearing adults or if the responses are more like the responses of the hearing children.

Table VII shows a comparison in the various categories of the differences of the percent of responses and standard deviation of the differences of the percentages between (Woodrow and Lowell) adults minus children and the differences of the percent of responses between hearing minus deaf. In this table we find the differences in the percent of responses, adults minus children (W-L); the differences in which the deaf gave responses more like the adults by (W-L); and the differences in which the deaf gave responses more like the children by Woodrow and Lowell. This table also shows the  $\frac{D}{\sigma_{diff}}$  for the differences in percentages of responses in different categories. The standard deviation of the differences of the percentages in the summary tables upon which the conclusion of this study are based was determined by means of the formula  $\sigma_{diff} = \sqrt{\sigma_{p_1}^2 + \sigma_{p_2}^2}$ . The table by Edgerton and Paterson (5) was used in determining the standard deviation of percentages. The reliabilities of the differences were determined by the formula  $\frac{D}{\sigma_{diff}}$ .

Table VII

Comparison between the differences between adults and children (Woodrow and Lowell) and differences between deaf and hearing for the different categories. + Adults, - Children.

	Diff. ads-ch (W.L.)	$\frac{D(\text{ads-ch})}{0}$ diff.	Diff. (H-D) in which D are more like W-L ads.	Diff.(H-D) in which D are more like W-L ch.	$\frac{D(H-D)}{0}$ Diff.
1. Superordination	+ 9.5	+ 22.2		+ 6.8	+ 3.7
2. Coordination	+ 5.3	+ 18.8	- 20.55		- 14.9
3. Contrast	+ 27.7	+ 60.	- 46.7		- 24.5
4. Similarity	- 2.9	- 6.85	+ 19.1		+ 9.85
5. Whole-part	- 7.7	- 13.3		- 1.4	- .96
6. Contiguity	- 9.7	- 22.75	+ 16.1		+ 9.
7. Verbs	- 12.3	- 18.1	+ 4.95		+ 4.84
8. Participles	+ 7.6	+ 13.15		+ 6.	+ 6.
9. Adjective-noun	- 9.1	- 18.1	+ 29.5		+ 15.
10. Noun-adjective	- 3.9	- 9.15	+ 6.31		+ 4.72
11. Miscellaneous	- 4.7	- 9.4	+ 9.5		+ 4.35



As a result of this comparison we are surprised to see the number of differences in which the percent of responses of the deaf children are more like Woodrow and Lowells (W.L.) adults responses. In previous tests given to deaf children we found that tests pertaining to language aspects showed they were retarded, but in regard to the responses of this test we find the deaf are more like adults rather than children. In only 3 cases are the percent of deaf responses more like those of children (W-L); these differences are in superordination, participles, and whole part, and in whole-part there is only a small difference. The categories in which the percent of the deaf responses are more like Woodrow and Lowells percent of adult responses are in coordination, contrast, similarity, contiguity, verbs, adjective-noun, noun-adjective, and miscellaneous.

In all of the categories we find that the differences between the responses of Woodrow and Lowells adults minus children (ad-ch) are significant. For the differences between the responses of the hearing minus deaf (H-D), we find that the differences are significant in all of the categories except whole-part.

In the above explanation we have used the abbreviations (W-L) for Woodrow and Lowell, (ad-ch) for adults minus children, and (H-D) for hearing minus deaf. In the remaining part of this paper we shall refer to these abbreviations as having the same meaning as just mentioned.

Comparison of age trends

Next we want to know how the age groups of the hearing and deaf compare with each other as well as with the adults and children of Woodrow and Lowell.

In Table VIII are shown: the differences between the percent of responses of adults and the percent of children (W-L); the percent of responses of older hearing children minus the percent of responses of younger hearing children (Ho-Hy); the percent of responses of the older deaf children minus the percent of responses of the younger deaf children (Do-Dy); and the reliability of these differences in the different columns. The standard deviation of the differences of the percentages of differences in this Table was determined by the same method used in Table VII. In this paragraph we have used the abbreviations Ho-Hy for older hearing minus younger hearing, and Do-Dy for older deaf minus younger deaf. In the remaining part of this paper we shall refer to these abbreviations as having the same meaning as just mentioned.

First, from this Table we see that the standard deviation of the differences of Ho-Hy and Do-Dy are much smaller than the standard deviation of the differences of ad-ch (W-L) and smaller than the standard deviation of the differences H-D (from Table VII). The small differences for Ho-Hy and Do-Dy is understandable because the age differences between Ho-Hy and Do-Dy is much smaller than the age differences ad-ch (W-L). However the most important thing is that the differences H-D is bigger than the differences Ho-Hy or Do-Dy. All the differences H-D are significant except whole- part.

Then we are interested in seeing whether the results obtained by Woodrow and Lowell show the same age trends as the results of the present investigation for hearing children. Out of the 11 categories that are listed we find that 8 show the same age trend (superordination, similarity, whole-part, contiguity, verbs, participles, noun-adjective, and miscellaneous). In the remaining 3 categories (coordination, contrast, and adjective-noun) an opposite age trend is shown. The difference (Ho-Hy) for the category adjective-noun is not significant, but the results for the categories coordination and contrast are significant. The reasons for these differences or opposite trends especially in the categories coordination and contrast are not definitely known, but may be due to a change in the educational methods of teaching English. That is, the results of Woodrow and Lowell are based on the responses of children who received instructions in schools over 20 years ago and no doubt the educational methods of teaching have changed since that time. These exceptions may also be due to the different means of presenting the stimulus words to the children. Woodrow and Lowell used the oral method and for this study the written method was used. Due to the fact that no differences were found in any of the other categories we believe that the above reasons are not probable. To fully explain why these differences further analysis of the problem will be necessary.

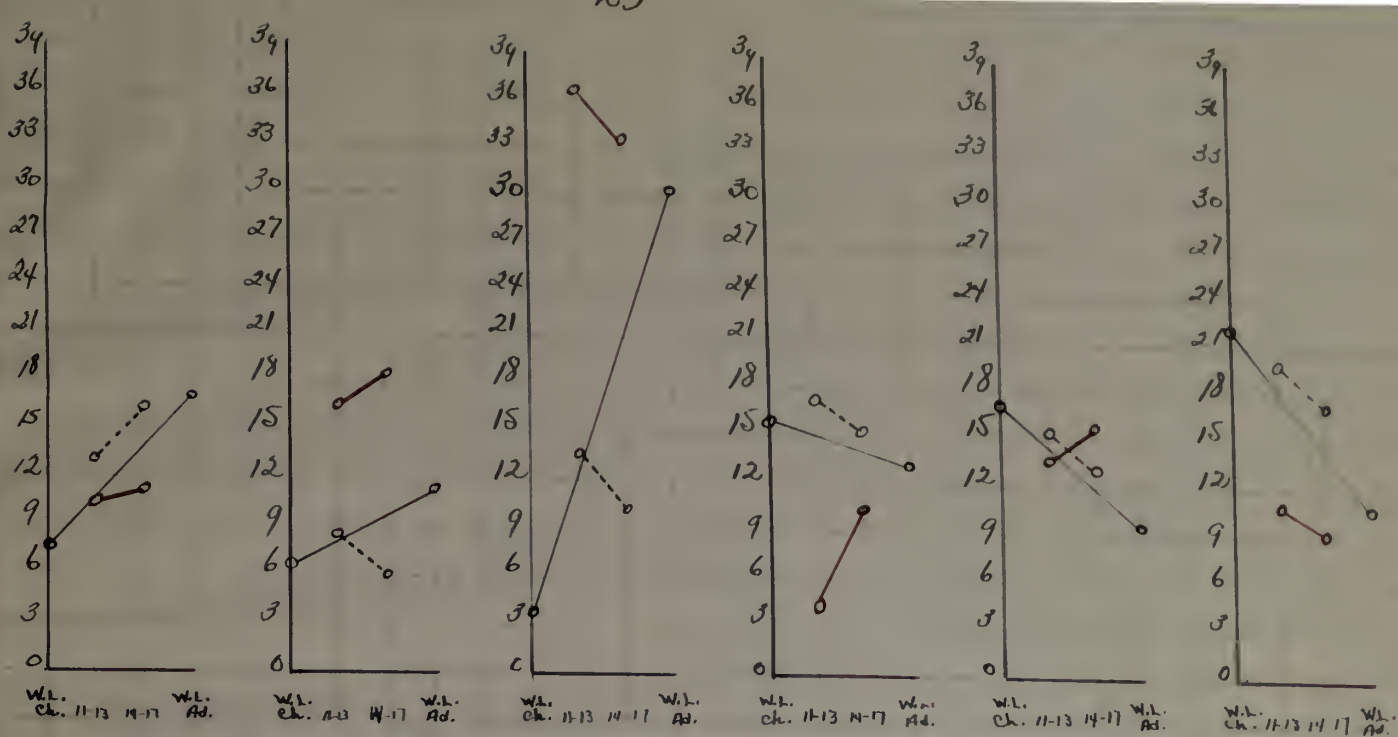
Second, we are interested in seeing how the age trends of the deaf and hearing children compare. Out of the 11 categories

Table VIII

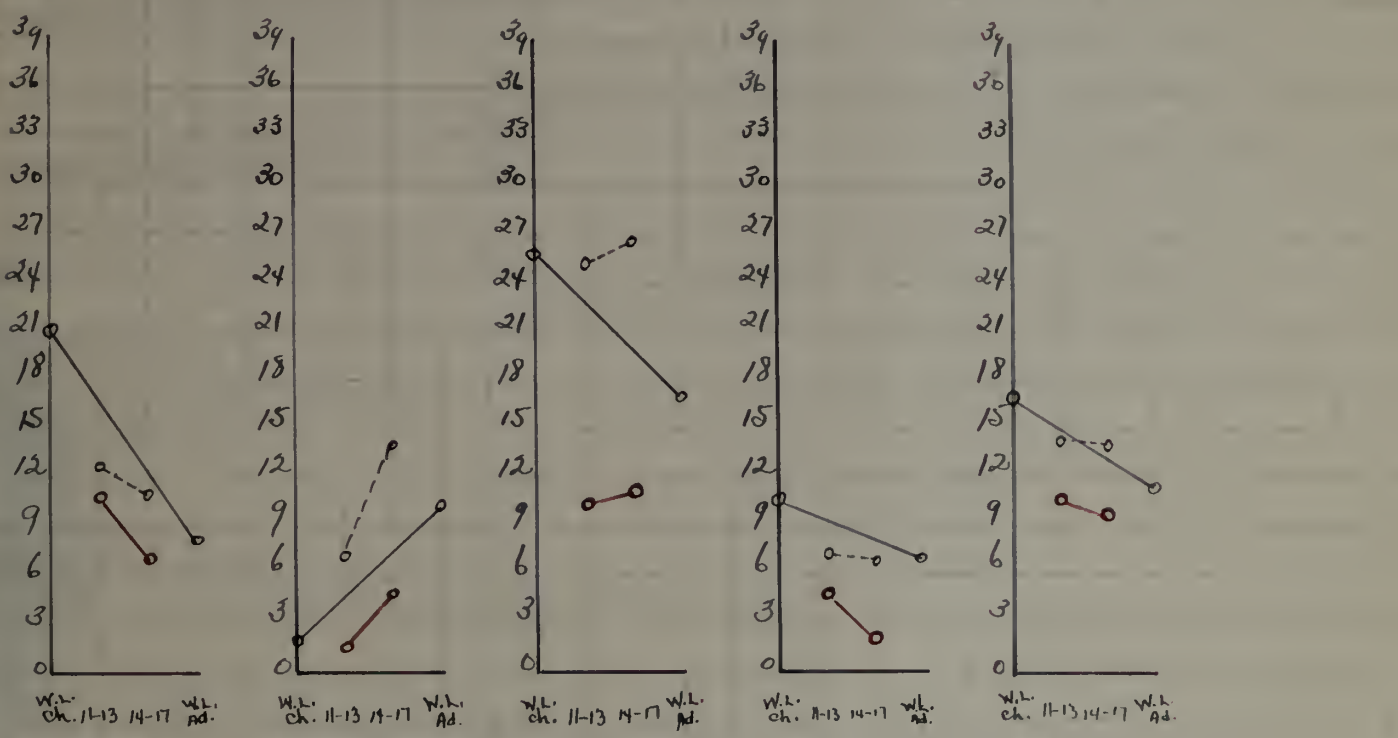
Differences older minus younger groups for Woodrow and Lowell results; hearing and deaf children (older groups+; younger-)

	Diff. ad.-ch.	$\frac{D}{\sigma \text{ diff.}}$ ad-ch	Ho-Hy	$\frac{D}{\sigma \text{ diff.}}$ Ho-Hy	Do-Dy	$\frac{D}{\sigma \text{ diff.}}$ Do-Dy
1. Superordination	+ 9.5	+ 22.2	+ 2.9	+ 2.28	+ .8	+ .85
2. Coordination	+ 5.3	+ 18.8	- 2.55	- 3.32	+ 1.7	+ .73
3. Contrast	+ 27.	+ 60.	- 3.2	- 3.2	- 3.3	- 2.42
4. Similarity	- 2.9	- 6.85	- 2.2	- 1.39	+ 5.6	+ 6.3
5. Whole-part	- 7.7	- 13.3	- 2.3	- 1.65	+ 1.3	+ .76
6. Contiguity	- 9.7	- 22.75	- 3.2	- 3.22	- 1.5	- .114
7. Verbs	- 12.3	- 18.1	- .7	- .118	- 3.45	- 3.1
8. Participles	+ 7.3	+ 13.	+ 6.35	+ 3.3	+ 2.32	+ 2.2
9. Adjective-noun	+ 9.1	- 18.1	+ .9	+ .55	+ 1.2	+ 1.1
10. Noun-adjective	+ 3.9	- 9.15	- .45	- .71	- 1.72	- 2.05
11. Miscellaneous	+ 4.7	- 9.4	- .3	- .31	- .4	- .127





Superordination Coordination Contrast Similarity Whole-part Contiguity



Verbs Participles Adjective-noun Noun-adject. Miscellaneous.

Figure 2.

Percent of children responses belonging to different categories by age groups.

Woodrow and Lowell \_\_\_\_\_ Hearing \_\_\_\_\_ Deaf \_\_\_\_\_



that are listed we find that 8 show the same trend (superordination, contrast, contiguity, verbs, participles, adjective-noun, noun-adjective and miscellaneous). In three categories we find that the trends disagree (coordination, similarity and whole-part). From this we see that on the whole the hearing and deaf children have the same age-trend.

In Figure 2 we have a graphic presentation of the above results. These graphs show the percent of children who gave responses belonging to the different categories by age groups. On the first ordinate the results for the children in Woodrow and Lowells investigation are recorded, because they are the youngest of the groups which are considered; on the second ordinate the results of the younger groups of deaf and hearing children are recorded; on the third ordinate we have the results of the older groups of the hearing and deaf; and on the fourth the results for adults in Woodrow and Lowells investigation are recorded, and they are last because they are the oldest of the groups which are considered.

Figure 2 shows a survey of the results that have been previously discussed. The graphs show better the differences hearing minus deaf are greater than the differences older hearing minus younger hearing and older deaf minus younger deaf. Also the graphs show the different age trends and how they compare in their particular category.

Summary of results.

Briefly summarized the most important conclusions which have been reached in this investigation are as follows:

1. The responses of deaf children to free association test are different from the responses of hearing children of the same age.
2. The deaf children showed more failures of response than the hearing children.
3. The deaf have a larger percentage of the commonest (most frequent) response than did the hearing.
4. If we classify the responses according to the categories used by Woodrow and Lowell, we find that the differences in number of responses between the hearing and the deaf are all significant except in the category whole-part. We also found that these differences were much larger than the differences between older and younger deaf children and older and younger hearing children.
5. A comparison between the results of this study and the results of the investigation of Woodrow and Lowell shows that in only 3 categories are the responses of the deaf children more like those of children in Woodrow and Lowell's investigation; these differences are in superordination, whole-part, and participles. The categories in which the responses of the deaf are more like Kent and Rosanoff's adult responses are in coordination, contrast, similarity, contiguity, verbs, adjective-noun, noun-adjective, and miscellaneous.

6. Comparing the age trends for Woodrow and Lowell's results with results of the present investigation for hearing children, we found, on the whole, that the age trends agree. Out of the 11 categories listed we find that 8 show the same trend (superordination, similarity, whole-part, contiguity, verbs, participles, noun-adjective, and miscellaneous) and the remaining 3 show an opposite trend (coordination, contrast, and adjective-noun).

In comparing the age trend of the hearing and deaf we found again that on the whole they agree. Out of the 11 categories, we find that 8 show the same trend (superordination, contrast, contiguity, verbs, participles, adjective-noun, noun-adjective, and miscellaneous). The disagreements were in coordination, similarity, and whole-part.

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