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Margaret Morse Nice

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AMBIDEXTERITY AND DELAYED SPEECH DEVELOPMENT

By MARGARET MORSE NICE, Norman, Oklahoma.

The present paper is a study of a number of cases of delayed speech with special reference to the "handedness" of the children. It has often been observed that interference with congenital left-handedness has caused disturbances in speech, although this does not always happen; the literature on this subject will be reviewed briefly.

Whipple ('11) reports three such cases and in a personal letter speaks of "ten or twelve more." Jones ('15) says, "The fact that I have found a larger number of feeble-minded individuals and stutterers among the 419 transfers of my study easily causes me to fear any transfer from one arm to the other." Smith ('17) found a high percentage of left-handedness in a school for stammerers. Scripture ('17) and her co-workers in the treatment of speech defects report: "Among the left-handed patients who had come to us for training we found a number whose speech defect appeared at about the same time that they were forced to change to the dextral hand. We were able to find some twenty cases which seem to us clearly indicative of the interaction of these two motor coördinations." Bolk and Lueddekins ('00) as reviewed by Scripture, "found an anomaly of speech in 24 per cent of the left-handed children of normal mental qualities, in those of mediocre, 35 per cent and in those of lower mental qualities, 44 per cent." Ballard ('12) examined 431 left-handed school children and gives convincing figures. He found that: "The proportion of stammerers among normal children is probably not higher than 2 per cent; but among dextro-sinistral (left-handed yet forced to write with the right hand) children of school age the percentage is 17. One in every six stammers, and, if the past school career is taken into account, one in every four." "It is highly significant that among those cases where no serious attempts had been made to change the skillful hand, not a single instance of stammering appeared." Stier ('11) found the percentage of stutterers among the German soldiers in general is at the highest 0.5 per cent, but among the left-handed soldiers from

6.6 to 8.5 per cent, ten times as much. Of 33 left-handed children, 17 stuttered, stammered or lisped.

Prof. C. W. Shannon of Norman, Okla., tells of a very left-handed boy, 12 or 14 years old, whose family and teachers had tried to make him use his right hand. He talked very fast and stammered to some extent when excited.

The following analysis of a case of speech difficulties in connection with left-handedness has been given me by Mrs. Miriam Oatman-Blachly of Norman, Okla. F. comes from a long line of physicians, ministers, missionaries, lawyers and college professors, his father and mother having been first cousins. He is the second of eight brothers. He was brought up in Colorado where school facilities were poor and many of his associates were illiterate, yet those who formed his home circle were all persons of culture. His grandmother and father possessed a considerable talent for making rhymes and jingles, a gift shared by F. The grandmother instructed the children in mathematics and theology, their uncle spent hours in reciting to his nephews the great events in English history, clothed in the most impressive language, while their mother read aloud to the boys a great deal, reading Shakespeare's plays to them before they were of school age. "This family circle must have counteracted to a large extent the tendency to uncouth methods of speech which the rural schools would give. Probably the *opposition* between two speech standards, that of the home and that of the community, ought to be considered in the case under discussion."

F's schooling came to a sudden end when he was 14 years old; for ten years he farmed and raised cattle, yet during this time he read many standard works of English literature and memorized a considerable amount of poetry while riding after cattle. He was finally able to continue his education, completing his preparatory and college work in six years; he received his Ph.D. degree, spent two years in research and since then has been professor of government in a university. "It is evidently not lack of educational facilities that can wholly account for his speech difficulties, though the hiatus during adolescence may have had some effect. However, are not speech habits formed principally in early childhood?"

His father was naturally left-handed, but had learned the use of his right hand. F's fifth brother, now dead, was also left-handed, but was made to use the right hand. He was the slowest of all eight boys in learning to speak, not talking much till he was three or four. He also had great difficulty in writing and spelling.

F. was left-handed, but prevented from using it at a very

early age by his father, and also at school was made to use his right hand for writing. He, his father and brother were almost ambidextrous in many kinds of manual work. He began to talk at 14 months, which was later than his brothers except the other left-handed one; the oldest beginning at 9 months. His mother reports that "he was always a very silent child."

F's difficulties in regard to speech are as follows:

"1. F. finds it almost impossible to remember the pronunciation of words, even though he may have been told repeatedly how to pronounce them, or may have looked them up in the dictionary several times. He explains this by saying that his sight is defective, and also that he reads by noticing ideas, not word forms. This is true, but why can he not fix the word form in memory when he *does* notice it, as in using the dictionary?

2. Of a piece with this difficulty is his trouble in acquiring a foreign language. He can read German fairly well, but his pronunciation is hopeless; and however many times he may have been told the pronunciation of a French phrase, he seems absolutely unable to remember it.

3. In memorizing the vocabulary of a foreign language he has great difficulty. Of course he learned them late—after he was 24.

4. Spelling in any language is his *bête noir*. It ought to be remarked that large and technical words which he has acquired late in life are easier for him to spell than those words acquired in childhood.

5. His writing is almost illegible. Examination of the writing of several members of his family shows that they all write legible hands. He prefers to use the typewriter whenever possible, partly because writing with the pen bores him, partly because he says that typing forms an excuse for misspelled words. His writing varies a great deal and is not reduced to standard forms, but he makes the same letter in several different ways.

6. In reading aloud he often stumbles over very familiar words.

7. In lecturing or talking he often has the greatest difficulty in finding the words that he wishes to use, and hesitates noticeably until he recalls them.

8. His memory for ideas, and for details of many kinds, is remarkably good, while his memory for words is very poor. He knows a great deal of poetry and a quantity of scripture, but he seldom quotes anything with precision."

DELAY OF SPEECH IN CONNECTION WITH HANDEDNESS

Before we can discuss the subject of delayed speech development we should establish, if possible, some standard of normal speech development.

NORMAL SPEECH DEVELOPMENT

The First Word

Bateman ('17) has reviewed the literature on this subject and gives us exactly the data we need. Of eighteen English speaking children, one began to talk at 8 months, two at 9, five at 10, one at 10½, three at 11, three at 12, one at 13 and two at 14. "Of the 35 children, 15 or 42.85 per cent are in the 10-11 group, while 26 or 74.28 per cent have begun articulate speech by the end of the first year." "From the above it would appear that a child of good heredity and environment who has not begun talking at 15 months of age is more or less retarded in this respect, and a like failure at 18 months should instigate an examination for probable cause."

Normal Speech Development at Two Years

Twenty-five vocabularies of two-year-old English speaking children appear to have been published, 18 of girls and 7 of boys. The girls, except for a single example of one very small vocabulary of 36 words (Tracy, '95), range from 263 to 1,227 words, their average being 556. The boys range from 115 to 771 words, their average being 384. The average of all 25 is 508. Since many of these vocabularies are probably unusually large, a safe estimate would seem to be that the normal child of two years has a vocabulary of 200 words or more.

Moreover, the average child of this age is putting words together in sentences. In studies of children's vocabularies the date of the first sentence is given at 14, 15, 16, 17, 17, 19 and 19 months. The only one who is reported as beginning later than two years is Mateer's brother ('08), who was undeniably retarded in talking: "he was three years old before he began to make any connected sentences in speaking." Holt ('10) voices the consensus of experience when he says, "At the end of the second year the average child is able to put words together in short sentences."

Normal Speech Development at Three Years

The 11 published vocabularies of three-year-old children range from 681 to 1,807 words, their average being 1,338. Six hundred words for the vocabulary of the normal three-

year-old would seem a conservative estimate. The speech of the ordinary three-year-old child approximates that of the adult, i. e., verbs are inflected, conjunctions, articles, pronouns and the verb "to be" are all used.

To sum up then, our standard for normal speech development is: the first word by 15 months; at two years, a vocabulary of at least 200 words, and sentences used; at three years, a vocabulary of at least 600 words, and the parts of speech all represented.

DELAYED SPEECH OF LEFT-HANDED CHILDREN IN CONNECTION WITH COMPULSORY RIGHT-HANDEDNESS

Stier ('11) found that 6 of the 33 left-handed children already mentioned—18 per cent—learned to talk late. In 1915 I published some observations on a little girl who had been prevented from using her left hand till she was two, but left free after that; she is still decidedly left-handed. She did not talk at all by the time she was two and at the age of three and a half her language was almost unintelligible. She improved rapidly in speech after this until at four and a half she talked nearly as well as other children of her age. Now, at the age of seven in the third grade she has a good deal of difficulty with spelling, though doing well in her other subjects.

L., a boy fourth in a family of six children, was naturally left-handed, but prevented from using it by his father at an early age. The other five children learned to talk at the conventional age, the oldest beginning at eight months. I spent a day with his mother when he was 28 months old; the only words I heard him say were "Mamma" and "Moo," but probably there were some others he could use. In answer to my questions, his mother wrote me when he was four years old: "L. was very backward about talking but began to talk all at once. He must have been nearly three years old." I saw him at four years and again at five years and four months. At both periods he stuttered when excited, and at the latter age he could not pronounce "r" nor "dh," saying "Mawy" and "dat."

Another case of delay in speech following interference with left-handedness would appear to be furnished by Major's ('06) boy. At one year old the child was clearly left-handed so the parents started in systematically to break up this preference. By the 16th month the right hand began gradually to have the place of ascendancy and by the end of the second year the child was "decidedly right-handed and has been ever since." p. 45.

His speech was markedly imperfect by the time he was three, as the following quotations will show. "The only forms of the personal pronoun which I am sure he used prior to the fourth year were 'I, itself, himself and it,' " p. 308,—a very small list. "He used 'I' a dozen times during the latter part of his third year. The 'I' seemed to take the place of 'Wa' or 'Wadu'—his name for himself—for the moment." He used no conjunctions at three. His father, evidently generalizing from the state of his son, says, "The relative pronouns are not used until long after the close of the period now under review" (the first three years), p. 308. However, of nine published vocabularies of three-year-olds, every child, except possibly one, used relative pronouns. The sample sentences given for the 35th and 36th months show clearly his retardation in speech.

"Was Wa han uh suf." (Wants to wash his hands himself.)

"Tull Wa uh sins." (Tell R. what these things are.)

"Baby tine uh git uh soap." (Baby is trying to get the soap.)

"Iss like uh tsame." (This card is like that one.)

A fourth example is furnished by N., a boy, only child of a University professor of sociology; the information was given me by his mother, a psychologist, Mrs. Anna Kranz Odum of Athens, Ga. N. has always been well and robust; he did not walk with assurance until past 18 months. He has always used his hands well.

Before he was one year old "he had seemed to use the left hand in preference to the right although the right hand was used sometimes for throwing his toys or in fitting things together." At about one year he started to suck the index finger of his left hand and in consequence had to wear a little mit. "Therefore he was forced to use the right hand from then on for exact manipulations. The mits were of thin cloth and loose enough for fine movements of the fingers." Now, at the age of four, "the finger sucking habit persists momentarily when fatigued or hungry. He is ambidextrous and uses his fork with either hand or his pencils, and throws balls with either hand."

He began to talk at eight months, using "the word 'pretty' often and with various applications—to express satisfaction—something desired and as a name for his toys." He had about six words at one year. Simultaneously with the interference with his left-handedness there appeared an arrest in his speech for the next six months; at eighteen months he had less than a dozen words in his vocabulary. His attempts

at learning to walk at the end of this period might possibly have had something to do with this "plateau," but it hardly seems possible that the influence could have lasted so long. "From 19 months on he added new words to his vocabulary rapidly. From two years on he talked much and used a variety of words and short sentences, making sentences of five and six words at two and a half years." Recently from three months before his fourth birthday to two months after, "he has shown more or less marked spells of stuttering, on occasions when he seems excited or intense over something he is trying to relate."

N's left-handedness was interfered with, but instead of his being forced into right-handedness as the two other boys mentioned, or remaining left-handed as the girl did, he is still ambidextrous at the age of four, even to the extent of drawing with both hands which seems most unusual. He began to talk early before the interference began; the six months arrest in speech occurred at the same time as the interference. His stuttering at four years may have some relation to the earlier interference with his left-handedness, or to his present ambidexterity.

AMBIDEXTERITY AND DELAY IN LEARNING TO TALK

Seven children whom I have observed in the last three years have shown retardation in their speech development and at the same time more or less marked ambidexterity.

As we have established a standard for normal speech development, let us see whether we can do this for "handedness," that is, when is right-handedness definitely established in the average child?

NORMAL "HANDEDNESS"

There do not seem to be many observations on the normal development of right-handedness in the baby. Meyer ('13) "states the fact of general left-handedness in infancy," by which term he means the first six or twelve months, but he gives no observations on which he bases his belief. Mrs. Wooley's ('10) baby was left-handed at 7 months and right-handed after 9 months. Baldwin ('95) as a result of very elaborate experiments found that his daughter was ambidextrous when 5, 6 and 7 months old, right-handed at 8 months and left-handed at 9 for a neutral stimulus within easy reaching distance; but when a colored object was substituted, or the neutral stimulus placed farther away, she was decidedly right-handed at this latter age. Dearborn's ('10) daughter

was left-handed at five months, right-handed at 10 months, ambidextrous at 12 months, and right-handed at 19 months. Major's ('06) boy was ambidextrous at 3 months, right-handed at 4 and 5 months, ambidextrous from 6 to 11, and left-handed from 12 to 15 months. His left-handedness was discouraged as before mentioned so that by 16 months he was right-handed.

Dearborn's child is the only one observed after a year old, except Major's boy, who, of course, had not a natural history.

In an attempt to gather more information on this subject, I asked all my acquaintances with babies between one and two and a half years old as to the handedness and speech development of their children. Only four of these parents had had any particular interest in noting the handedness of their children or could give me an idea of when the baby became predominantly right-handed; the others simply gave the present status of the child.

Sex	Handedness	Speech	Present age in months
Boy ¹	Right-handed at 6 months.	Average in talking.	30
Boy	Right-handed, yet uses left somewhat.	Does not yet talk.	13
Boy	Right-handed at 14 months.	Says 3 words.	16
Boy	Right-handed.	About 8 words.	15
Boy ²	Ambidextrous.	Says 2 words.	16
Boy ³	Right-handed "early".	Does not use sentences.	22
Boy	Right-handed.	Talks in long sentences.	22
Girl	Right-handed.	Says 3 words.	12
Girl	Right-handed.	About 8 words.	15
Girl	Right-handed.	About 40 words.	19
Girl	Right-handed.	Talks in long sentences.	26
Girl	Right-handed.	Talks in long sentences.	27

¹ Father a physician. Baby had been paralyzed on right side for two weeks after birth on account of pressure of instruments, so parents noted especially when he became right-handed.

² Both parents medical students, mother also a biologist.

³ Grandmother left-handed.

Only one of the twelve children is reported as ambidextrous, a boy of 16 months. Eight of these children were right-handed by the time they were 19 months old and three others may have been. We might say tentatively that if a child is not definitely right-handed by 20 months that the fact is noted by its relatives. But this is a subject on which we need much more data.

THE HANDEDNESS AND SPEECH DEVELOPMENT OF THE
CHILDREN OBSERVED*Cases I and II*

D. is our second daughter and R. our third. Their father was a precocious talker; according to his mother he "could say everything at a year old, make sentences and tell a story. He talked earlier than any other child I ever heard of; he was a wonder to the neighborhood." Their mother appears to have been an average child in learning to talk, saying her first word, "Addie," at 13 months. All of her brothers and sisters began to speak at about this same age, except the oldest brother who "said very little even after he was two."

Their elder sister, E., exhibited a normal history of speech development, (Nice, '15 and '17) beginning to talk at 14 months, having a vocabulary of 133 words at 18 months and using sentences at 19 months. Her vocabulary at 3 years included 1,139 words; at 4 years, 1,765; at 5 years, 2,502, and at 6 years, 3,075 words. She crept at 8 months and walked at 13. She developed a consistent right-handedness early. She has been less skillful in the use of her hands than her sisters; in cutting, sewing, dressing herself and drawing, D. has done better than E. at the same ages.

Case I

D. has always had a splendid health and a fine physique, all her life being taller and heavier than the measurements of average children in Holt. She crept at 10 months and walked at 15; the reason for her being later than E. was probably because she was heavier.

D. was ambidextrous to some extent till after she was two years of age; at 25 months I noted, "When she draws on the blackboard or on a paper she is as apt to use her left hand as her right." She outgrew this ambidextrous tendency rapidly; in a month or two coming to use her right hand exclusively when using the chalk or crayon.

D. did not begin to talk till she was 20 months old. She learned 3 words that month, added 13 during her 21st month, 16 the next and 13 the next so that she was using 44 words by her 2nd birthday. This is one-thirteenth as large as the average of the published vocabularies for this age. I recorded her all day's conversation when she was 2 years and 2 days old. She said 7 different words and a total of 18. When we compare this with Gale's boy ('00) who used 5,194 words in one day at this age, and his friend's son who used 10,507 words, D. appears considerably retarded!

She learned rapidly after this, adding 24 words the next month. I recorded her all day's conversation again at 25 months and 12 days; at that time she said 28 different words and 152 in all. By 26 months she had attained 145 words and had begun to connect them in sentences. At 30 months she had a vocabulary of 538 words. Five vocabularies of children of this age have been published; two boys had 480 and 1,432 words while three girls had 769, 1,111 and 1,509 words, the average being 1,060, twice as much as D.

At three, D's vocabulary had grown to 856 words. This is larger than two other girls who started to talk at 10 and 10½ months, yet by three years had attained 681 and 736 words respectively. The average of 11 vocabularies (this includes D's) is 1,338. At 35 months we recorded D's whole day conversation; she used 2,018 sentences or 7,600 words, the average number of words in a sentence being 3.77. Her sentences were short; E. and Brandenburg's ('15) daughter at the same age used sentences of 6 and 7 words on an average. When we examine D's sentences we find omissions in many of them. "I write bine (fine) letter. Want to write more letter. No, dit (this) one my cow." Yet, "is," "a," and "I" were not uniformly omitted. From the character of her speech and the shortness of her sentences, I would consider her still somewhat retarded at three, although her vocabulary contained more than 600 words, and she used all the parts of speech.

At four, her vocabulary contained 1,506 words, the average of 7 published vocabularies being 1,843. By this time her speech development was certainly normal.

At five, by the Binet test, she had an understood vocabulary of 3,600 words, the 8 year level.

Case II

R, our youngest daughter.

She has not been so uniformly well as our two older children. From the age of 8 months to 11 she had some digestive troubles, part of the time being under-nourished. But since then she has been perfectly well most of the time. She crept at one year and walked at 16 months.

In giving an account of the use of her hands, I will give only those records that appear to be of most significance. The two main points on which I watched her were her use of her hands in eating and with the pencil.

I will first give an account of her handedness in eating.

At 12 months, I noted: "She seems to be left-handed. She often holds her toast in her left hand and although I change it to the right, she usually changes back to her left."

For the next three months she appeared to be ambidextrous. No effort was made to encourage right-handedness till after she was 16 months old.

At 16 months I tested her three days in succession with cornflakes placed in the middle of her tray. She used her right hand 30 times and her left 22; so that her right was used 57.5 per cent of the time and her left 42.5. After this we took pains to put her cornflakes on the right side of the tray.

At 19 months at one meal when eating cornflakes she used her right hand 7 times and her left 6.

At 21 months when eating cornflakes with her bare hand she used her right hand 18 times and her left 24. She was given a spoon and used it entirely in her right hand. From now on she used her left hand often at her meals, but always changed to her right when it was suggested to her.

At 27 months. I kept track of the use of her hands at meals for the first 12 days after she was 27 months old. During this test period she was never reminded about changing to her right hand but she occasionally did it of her own accord, patting her right hand in approbation.

- 21 meals were eaten wholly with the right hand.
- 1 meal was eaten wholly with the left hand.
- 8 meals were eaten half with the right and half with the left.
- 4 meals were eaten mostly with the right.
- 2 meals were eaten mostly with the left.

The proportions may be represented as follows:

Use of Right Hand	Use of Left Hand
21	1
8	8
8	4
2	4
<hr/>	<hr/>
39	17

Therefore she used her right hand 69.6 per cent of the time and her left 30.4 per cent.

I made another series of observations beginning 3 days before she was 28 months old and lasting 7 days. Sixteen days had elapsed between the two series during which time we encouraged the use of her right hand.

- 18 meals were eaten wholly with the right hand.
- 3 meals were eaten half with the right and half with the left.
- 1 meal was eaten mostly with the right.

The proportions are as follows:

Use of Right Hand	Use of Left Hand
18	0
3	3
2	1
<hr/>	<hr/>
23	4

She used her right hand 85 per cent of the time and her left 15.

The use of her hands in these three tests may be summarized as follows:

Age	Use of Right Hand	Use of Left Hand
16 months	57.5 per cent	42.5 per cent
27 months	69.6 per cent	30.4 per cent
28 months	85 per cent	15 per cent

During her 27th month the preponderance of her right hand became so marked that by 28 months her ambidextrous tendency had almost disappeared.

Now as to the use of the pencil.

At 16 months she took a pencil with her right hand, changed to her left and made marks with it.

At 17 months she crayoned on paper and wrote once with her right hand and twice with her left.

At 25 months I gave her chalk in her right hand, she transferred it to her left and marked on the board with the left. The next piece she took in her right hand and marked with the right. With the third piece she began to mark with her left hand but changed to her right. The next was used with the left hand, but the last three were with the right. She marked five times with her right hand and three with her left.

When 26 months and 2 days old, she crayoned a little with her left hand but mostly with her right. Three days later she started to scribble with her left hand but quickly changed to her right.

When 27 months old she used her right hand exclusively for drawing.

In summing up this phase of her development, we find that at 16 and 17 months she used the pencil in either hand indiscriminately; at 24 months she was in the experimental stage but showing a slight preference for the right hand; at 26 months this preference had increased, but she was still experimenting to some extent. By 27 months she had definitely discovered that the right hand was the hand to draw with. In the use of the pencil she was left absolutely free to work out her own experiments and was not helped by direct training as in the use of her spoon and fork.

R's speech development has been unusually slow. She began to talk at 16 months, saying 2 words that month, but these 2 words sufficed her for 5 months. Her vocabularies of total words for each month follow: 16 months, 2 words; 23 months, 4 words; 24 months, 5 words; 25 months, 8 words; 26 months, 12 words; 27 months, 15, and 28 months, 25 words. Her vocabulary of 5 words at 2 years is one-hundredth the size of the average of the published vocabularies. I recorded her whole day's conversation at 2 years and one week; she said 3 different words and 53 in all. Her 25 words at 28 months should be compared with the published vocabularies of this age (Bateman,'16); there are six of these for English speaking children; they range from 308 to 677 words, the average being 469, 19 times as large as R's.

By 27 months R. had become entirely right-handed in her use of the pencil and by 28 months she was almost entirely right-handed in her use of the spoon. During her 27th month she made much more progress in talking than in any of the preceding months, her vocabulary increasing 66 per cent.

Although R. is so loath to speak, she constantly surprises us by the amount she understands. She makes us understand her too, by shouts, grunts, exclamations, squeals, gestures and by taking hold of us and leading us to the desired place. Pretending not to understand her, nor really failing to guess her meaning seem to be no encouragement to her to express herself more fully by the conventional method.

Case III

C. is a cousin of D. and R., her father being brother of their mother. Her father "was very slow in learning to talk, and said very little even even after he was two." She has two older brothers who were perfectly normal in their speech and handedness, the oldest being rather precocious in his use of language. She had a severe illness—pneumonia and ear trouble—from the age of 7 to 9 months, but since then has been exceptionally well and sturdy, a very large child for her age.

At 28 months, at which time I saw much of her, she was markedly ambidextrous; she would eat with her right hand for a while and then with her left. She seemed to use her two hands perfectly interchangeably.

Her vocabularies at 2 years, 28 months and 30 months were collected by her mother, Mrs. Ruth Tucker Morse of Princeton, N. J.

2 years:

Nouns: 8. Baa, ball, brother, bow-wow, Daddie, Mamma, moo, quack.

Adverbs: 3. Downstairs, more, no.

Interjections: 2. By-by, hullo.

Total—13 words. Adding one proper noun makes 14.

28 months: All of 2 year vocabulary repeated except "baa" and "quack."

Nouns: 18, 6 old and 12 new. Animal cracker, auto, baby, bath, bread, brush, butter, choo-choo, girl, milk, potato, water.

Verbs: 2. See, come on.

Pronoun: 1. Me.

Adjectives: 3. Dirty, good, poor.

Adverbs: 8, 3 old and 5 new. All gone, outdoors, please, there, yes.

Interjections: 3, 2 old and 1 new. Oh.

Total—35 words. Adding 4 proper nouns makes 39.

30 months: All of preceding vocabularies repeated.

Nouns: 69, 20 old and 49 new. Apple, bag, beads, bed, bib, bird, block, boat, boy, box, clock, cloth, color-book, cocoa, cup, door, dress, egg, fish, geese, hands, hat, hay, hole, horse, ink, juice, key, man, meat, moon, paper, peach, pear, picture, piece, pin, pudding, rooster, rubber boots, rubbers, sheet, shoe, slip-pers, spoon, stone, teeth, toast, zwieback.

Verbs: 19, 2 old and 17 new. Beat, broke, cry, don't, dress, excuse, get, go, look, open, undress, pull, shut, tore, walk, want, wash.

Pronouns: 4, 1 old and 3 new. I, mine, my.

Adjectives: 11, 3 old and 8 new. All, back, bad, bare, blue, the, new, two.

Adverbs: 10, 8 old and 2 new. Here, out.

Interjections: 4, 3 old and 1 new. Good-night.

No conjunctions and no preposition.

Total—117 words. Adding 5 proper nouns makes 122.

Her vocabulary of 13 words at 2 years is one thirty-fifth as large as the average of the published vocabularies of that age. Her vocabulary of 35 words at 28 months is one-twelfth as large as the average of the published vocabularies for that age. At this time she began to put words together: "Poor Barbar." "See—there dirty."

Her vocabulary at 30 months—117 words, although it shows rapid improvement over the preceding, is only one-eighth as large as the average of the 5 published vocabularies of this age, 1,060. Sample sentences at this time were: "Cho-choo

go over the wawa (water)." "Com'on, Mamma, or (I) want bark (Zwieback)."

When she was 33 months old, her mother wrote: "C. still uses her left hand sometimes, but ordinarily uses her right. Her vocabulary has increased tremendously. She is such a chatterbox now that she has really found a use for her tongue."

I saw the child for a few days when she was 3 years and 4 months old. She was decidedly right-handed and a great talker. She mixed her pronouns, preferring to call her girl cousins "he." She did not seem to have quite recovered lost time, most children of her age talking more distinctly and more correctly than she.

Case IV

G. is also a cousin of D. and R. but on the father's side, her father is brother to their father. She is the first child in the family. Her father stutters to some extent.

I saw her for one day when she was 2 years old. At that time she appeared to use both hands interchangeably. This was confirmed by her aunt, a College student, who took much care of her, and whom I asked to observe her.

Although I listened carefully, I did not hear her say a single word. Her aunt reported her two year vocabulary as consisting of 7 words: Baby, Mamma, Papa, see, here, now, by-by. This is one-seventieth as large as the average of the published vocabularies.

I saw her again for a day when she was three and noticed that she still used her left hand equally with her right. Her father, when asked whether G. was left-handed, said, "She uses one as handily as the other," and then bade her eat with her other hand and she obediently changed from her right to her left. There has been no attempt to encourage right-handedness in her case.

She is a quiet, rather shy child, and talked less than usual with strangers about. All I heard her say were single words: "Eggy," "broke," "bile (auto)," "baby," "don't," "Poppy." Her relatives said she did put some words together, but all they could think of were "Grea' big bile," "Grandpa's baby" and "big blue hen."

G. apparently talks less than an average 2 year old child. She is the oldest child I have personally observed who uses one hand as much as the other.

Her sister, 18 months younger than G. uses her right hand more than her left. She talked nearly as much as G. when I saw the two children. Two months later their aunt wrote that she "talks better than G."

Case V

M. came under my observation when 3 years old as a playmate of my own children. She is the daughter of a physician, having one brother 7 years older. She was delicate as a baby, as was her brother.

Her mother said she had been slow in learning to use her right hand; she would take her spoon in her left hand and her mother would have to change it. Yet if she spoke about it, M. would be apt to persist in her wayward ways.

She talked late; her mother was in despair lest she never would talk. She hardly talked at all at 2, and did not form sentences till she was $2\frac{1}{2}$, whereas the brother talked in sentences at 18 months. At 3 years and 3 months it was impossible for a stranger to understand her when she said more than a few words. She left out "is" and many of her consonants.

Case VI

U. is a girl, only child of a farmer. I became acquainted with her and her mother on the interurban when she was 20 months old. She was a large, healthy looking youngster who had walked "at 14 months all at once." Noticing a scar on her left thumb I asked the cause of it, and how she used her hands. She had fed the cat and been bitten. She used her left hand "right smart," always for throwing, so that her father was bothered. However her mother said she used her right hand more. There was no left-handedness in the family.

She talked very little according to her mother, saying "Daddy," "myow," "ch" for horse, "all right," and "Where is it?" All others of the family connections have been in the habit of talking long sentences by the time they are two years old.

Case VII

W. is a boy, only child of a college professor of biology. I saw him often from the age of 10 months to 18, but practically all the data has been supplied by his mother, a writer, Mrs. Marjorie Hill Allee, of Lake Forest, Ill. W. has always been a sturdy child and large for his age. He walked at 14 months.

He was ambidextrous till he reached the age of two and a half. "He was not any more left-handed than right-handed, my impression is that he always favored the right hand a little," wrote his mother. "I used to take some pains to put his spoon on the right hand side of his tray, but I don't need to do that any more (at 3 years). At 2 he was still uncertain which hand to use. At 3 he much prefers his right to his left, but is not particularly clever with either, though quite strong."

As to his speech history, "at 18 months he had a rather indefinite 'see' and at 20 months he added a very plain 'cow.' He seemed to understand our talk to him well enough for all practical purposes." At 2 he said only a few words.

His mother started to collect his vocabulary at 3, but sent it on still incomplete. She did not include proper nouns, nor animal noises, "nor colors, nor numbers, of which he is still rather uncertain, though in a general way he understands their meaning. Outside of these I should say that there were perhaps 50 more words I have not caught and that the majority of them were nouns." As it stands it contains only 271 words; adding 50 makes it 320. Of course this is approximate, yet it is significant on account of its very small size. The smallest 3 year old vocabulary published contains 681 words, the largest 1,807 and the average of the eleven published is 1,338—four times as large as W's.

His pronunciation was imperfect, final letters often being left off. "His supply of verbs is very short and irregular; of these he can use the third singular present and the 'ing' form in every case. Usually he leaves out the verb if possible." Of personal pronouns he used "me, mine, my, you and thee." "My" was often used as the nominative. He did not use "I, we, him, her" or "they," substituting the name. He used "me" occasionally but confused it with "my" or "mine." He did not use "a" or "the."

"He isn't at all certain about colors and while he knows a few colors he cannot be relied upon to tell even black from white. Red seems to be a pretty certain quantity."

Sample sentences at this time were:

"One time was old man. Climbed up tree."

"Time go bed for mine. Going kiss—you me?"

"My going sit here."

The handedness and speech development of these seven children is summarized in the accompanying table.

TABLE OF SPEECH DEVELOPMENT OF SEVEN CHILDREN

Child	Handedness	Time of first word	Speech development at 2 years	At 30 months	At 3 years
Standard	Right-handed at 20 months	15 months	200 words; sentences used	.....	600 words; all parts of speech
D. Girl	Somewhat ambidextrous at 2	20 months	44	538	856
R. Girl	Ambidextrous till 26 months	16 months	5	.....	.....
C. Girl	Decidedly ambidextrous till 30 months	.....	13	117	Nearly normal
G. Girl	Decidedly ambidextrous at 2 and 3	.....	7	.....	Very few words
M. Girl	Ambidextrous till after 2	.....	Very few words	Began sentences	.....
U. Girl	Ambidextrous at 20 months	Few words at 20 mos.	.....	.....	.....
W. Boy	Decidedly ambidextrous till 2½	18	Very few words	.....	320?

Let us see how the addition of these small vocabularies affects the averages of the vocabularies already published.

The 2-year-old vocabularies of R., G., C., and D. were 5, 7, 13 and 44 words respectively, the average being 17.25. The average of the 18 vocabularies of 2-year-old girls already published is 556—32 times as large; they reduce the average of 2-year-old girls to 458 words. Counting in the boys' vocabularies, the average of all 25 published vocabularies is 508—29 times as large as the average of these four children. The average of all 29 vocabularies is 440 words.

R. with 12 words and D. with 145 at 26 months reduce the average for this age from the 896 words of the 3 vocabularies already published to 569.

R. with 25 words and C. with 35 at 28 months bring the average vocabulary for this age from 469 words to 359.

The average of the published vocabularies for 30-month-old children is 1,060; D. with 538 words and C. with 117 reduce it to 851.

DISCUSSION

Can we find any explanation for these children's retardation in speech?

Bateman ('17) says: "It is difficult to believe that a child who has made no attempts at articulate speech by the eighteenth month, and still more so by the twenty-fourth, can be entirely normal in all other respects. General feebleness of health, poor powers of hearing, defects in or lack of development of the vocal organs, or adenoids may lead to disability in speech." As to health, R. suffered from under-nourishment from the age of 8 to 11 months, C. had a serious illness from the age of 7 to 9 months, and M. was a delicate baby. However all these children were well and sturdy most of their lives. D., G. and W. had exceptionally good health and U. surely looked as if she did too. M's brother was as delicate as she when a baby and yet he talked early. The matter of ill-health might be remotely involved in only 3 of the 7 cases, and it does not seem probable that it had anything to do with the retardation in speech.

None of these children have suffered from "poor powers of hearing, or defects in or lack of development of the vocal organs." As to adenoids, D. and R. had none, although their sister who talked early, has small ones; C. has had none, while her brothers who talked early, had to be operated upon for this cause. So far as I know, none of the other children of this study have had adenoids. The boy, L., had none, while a brother and sister were seriously troubled with them.

Dr. Wm. Boyd in a personal letter speaks of a child who was slow in talking and considers the matter one of phonetics for "the majority of her vowels are the back vowels oo, oh, aw, ah and the mixed vowel uh." In R's 26-month vocabulary of 12 words all the vowels were back vowels except one mixed; yet in her own spontaneous sounds and expressions she used the front vowels about one-third as often as the back vowels. Of the 14 new words learned in the next 2 months, 8 employed back vowels, 2 mixed and 4 front. D's first 14 words showed 7 back vowels, 1 mixed and 6 front. R. apparently is in accordance with Dr. Boyd's observations, while D. was not. Of the other children I cannot say, for it takes most careful noting of the exact pronunciation to report on a matter like this. However, even when this holds true, does it take us back to the underlying cause; what is the reason that the front vowels should be more difficult for one child

than for another? May it not be just another *evidence* of retardation in speech, on the same par with a small vocabulary, and not an *explanation* of the retardation?

Can general mental retardation account for the backwardness in speech of these children? With all of them their ability to understand has far outstripped their powers of expression. The parents testify that they are as intelligent as other children of their age despite their lack of loquacity. In some practical matters R. knows more than either of her sisters did at her age. D's intelligence quotient according to the Binet test was 133 at three and a half years, while her sister E's was 120.

There is one respect in which four of these children were slower in developing than their brothers and sisters, and that was in appreciating rhymes and stories. C. and M. were later than their brothers in this phase. D. has been slower than E., and R. is the slowest of all our three children. With D. and E. there has come a very definite period when they liked Mother Goose recited to them with no pictures as added attraction; if they were inclined to be restless, the verses would command their rapt attention, whereas before there was no calming effect whatever. With E. this period came at 18 months, with D. at 23 months and it has not yet arrived with R. who is 28 months old. However, at 26 months, she just began to pay attention to verses when they were read out of picture books and at present demands a good deal of reading of rhymes and the Potter stories. E. liked the "Three Bears" and "Red Riding Hood" at 22 months but D. did not care much for them till she was 35 months old. W. enjoyed these stories at 3 years.

We have no criterions for this phase of mental development except Jegi's child ('01) who outgrew Mother Goose before she was two, and she can scarcely be considered normal, so we cannot tell how these children would compare with a large number of others. It is perhaps natural that these children who were slow in learning to talk should also be slow in understanding or caring about more difficult words, yet at the same time they might be as intelligent as others in other directions. At any rate we are safe in concluding that general mental retardation does not apply in any of these cases.

Ill health, defects of hearing, malformations of the vocal organs, adenoids, phonetics and backwardness of intelligence do not seem to explain the retardation in speech of these children. The only constant phenomenon that appears to be associated in all seven cases is the more or less marked ambidextrous tendency. It is well known that there is an intimate association between the hand center and speech center

in the brain and that normally the speech center is located in the dominant side of the brain in close connection with the hand center. An attempt to change the dominant hand often disturbs the speech mechanism, causing stuttering, stammering, lisping or sometimes a delay in the appearance of speech. These seven children showed a prolonged state of uncertainty as to which hand should lead and in the meantime they did not talk. An explanation of the coincidence of retardation in speech and in the ascendancy of the right hand might be that as long as the dominant hand center was not definitely settled the speech center could not be located. Yet it is impossible to know the exact relationship of these two factors; they might both be the results of some other cause.

This coincidence of ambidexterity and delay in learning to talk does not occur in all cases. There are of course many other reasons for retardation of speech in individual children. For instance, R. at present has practically outgrown her ambidextrous tendency, yet she hardly talks at all. Others may talk early and yet be ambidextrous. Two such cases have been reported to me. One is a girl who at 27 months talked a good deal, yet she used her left hand almost as much as her right despite her parents' corrections. A month later, however, she was practically right-handed. The other is a boy now 12 years old, who was ambidextrous till after he was two; the parents made no effort to encourage right-handedness, which he developed later. He was an early and distinct talker.

We have an almost untouched field in this subject of the relationship between speech development and the use of the hands. We need a large number of studies on children and particularly on those who are more or less slow in talking and who have hitherto been almost wholly neglected by observers, before we can hope to find the underlying causes of the differences in speech development in different children.

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