

MENTAL DISEASE AND LANGUAGE

BY WM. McDONALD, JR., A.M., M.D.

(Continued from page 491)

II

THE CHILD'S VOCABULARY

The development of verbal expression in the child is of especial interest to the student of mental disease, since the laws for the acquirement of language might be expected to have some relation to its loss.

Other factors being equal, the words first learned, while the mind is in the highest degree receptive, should prove to be the most fundamental and the most permanent, both by reason of duration of existence and firmness of establishment.

Likewise, the frequency of repetition and the extent of association of words with other verbal memories and sensory images should receive careful consideration in any attempt to explain the loss of vocabulary.

For example, the word *mamma*, having been learned first of all and repeated innumerable times, might be regarded as the one word above all others likely to be retained to the last in a disease capable of gradually obliterating the mental images and processes. The same expectation might be applied to a large number of the simple substantives which play so large a part in childish prattle.

A single word expressive of motion, however, by reason of its associations may be more liable to re-arousal than any one of several substantives perhaps earlier established. Thus, the word *go* might exist as the only verb in the child's vocabulary, with perhaps a dozen or more substantives, and yet, by reason of its possible association with every one of those substantives, be the most permanently fixed and the most easily aroused. Thus many different words may be used in combination with a single verb; as

Mamma	}	gone	{	away.
Papa				out.
Light				home.
Milk				upstairs.
Baby				on the cars.

In the same way the article *the* or *a* or the adjective *good* or the adverb *soon* might well be better established than a substantive of earlier adoption.

The character and intensity of the emotional coloring accompanying the impression and first expression of a word, the degree of interest aroused and of desire seeking satisfaction, the relation of the verbal symbol to primary instinct: all these must be considered with other psychological laws in the endeavor to estimate the probable fixity and permanence of verbal images.

But however and whenever acquired there can be no doubt that a knowledge of the way in which a child learns to talk is essential to a proper understanding of a loss of language.

W. Preyer¹ has reversed this proposition and has made use of adult speech disturbance in his excellent studies in speech formation. He says, "What organic conditions are required for the imitation of sounds and for learning to speak I have endeavored to ascertain by means of a systematic collection, resting on the best pathological investigations, of all the disturbances of speech thus far observed in adults; and the daily observation of a sound child, . . . has brought me to the following important result: *That every known form of disturbance of speech in adults finds its perfect counterpart in the child that is learning to speak.*" In the present studies, while the converse of Preyer's methods has been used, it should be remembered that the analysis has been limited—so far as possible—to the expressive features of language as distinguished from speech understanding. It is of course admitted that long before the child speaks intelligently he understands spoken language to a considerable degree, and it is likewise acknowledged that, in the majority of cases, some comprehension of language persists when the ability to express has been lost. The study of language acquirement and loss is so broad that one aspect alone—the expressive function—affords sufficient opportunity for these investigations.

The First Word.—The age at which the first word may be expected to appear and the character of that word are matters of intense interest to scientists as well as to the mother and family. There are wide differences in children, and observers give varying opinions as to the average normal age at which the first word is spoken. Failure on the part of observers to distinguish between mere imitative reproduction without understanding and

the first intelligent use of a word, is partly responsible for the lack of unanimity in testimony on this point.

Tracy² says that a few words are spoken without understanding in the second six months of life, and that though a few words may be spoken understandingly—as *papa* or *mamma*—most children have no vocabulary in this period.

One child of 9 months is reported as speaking 9 words plainly though the words are not given, and another child of 12 months is said to have used 10 words with meaning.

Major³ says that before the end of the first year the child uses uniformly a small number of sounds or words to express wishes, facts and ideas.

Dr. Paul Maas⁴ gives the 12th month as the beginning period of active speech but the 15th month as the average time of appearance of intelligent verbal expression.

The babies of my own acquaintance whose mothers have assisted me in these studies, varied greatly as to the date of the first intelligent verbal expression. One used his first word when 8 months old, while his sister reached the 11th month before a word was employed with meaning. Other children scarcely spoke at all until walking had been mastered in the 20th and 21st month. The 15th month is probably correctly given as the average time for the first use of words with meaning.

While the age at which the first word appeared is, for our purposes, of minor importance, the character and significance of that word deserve closest attention.

So many writers have laid stress upon the occurrence of the first words as simple designations of objects and upon the overwhelming preponderance of nouns in the child's vocabulary, we might be led to regard the noun as the most fundamental element of speech and thus be brought to confusion when, in considering the pathological loss of speech, it is found that nouns are the first to be forgotten and lost.

Disregarding for the moment the published records of children's vocabularies, note the first intelligent spoken word of each of the six children under two years of age who enter into my own analyses.

Gone, *bye-bye*, *drop*, (*dropped*), *how-de* (*how do you do*), *hello*, *take* are the first words used respectively by each of the six.

Is it not significant that these are all words expressive of a *situation* or *motion* and not designations for objects?

What the particular word first spoken may be depends, of course, largely upon what the child hears, what it is taught, the emotional experience accompanying verbal impressions, the ease with which various sounds are made, and upon other more or less accidental factors; but it must be evident to every one who has closely observed the child beginning to talk that these first words of active speech are exclamatory desire words, expressions of emotion, of interest, of instinct and of volition, even though a certain number of them happen to designate some object to the adult mind.

Extent of the Child's Vocabulary.—The number of different words at the child's command at various ages has been estimated by many authors.

M. C. and H. Gale⁵ counted the different words used in one day by a boy and a girl each 2½ years old. It was impossible to record each word, but 751 and 629 different words in a total of 9,290 and 8,992 used by the boy and girl respectively were counted. Up to 2½ years 1,432 different words were used by the boy and 1,300 by the girl, each using therefore in one day about one-half of the total vocabulary.

A girl of 20 months used 80 different words in a day—about 96 per cent. of her total vocabulary.

These authors consider Tracy's estimated average vocabulary of a child of 2 years (257 different words) as only one-half to one-third of the correct amount.

Unless a child is under constant observation, it is impossible to form an accurate estimate of the number of words used over a prolonged period, and my own records contain but one example of a faithful attempt to record the vocabulary of a child under 2 years of age. One average girl up to her 21st month had used 162 different words: this is probably considerably under the actual number.

I have, however, accurate stenographic records of the number of different words in a total of 500, used by each of 10 children of ages varying from 26 months to 5 years and 5 months. The average number of different words was 170.2, the largest number 202 and the smallest 117.

From the second year the vocabulary increases in direct ratio

with the age, though even the oldest child has a vocabulary still far below the average adult. The average child of this period has a vocabulary of about three fourths that of the average adult.

TABLE OF DIFFERENT WORDS USED IN 500 CONSECUTIVE WORDS

Child	Age		
G. C.	4 years	5 months	202
E. S.	5 years	5 months	197
N. R.	5 years	3 months	189
B. M.	4 years	6 months	187
C. W.	4 years	5 months	182
N. D.	5 years		174
H. F.	4 years	2½ months	170
M. S.	3 years	2 months	149
B. D.	2 years	3 months	135
N. S.	2 years	3 months	117
			<hr/> 1,702

Professor Launé⁶ is, therefore, inaccurate when he says that up to the 8th year the child's range of language is very small and that he probably confines himself to not more than 150 words.

The Parts of Speech. Nouns and Verbs.—Unquestionably nouns make up a larger part of the young child's *vocabulary* than does any other part of speech, but this should not be taken to mean that the total number of nouns *used* exceeds the total number of verbs, a mistake too frequently made by writers on this subject.

Of the *different* words spoken by children under 2 years, of my own acquaintance, 62 per cent. were nouns. In the 5,000 consecutive words recorded stenographically, from 10 children between 2 and 5 years, 1,702 different words were used of which 572 (33.6 per cent.) were nouns, the total number of nouns used being 1,053.

Compared with adults it may be seen that the average child between 2 and 5 uses a smaller total number of nouns (in 5,000 words the children used 1,053, adults 1,088 nouns) and a smaller number of different nouns (the average per child being 57.2 different nouns in 500 words, vs. 73.1 per adult); but the same figures show that nouns compose 33.6 per cent. of the child's vocabulary and 21.4 per cent. of the adult's.

Turning to the verbs, the studies show that the ten children used 1,178 verbs in 5,000 words, while the adults used but 978. The adults, however, used a larger number of different verbs. (Average per adult 48.8 different verbs in 500 consecutive words vs. 42.2 per child.)

Therefore, in the vocabulary of the average child between 2 and 5 years, verbs compose 24.7 per cent. of the vocabulary, whereas they compose but 14.3 per cent. of the average adult vocabulary.

The following table will show at a glance the remarkable reversal which takes place in the comparative use of nouns and verbs as the child becomes adult:

	Diff. Words in 5,000	Nouns Total No.	Verbs Total No.	Diff. Nouns Av. Per Subj.	Diff. Verbs Av. Per Subj.	Nouns Per Cent. in Vocabu- lary	Verbs Per Cent. in Vo- cabulary
10. Norm. Adults speaking ca. 500 words, used....	3,404	1,088	978	73.1	48.8	21.4	14.3
10 Norm. children speaking ca. 500 words, used....	1,702	1,053	1,178	57.2	42.2	33.6	24.7

Nouns and verbs, therefore, make up 58.3 per cent. of the child's vocabulary and but 35.7 per cent. of the adult's.

Tracy,² adding the vocabularies of a number of children observed by himself and by others, finds that in 5,400 words 60 per cent. were nouns. He says that this would make it appear that the nouns have the advantage, "but such a conclusion obviously cannot be drawn unless a comparison of the child's vocabulary with that of the adult justifies us in so doing. In order to show that the child learns nouns more easily than verbs, we must be able to show that the number of nouns bears a larger proportion to the number of nouns he will use as an adult than the number of verbs bears to the numbers of verbs he will use in adult life.

"Let n = the proportion of nouns in the child's vocabulary,

Let N = the proportion of nouns in the man's vocabulary,

Let v = the proportion of verbs in the child's vocabulary,

Let V = the proportion of verbs in the man's vocabulary.

"Then if the child learns nouns more easily than verbs, the proportion of n to N will be greater than that of v to V . But on comparing the two tables, the very opposite is found to be the case.

"For

$$\frac{n}{N} = \frac{60}{60} = 1.$$

"But

$$\frac{v}{V} = \frac{20}{11} = 1.81+.$$

"In other words, the child of 2 years has made nearly twice as much progress in learning to use nouns—according to my tables of child language and Professor Kirkpatrick's table of adult language—to my mind, this fact . . . possesses great value for philology and pedagogy, as well as for psychology. In the first place it supports the view that the acquisition of language in the individual and in the race proceeds by similar stages and along similar lines. Max Müller says that the primitive Sanscrit roots of the Indo-Germanic languages all represent *actions* and not *objects*."

He thus concludes that "the ideas which are of greatest importance in the infant mind and so clothe themselves most frequently (relatively), in words, are the ideas of *actions* and not *objects*, of *doing* instead of *being*. The child learns to use *action-words* (verbs) more readily than *object-words* (nouns); and words descriptive of actions (adverbs), more readily than words descriptive of objects (adjectives)."

It seems to me, however, that the terms of Tracy's proportion cannot properly be compared. Kirkpatrick's table refers, I take it, to the whole number of nouns and verbs in the English language, not the proportion actually used by any single adult. It means simply that there are in existence more names for objects than names for actions, but does not indicate the proportion of either of which the ordinary adult makes use.

To make the tables comparable, the whole number of words used by all 2-year old English children of all times should be substituted for the limited vocabularies of the twenty-five children of Tracy's text. Or, the ratio which the number of nouns or verbs used by the average adult bears to the whole number in the English language, could be compared with the ratio between the number used by the average child of 2 years and the total number used by all 2-year old children of all times. Of course, such a comparison cannot be made since it is impossible to determine the limits of child language.

A true proportion could, however, be made somewhat after Tracy's method by using the two series of 5,000 words which I have recorded stenographically from children and from adults.

Thus

Let N = per cent. of different nouns used by adults in 5,000 words,

Let n = per cent. of different nouns used by children in 5,000 words,

Let V = per cent. of different verbs used by adults in 5,000 words,

Let v = per cent. of different verbs used by children in 5,000 words.

Then

$$\frac{n}{N} = \frac{33.6}{21.4} = 1.57+,$$

$$\frac{v}{V} = \frac{24.7}{14.3} = 1.72+.$$

The conclusions, therefore, verify Tracy's statement that children make more relative progress in learning verbs than in learning nouns.

Moreover, it may be readily seen that as the child uses a smaller number of different verbs than different nouns, but uses the verbs much oftener than the nouns, the verbs—other things being equal—will become more firmly fixed, and moreover, will have a larger number of associations and can thus be more easily aroused to memory. The verb is thus a more fundamental part of speech than the noun.

The particular words most used by children reveal the influence of environment and the part played by egoistic interest and desires in the prompting to verbal expression.

Among the nouns, *mamma*, *mother* and *ma* take first rank, while *papa*, *dada* or *daddy* and *father* occur next in order of frequency. In my own cases proper nouns occurred with equal frequency among adults and children.

Some authors (see M. C. & H. Gale⁵) mention *want* as the most frequently used verb; my records give *do* and *don't* the highest place, while *got*, *go*, *have*, *see*, *look* and *want* follow in the order given.

Adjectives.—The 10 children from 2 to 5 years of age used 314 adjectives, about half the number used by the 10 adults (619). The youngest child used 8, the oldest 51, while the others used a number very nearly proportionate to the age.

The size of the adjective vocabulary increased almost uniformly with the age. No child used as many different adjectives

as the smallest number used by an adult. As compared with adults, the children used a smaller number of adjectives, a smaller variety and even a smaller variety proportional to the total number used. The favorite adjectives were *that*, *little*, *this*, *big*, *old* and *funny* in the order given.

Prepositions.—All authors state that the preposition appears late. Preyer¹ did not hear it until the 28th month with his child. I have observed it in the 23d month, though it certainly is not frequent before this time.

A child of 25 months used 39 prepositions in 500 words, while another of 5 years and 5 months used but 30. The average child between these ages uses about $\frac{2}{3}$ the number used by the average adult and $\frac{3}{4}$ the variety.

The preposition *in* occurs twice as often as any other preposition and almost as often as all the others together.

Articles.—Before the second year the article is exceedingly rare. Thereafter it occurs with increasing frequency. A child of 25 months used it 22 times in 500 consecutive words, while a girl of 29 months used it more often than did any other child or adult. The average use between the 2d and 5th year is nearly as large as in adult life.

A peculiarity of the children was the rarity of the indefinite article *an*. Only 2 children used it; whereas, every adult but one made use of it.

Preyer¹ found that in the 28th month and even in the following months the definite article appeared almost solely; in my records it is otherwise, for *a* appeared 156 times and *the* 144 times in 5,000 words. This contrasts with the adults since these used the definite article more often (*the* 187, *a* 111).

Pronouns.—The use of the pronoun is one of the most interesting features of the child's speech. The 10 children whose words were taken down stenographically used 999 pronouns in 5,000 consecutive words, practically a third more than were used by adults (700 used by adults). Moreover, the younger children of the series used more pronouns than the older ones, and the oldest child used the fewest. This is significant if it be remembered that with the adults the use of pronouns decreased almost exactly in direct proportion with the degree of culture of the individual.

Most surprising is the fact that the children actually averaged a greater variety of pronouns (16.2 different pronouns in 500

words vs. 14.2 used by adults), though, of course, the variety in proportion to the total usage is much less than with adults.

These data are all the more astonishing when it is found that other observers are mostly agreed that the pronoun is a comparatively late acquirement.

In the cases tabulated by Tracy² no pronoun appears before the 21st month. Major³ was not sure that any pronouns other than *I*, *it*, *itself* and *himself* appeared before the 4th year of the child *R*. He says that the relative and interrogatives did not appear until after the period under review (end of 3d year). He heard *I* a dozen times in the latter part of *R*'s 3d year.

Nevertheless, I note that in the records of M. C. and H. Gale, a boy of 2½ years used 27 different pronouns and a total number of 678 pronouns in 9,290 words, while a girl of the same age used 15 different pronouns and a total of 761 pronouns in 8,992 words.

These figures, with my own stenographic records, leave little doubt that carelessness of observation explains the absence of pronouns in the records of other writers. I have three records of children under 2 years of age, all of whom used pronouns. In one the pronoun *that* was distinctly heard in the 19th month, while in the other two *I* and *it* were recorded in the 21st month.

Probably no great use is made of the pronoun before the second year, when it suddenly appears to great excess, bearing the brunt of the child's lack of familiarity with particular names, only to recede into the background as the child's knowledge becomes more specialized.

It is interesting to note that in 5,000 words *I* appeared but 213 times, against 318 times in the same number of words from normal adults.

Particular attention should be given to the excessive use of the pronouns *it* and *that* (used 153 and 114 times respectively, in 5,000 words vs. 32 and 32 times in the 5,000 words of adults). As convenient substitutes for unremembered names they will be found again in excess with the aphasics and those whose power over language is waning.

Adverbs.—Most writers underrate the use which the child makes of the adverb. In my experience it appears early—frequently in the 16th month—and from the close of the 2d year adverbs compose a considerable, though decreasing, portion of the speech. A child of 26 months used, for example, 67 adverbs in

500 words and the 10 children used 554 adverbs in 5,000. They far out-number the adjectives. The variety of adverbs is, however, much smaller than with adults, especially in proportion with the larger number used. (Average, 21 different adverbs per child.)

These figures are quite in agreement with the records of M. C. and H. Gale, whose studies in general seem to have been most carefully pursued. (The Gale records of two 2½ year old children give 2,345 adverbs in 18,282 words and a vocabulary of 42 and 38 adverbs respectively.) As Maas⁴ and others have noted, adverbs of time appear much later than adverbs of place.

The adverb *there* is usually the first to appear and remains the favorite, outnumbering any other single adverb (58 times in 5,000 words). The word *there*, of course, is used as an exclamation very early, but it is considered in this place only when the adverbial sense has become definite.

Yes and *no* occur three times as often in the records of children compared with those of adults. *Up*, *down*, *out* and *here* occur next in order of frequency, in the order given, and are followed by *where*, *when* and *then*.

Conjunctions and Sentence Building.—No other part of speech is so conspicuous by reason of its rarity in early childhood as the conjunction. The earliest recorded appearance which I have is in the 26th month where it was used but once in 500 consecutive words, and even then apparently in quotation. It was heard distinctly in the 27th month (also but once in 500 words), and then as a simple connection between two substantives. As a connection between clauses and sentences it occurred first in my records from a girl of 3 years and 2 months. Tracy reports the conjunction in the 23d month but not again until the 27th month. In Major's³ records it has not yet appeared at the end of the 3d year.

Its use increases almost directly with the age, as does also the variety of conjunctions. Not until adult life is there that play of judgment and reason which, with finer distinctions of cause and effect and association, demand appropriate logical combination in forms of expression.

The conjunction represents, therefore, one of the highest forms of verbal acquisition.

In the 5,000 words of 10 children between the ages of 2 and

5½ years, it occurred but 172 times as compared with 229 times in the same number of adult words.

An average of 3.6 different conjunctions were used by each child, next to the oldest child using 8. By all 10 children actually 12 different conjunctions were used. The simple conjunction *and* was most used (125 times), followed by *because* (14), *but* (10), *or* (8), *then* (4).

Interjections.—Exclamations occurred almost three times as often with the children as with the adults (68 times in 5,000 words) and there is probably no rule as to the age of appearance. They often are the first actual words spoken.

Relation of the Different Parts of Speech to Each Other.—The order of frequency of the different parts of speech in 5,000 words from 10 children of ages between 2 and 5½ years is shown in the following table.

		Per Cent.
Verbs	1,178	23.56
Nouns	1,053	21.06
Pronouns	999	19.98
Adverbs	554	11.08
Prepositions	356	7.12
Adjectives	314	6.28
Articles	306	6.12
Conjunctions	172	3.44
Interjections	78	1.36
	5,000	100.00

The average variety of words per child in each part of speech was as follows:

Nouns	57.2
Verbs	42.2
Adverbs	21.0
Adjectives	17.2
Pronouns	16.2
Prepositions	9.7
Conjunctions	3.6
Interjections	1.9
Articles3
	169.3

The following table represents a rough estimation of the average number of repetitions of a given word in each part of speech in 5,000 consecutive words:

Articles	102.	repetitions
Pronouns	6.16	repetitions
Conjunctions	4.41	repetitions
Prepositions	3.67	repetitions
Interjections	3.56	repetitions

Verbs	2.79 repetitions
Adverbs	2.63 repetitions
Nouns	1.83 repetitions
Adjectives	1.82 repetitions

The verbs, pronouns, adverbs, conjunctions and interjections in 5,000 words numbered 2,971. The nouns, adjectives, prepositions and articles numbered 2,029.

III

THE MORBID VOCABULARY

Following the study of the speech of children and of normal adults, a comparative investigation of the verbal expressions of persons with mental derangement is intensely interesting. The same general plan has been carried out with the abnormal cases as with the normal adults and children; namely, the careful recording of a series of consecutive words from a considerable number of subjects, the abnormal cases being arranged in groups according to diagnosis and analysis of the stenographic notes.

The work is far from complete, and one must be constantly on guard against the temptation to draw deductions from insufficient data.

5,000 words from 10 classical dementia præcox cases, 5,000 from 10 mania-melancholia cases and nearly 10,000 from unquestionable cases of gross organic brain lesion have already been analyzed, as well as a considerable number from cases of senile and paretic dementia.

Unfortunately the observations on the last two mentioned groups have not been completed in time to permit of analyses and incorporation with the present studies. The senile cases are especially essential since they represent transitional stages between the great group of so-called inorganic psychoses and that composed of cases with mental derangement dependent upon gross organic lesions presenting speech disturbances of a grave and striking character.

The series of vocabularies from the cases of dementia præcox and mania-melancholia have been completed and the analyses worked out. The results are interesting in their deviation from the normal, and particularly when compared with the vocabularies of children. The significance of these variations, however, is not sufficiently evident to warrant positive conclusions without study

of additional cases, and, moreover, tentative deductions of a theoretical nature would carry this monograph beyond the limits of practicality. Discussions of these two groups, therefore, may well be reserved for a later contribution.

Meanwhile, twenty patients with serious brain injury have been selected as subjects for the study of verbal expression as affected by various lesions. These lesions include cases of brain tumor, fracture of the skull, cerebral hemorrhage, embolism and thrombosis, a number of which have been identified by final post-mortem examination and the remainder having revealed themselves definitely in history and symptoms.

The 20 patients have been arranged in a series at one end of which are those with greatest speech defect, represented by absolute anarthria, and at the other end those whose symptoms—perhaps a slight paralysis, for example—barely differentiate them from cases of simple senile dementia.

The whole series has again been subdivided into two groups, one made up of those cases so severely disordered that 500 consecutive words could not be obtained from each patient, the other group containing the patients able to furnish at least 500 consecutive words.

Group I.—Those from whom 500 consecutive words could not be obtained.

It will not be necessary to describe in detail these 10 patients; the purpose of the paper will be sufficiently served by a brief outline of certain cases.

CASE I.—B. B. Male. Armenian. Age 38. Right handed. Has a right hemiparesis. Understands very well when spoken to in English, German, Syrian or Zanzibar. The last two languages his wife says he comprehends as well as he ever did. When spoken to in either the German or English (the latest acquired tongues) he certainly responds very readily. Points out objects named, points correctly to numbers mentioned, selects colors named, buttons his garment on request, etc. Has a bright, intelligent expression, is orderly and perfectly rational in conduct, and, judging from his lively expression, his responsive grunts and signs of assent and dissent, seems to follow understandingly the general substance of ordinary conversation. Knows when the time given by the clock is correctly expressed. Likewise understands written speech to a considerable though limited extent. Recognizes about 50 per cent. of written words and even short sentences, though fails to grasp certain of the words. Writes

with the left hand; writes his name spontaneously, and on request writes the name of the city in which he lives. Asked to write his address (10 Buffon St.), writes "10 B—" then "10 Pawtucket" (lives in Pawtucket). Copies very well.

When, however, the speech is investigated, it is found that he can say absolutely nothing, either spontaneously or in repetition. Moreover, cannot perform on request or in imitation any expressive act with the muscles of the face, lips, tongue, pharynx or larynx. Can smile, cough or whistle reflexly or perhaps even spontaneously, but when he attempts to repeat a sound or imitate a posture of the lips, he almost invariably performs the wrong action though he appreciates his failures and apparently comprehends perfectly what he has been requested to do. The sound *M* is practically the only sound which he succeeds in imitating, and never at any time was there any approach to a word expressed either spontaneously, on request or in imitation. In short, with remarkably well preserved—though not perfect—comprehension of spoken speech, *he has complete anarthria*.

CASE II.—L. G. Female. Age 40. German. Right handed. Almost complete right hemiplegia. Very bright and intelligent. Understands English, French and German. She comprehends even complicated sentences, though comprehension of spoken speech is not entirely normal. Gets confused easily.

The case is almost identical in symptoms with Case I, except that in place of absolute speechlessness she can say two words, *ice-cream* and *one*, and occasionally used the word *nein*. She can, however, sing correctly. She can make sounds but cannot articulate. She can protrude the tongue, show her teeth, and apparently uses most, if not all, of the muscles required for speech. The words that she uses are not spoken in a way to indicate that incoördination is the cause of her speechlessness. Her spoken vocabulary is limited to two, or at most, three words.

CASE III.—G. P. Left hemiplegia in a left-handed man, with very marked word deafness but a vocabulary consisting of 101 words, of which 11 are nouns, 22 are verbs, 27 are adverbs and 16 adjectives.

CASE IV.—J. S. Huge brain tumor, (found post mortem), largely left sided, in a right-handed man.

Here the vocabulary consists of 133 words, of which 23 are nouns and 28 are verbs. He used these nouns 41 times while he was using the verbs 82 times.

CASE V.—J. B. Brain tumor, (found post mortem) largely left sided, in a right-handed woman. Vocabulary 150 words, consisting of 28 nouns, 41 verbs, 23 adjectives and 32 adverbs.

It may be seen from these examples that there are various degrees of loss of vocabulary from wordlessness to the preservation of a word treasury sufficient for the purposes of intelligent conversation.

There are cases with a still larger vocabulary whose word comprehension is limited and who are unintelligent and silly.

In other words, the degree of loss of a speaking vocabulary bears no constant relation to the degree of intelligence and word understanding. Moreover, there are characteristic features to the loss of vocabulary, the verb-adverb class of preserved words largely outnumbering in variety and exceeding in usage the noun-adjective class.

These features become even more definite when a group of cases is analyzed in which the speech possibilities are of sufficient extent to warrant the striking of averages.

Group II. Those from whom 500 consecutive words could be obtained.

In 5,000 words spoken by 10 subjects an average of 164.3 different words was used by each person, an average considerably less than that of the normal child between the ages of 2 and 5 years (170.2), and far below the normal adult average. Indeed, the largest vocabulary possessed by a diseased person was lower than the smallest normal vocabulary.

Nouns.—Consideration of the nouns used by the 10 persons must impress one deeply with the importance of studies of this character. Here we are met with facts of the greatest significance—facts which command attention as tokens of a vast field of unexplored mental activity. Why in these 5,000 words are there but 642 nouns, whereas 10 normal adults used 1,088 nouns in the same number of words and 10 normal children used 1,053? An adequate answer to this question will greatly extend our knowledge of normal and abnormal mental processes.

The variety of nouns used is particularly interesting. An average of 37.3 different nouns per person contrasts remarkably with the average of 73.1 of the normal adult and with the 57.2 of the normal child. All but one used a smaller variety of nouns than that of any normal adult, and six had a smaller vocabulary of nouns than any child between 2 and 5 years of age.

Verbs.—The excessive usage of verbs in this group of cases is as striking as the deficiency in nouns. In the 5,000 words there were 1,317 verbs, 339 more than in the same number of words used in the normal group.

The absolute vocabulary in verbs is but slightly below the normal, averaging 44.3 different verbs per person as against 48.8

per normal person. The variation in proportion to the usage is, therefore, very much lower than the normal and even less than that of normal children.

The verb most used is *do*, the same word most often used by the children. The great use of *do* is explained largely by the frequent occurrence with these patients of such phrases as, "I don't know," "I don't remember," etc.

Adjectives.—430 adjectives were used, 189 less than were used by normal adults and 116 more than were used by the children. The variety was much less than with normal adults. There were but 110 numerals, 105 less than were used by normal adults.

The adjective *that* was most frequently used, followed in frequency by *this*, *right*, *good*, *little* and *old*, which were also used most frequently by the children.

Prepositions.—223 prepositions were used against 562 employed by normal adults; less than half the normal usage. This deficiency in prepositions is extremely significant. It was found that with normal adults the use of prepositions increased directly with the grade of culture, and as many as 98 were used by a single person, while the smallest number used was 28. Of these diseased persons but one used more than the smallest number from a normal adult, while the degree of culture had no effect on the usage, the patient of highest culture using the smallest number of prepositions (9).

The use of prepositions was much less than occurred with children. The variation in prepositions was far less than normal and even less than with children, there being an average of 7.6 different prepositions per person as compared with 12.8 with normal adults and 9.7 with children.

But one normal adult used a smaller variety of prepositions than the greatest number used by a patient with organic disease.

Moreover, the number of prepositions used increases directly with the size of the vocabulary as a whole, the use of prepositions, therefore, being an index of vocabulary defect and of brain disease.

Articles.—196 articles were used, 122 less than appeared in the normal adult series and 110 less than were used by the children.

In addition to this deficiency in articles, a significant feature

is that more indefinite than definite articles were used, as is the case with children, the reverse being true of the normal adults.

	Def. Article	Indef. Article
Normal adults	187	131 = 318
Children	144	162 = 306
Patients with organic diseases.....	86	110 = 196

Moreover, those who use the greatest number of indefinite articles have the smallest total vocabulary, the ratio for the two series being fairly constant.

Adverbs.—712 adverbs were used, 234 more than were used by the normal adults and 158 more than were used by the children. The average variety of adverbs per person was slightly greater than with the normal adults (organic diseases 26.1; normal adults 25.4), but the variety in proportion to the total usage was, of course, very much less than normal.

No and *yes* appeared 195 times (*yes* 99, *no* 96), more than six times more frequently than with normal adults (31) and more than twice as often as with the children (90), thus revealing the great lack of spontaneity with these patients, questions having been required to obtain a sufficient number of words for purposes of analysis. The other favorite adverbs were *not* (50 times), *here* (49 times), *so* (29 times), *there* (27 times).

Pronouns.—More than a fifth of the total number of words used by these patients was pronouns, 1,172 being used in 5,000 words against 700 in the normal adult series and 999 in the series of the children. Pronouns and verbs together compose about one half of the total number of words spoken; whereas, they compose but a third of normal adult speech.

Moreover, the average variety of pronouns per person was greater than normal (15.8 versus 14.6), though the variety in proportion to the usage was, of course, much smaller.

A variety of pronouns greater than that used by the average normal adult might at first sight seem contrary to expectations, being found with individuals whose brains are diseased and whose vocabulary is in other respects grossly limited. And yet a moment's consideration of the speech of children and of normal adults will show that such a finding should not prove a surprise, since the children actually average a greater variety of pronouns than their elders, and since in the adult group the person of highest culture uses the smallest variety of pronouns, while even a

writer like Hawthorne uses a smaller number than the average uncultured speaker.

The fact is that the pronoun is an extremely convenient word for those who are in need of a word. As its name indicates, it stands for or takes the place of a noun and accordingly is an ever present help to the youngster who has not yet acquired facility with names, for the aged person who has permanently or for the moment forgotten, and for the lazy-minded speaker or careless writer. The pronouns are thus fixed in memory by frequent use and by richness of associational connections.

A glance at the individual pronouns used is also instructive.

The pronoun *I* appears 459 times as against 318 times in the normal adult lists and 213 among the words of the children. Its frequency, however, probably is not an indication of excessive self-consciousness in these patients, nor an expression of a disproportional survival of the concept of the ego; for the use of *I* is not excessive as compared with the much greater than normal use of pronouns in general.

The pronoun *it*, on the other hand, occurs about five times more often with these patients than with the normal adult (151 times versus 32 with normal adults), and being a substitute word or pronoun *par excellence*, the reason for its excessive occurrence on the tongue of these word-poor subjects may be really seen. The word *it* was found 153 times in the children's words.

The same explanation applies to the frequency of the pronoun *that*, occurring as it does 100 times with the patients, 114 times with the children, and but 32 times with the normal adults.

Conjunctions.—The connecting words which were so difficult for children to acquire are again sparsely used by these diseased subjects, though there are exceptions. 165 conjunctions were used, while the children used 172 and the normal adult 229. And yet, though about one third less conjunctions were used than appear in the normal list, two patients used more than any normal person; on the other hand no normal person used so few as did four of the patients.

The variety of conjunctions averaged 4.7 per patient as against 5.4 with normal adults and 3.6 with the children.

And is the commonest conjunction, as with normal adults and children.

Interjections.—While only 28 interjections were used by the

normal adults, 104 were uttered by the patients, the frequent use probably being due to embarrassment resulting from lack of readiness with other parts of speech; the exclamations being fundamental are not quickly lost in disease. The average variety of interjections per person was greater than with normal adults or children, being 2.8 against 1.9 in each of the normal groups. *Oh!* appeared 55 times as against 5 times in the normal lists.

Order of Frequency of the Different Parts of Speech.—The following tables give the parts of speech in the order of frequency of use in the three groups thus far studied.

Normal Adults	Children	Diseased Persons
Nouns1,088	Verbs1,178	Verbs1,317
Verbs 978	Nouns1,053	Pronouns1,172
Pronouns 700	Pronouns 999	Adverbs 712
Adjectives 619	Adverbs 554	Nouns 642
Prepositions ... 562	Prepositions 356	Adjectives 430
Adverbs 478	Adjectives 314	Prepositions ... 223
Articles 318	Articles 306	Articles 196
Conjunctions ... 229	Conjunctions ... 172	Conjunctions ... 165
Interjections ... 28	Interjections 68	Interjections 104
5,000	5,000	Nonsense words. 39
		5,000

Among the important features of the analyses of the normal adult group, one of the most striking was the way in which the subjects fell into two groups; the one, composed of the persons of highest culture, using a majority of nouns, adjectives, prepositions and articles; the other, of those of lesser culture who express themselves largely in pronouns, verbs, adverbs and interjections.

Taking the normal adults as a whole, it was found that they use more words of the noun-adjective group than of the verb-adverb class (2,532 vs. 2,477). The relationship was reversed with the children, the verb-adverb class numbering 2,971 and the noun-adjective 2,029.

A still further reversal is found with the subjects of gross brain disease—the noun-adjective class shrinking to less than a third of the total number of words used (noun-adjective, 1,491; verb-adverb, 3,509).

Here we have a characteristic too pronounced to be neglected in a consideration of the effect of brain disease upon verbal expression. Allowing for personal idiosyncrasy, for the fallacy of statistics, for the particular choice of cases and for the comparatively limited nature of these analyses, we have still remaining

in the diseased persons a departure from the normal type of verbal expression sufficiently wide to warrant the most careful meditation.

Compared in tabulated form the figures are as follows:

	Normal Person	Children	Diseased Person
Noun-adjective group	2,523	2,029	1,491
Verb-adverb group	2,477	2,971	3,509
Total number of words.....	5,000	5,000	5,000

Not a single patient was there whose words of the verb-adverb group did not far outnumber those of the noun-adjective group.

IV

CONCLUSIONS FROM STUDY OF THE VOCABULARY AS AFFECTED BY GROSS BRAIN DISEASE

From the foregoing analyses it may be seen that the vocabulary is not a negligible quantity among the factors helpful to the diagnosis of organic brain disease. The degree of loss from the word treasury, the changes in the use and variety of the different parts of speech, the character of the words used, the numerical relationships between the parts of speech, and especially the degree of preservation of the normal balance between the noun-adjective group and the verb-adverb group; these are matters which one can ill afford to disregard where the diagnosis is difficult.

So pronounced may be these pathological features that mere careful attention to a few sentences from the patient may suffice for a diagnosis of brain disease, as was true of a case of brain tumor recently reported and which may be briefly referred to.

The patient in question was suddenly affected by symptoms while on a summer day excursion with his children, and was for a time held under suspicion of drunkenness. He was later brought to consultation with a diagnosis of hysteria. Such diagnosis would have been instantly discarded had the physicians heeded understandingly the verbal expression of the patient with his avoidance of nouns, his excessive use of pronouns and his general word poverty.

In other cases where the defect cannot be detected by the ear a careful analysis of the stenographic record of the patient's speech will often prevent an error in diagnosis.

Despite the self-given warning as to the danger of making deductions from limited data, I am constrained to yield to the

temptation of hazarding at least tentatively a somewhat ambitious conclusion.

We hear much of auditory word centers and memories and of motor speech centers and memories as though there were no further doubt of the existence of brain areas wherein lay stored separate auditory and motor images or memories of individual words as known to the ear and tongue. Many writers even go so far as to mention word centers for different parts of speech, for numbers, letters, etc., just as Mills⁷ has done for the visual memories of written speech.

Thus, Dr. G. M. Hammond⁸ at a meeting of the Philadelphia Neurological Society, spoke of the "proper name center in the superior temporal region," and Hoppe believes that there are separate naming centers in different languages.

Such an arrangement for the storing up of individual words separately would require a large amount of brain space—perhaps more than the superior temporal, the lenticular area of *Marie* or *Broca's* center could afford. Moreover, it would seem an unnecessarily lavish disposition to make of precious brain tissue and a crude invention of nature for the future resurrection of mere words independent of their significance—an invention which would be put to shame by man's invention of the typewriter or the piano, whereby a limited number of keys properly manipulated suffice for the expression of unlimited words or the reproduction of an infinite variety of harmony.

And, indeed, the study of vocabularies seems to prove that no such centers exist for the preservation of individual word sounds or word movements, as traces, images or memories distinct and separable from the centers having to do with the content, meaning and function of the words themselves: at least, that such discrete memories cannot exist for other than a few words of simplest form.

Let us assume that there is a motor speech center where the memories of the motions of expression *for each word* are registered. Then imagine those word traces arranged in any conceivable manner. Let them be nicely classified according to parts of speech in most convenient form. Here the nouns, there the verbs, there the conjunctions.

Now imagine a lesion springing from this, that or the other direction. In one case the nouns would suffer, from another

lesion the verbs, or a portion of this or that part of speech would be eradicated. From the widely different accidents to which the brain is subject, would arise an infinite variety of types of motor word aphasia. There would be a motor noun aphasia or a motor verb aphasia, etc., according to the extent and situation of the lesion.

But no such clinical varieties of aphasia are met with. From whatever direction the injury comes, whether it be frontal, temporal, from within, without, or from the structures beneath the brain, the loss of speech varies only in degree, proceeding always in the same manner, destroying first the superficial, the unessential, the least often practiced words, and leaving till the last the words first acquired and oftenest used.

Or conceive the word traces to be arranged in a jumble regardless of their class, or, suppose them to be grouped according to similarity of sound or with regard to the particular muscles or motions necessary for their reproduction. In the first instance there would also be no law or constancy in the manner or form of speech loss from different lesions, whereas these studies show that no such irregularities occur; in the second and third suppositions the words would be lost according as they were expressed by this or that sound or motion and not with any reference to their significance, associations or acquirement.

By the same reasoning the existence of an auditory word center *as an area for the recording or stowing up of discrete word memories* is excluded. If there were such a center—whether in the first temporal gyrus or elsewhere—the loss of word comprehension would be found in an infinite variety of types according to the nature, extent and location of the lesion affecting the area in question, a finding contrary to clinical experience.

We are forced to conclude that there is no auditory center for words as such and no speech center for words as such. It must be admitted that there is a center differentiated for the reception and registration of vocal sounds as related to words, and that there is also a speech center designed for the reproduction of those sounds in the form of words. The centers must be very closely connected by numerous associational pathways.

Since, however, words as heard and as spoken are but sounds without meaning save as related to sensory memories, and to higher intellectual and emotional processes, all that is required

for the purposes of these higher functions is a mechanism on one hand, capable of receiving and registering all elementary vocal sounds, so arranged that any conceivable combination of sounds may be experienced and according to experience be recognized and interpreted as words, and on the other hand a center capable of pronouncing and reproducing all of the elementary articulatory movements in such combinations as may be necessary for verbal speech.

The verbal articulatory and the verbal receptive centers are thus mere switchboards wherein comparatively few elements with wide spreading associational pathways suffice for the whole business of word understanding and word expression.

Thus it happens that the loss of words as a medium of expression and of words as a medium of understanding proceeds in a more or less uniform way regardless of the situation of the lesion, and differs in degree according to the extent of obstructions to the associational pathways.

The brain is no dictionary of separate words tabulated either by sound or motion. The speech function has probably been constructed according to principles on the one hand less crude than appear in the usual text-book conception, and yet on a plan infinitely more simple and less prodigal of time and space than has been represented in most theoretical descriptions of its supposed action.

These studies do not pretend to furnish more logical conceptions of the mental activities concerned with speech than have thus far been formulated and offered by students of normal and abnormal mind. They merely strive to show by analysis of a limited number of vocabularies that the way is open to us to acquire at the mere cost of effort a far wider knowledge than we at present possess of mental processes both normal and morbid.

REFERENCES

1. Preyer, T. W. *The Mind of the Child*. Part II, p. 216.
2. Tracy-Frederick. *The Psychology of Childhood*. 1893.
3. Major. *First Steps in Mental Growth*, New York, 1906.
4. Maas, Dr. Paul. *Die Sprache des Kindes und ihre Störungen*, Wurzburg, 1909.
5. Gale, M. C. & H. *Children's Vocabularies*. *Pop. Science Monthly*, Vol. 61, p. 45 ff.
6. Laune, Professor. *Lectures on Language and Linguistic Methods*.
7. Mills. *The Eye and the Nervous System*, by Posey and Spiller.
8. Hammond, G. M. Report of Meeting of Philadelphia Neurological Society, *JOURNAL OF NERVOUS & MENTAL DISEASE*, March, 1908.