19世紀における言語病理学者についての一研究ノート

—言語と脳機能の関連性について—

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THE CONTRIBUTION OF NINETEENTH CENTURY LANGUAGE PATHOLOGISTS TO OUR UNDERSTANDING OF LANGUAGE AND BRAIN FUNCTION

To begin with, I would like to discuss the relevance of psycholinguistics to the study of language and brain function.

Psycholinguistics is fundamentally the study of mental proceses-the study of the mind based on characteristics of speech, the study of the evanescent inner states which accompany speaking and understanding, from the nature of the human brain.

In order to study the nature of the human brain, it is necessary for psycholinguists and pathologists to bring together theroretical and empirical tools of psychology, language and the brain function.

A disturbance of language resulting from damage to the brain is called aphasia, and the victims are called aphasiacs.

Aphasia is a common aftereffect of the obstruction or rupture of blood vessels in the brain.

Three main language pathologists contributed to the understanding of language and brain function. They published several articles in the nineteenth century.

Geschwind (1972) points out that the first pathologist was Paul Broca who in 1861 published his work on language and brain. He was the first to observe that damage to a specific portion of the brain

results in disturbance of language output. The portion he identified is called 'Broca's area'. and loss of speech from damage to Broca's area is the result of paralysis of the muscles involved in speech production. Direct damage to Broca's area, which controls these muscles, often produces only mild weakness of the lower facial muscles on the side opposite the damage and no permanent weakness of the jaw, the tongue, the palate or the vocal cords. This is because most of these muscles can be controlled by either side of the brain. Damage to the facial motor face area on the side of the brain can be compensated for by the control center on the opposite side.

Paul Broca's second contribution to the study of language and the brain was made in 1865. He reported that, "damage to specific areas of the left half of the brain led to disorder of spoken language but that destruction of corresponding areas in the right side of the brain left language abilities intact. This unilateral control of certain functions is called cerebral dominance".

The second language pathologist was Wernicke, who published his paper on aphasia in 1874. He points out in his work that, "damage at a site in the left hemisphere outside Broca's area results in a language disorder differing from Broca's aphasias".

Broca's aphasia and the aphasia described by Wernicke are quite different.

For example, in Broca's aphasia speech is slow and laboured. Articulation is crude. Small grammatical words and the endings of nouns and verbs are omitted.

On the other hand, in Wernicke's aphasia, the patient fails to use the correct word and substitutes for it circumlocutory phrases and empty words. This patient also suffers from paraphasia, which is of two kinds.

Verbal paraphasia is the substitution of one word or phrase for another, sometimes related in meaning. Literal or phonemic paraphasia is the substitution of incorrect sounds in otherwise correct words.
The important contribution made by Wernicke was his model of how

the language area in the brain are connected.

What happens in the brain during the production of language is that, when a word is heard, the output from the primary auditory area of the context is received by Wernicke's area. If the word to be spoken, the pattern is transmitted from Wernicke's area to Broca's area, where the articulatory form is aroused and passed on to the motor area that controls the movement of the mustles of speech. If the spoken word is to be spelled, the auditory is passed to the angular gyrus, where it elicits the visual pattern. When a word is read, the output from the primary visual area passes to the angular gyrus, which in turn arouses the corresponding auditory form of the word in Wernicke's area. In most peole, comprehension of a written word involves arousal of the auditory form in Wernicke's area.

Accordingt to his model, if Wernicke's area is damaged, the patient has difficulty comprehending both spoken and written language. He is unable to speak, repeat and write correctly. If speech is fluent and well articulated, it means that Broca's area is intact, but receiving unadequate information. If, however, the damage is in Broca's area, the effect of the lesion would be to disrupt articulation. Speech becomes slow and laboured, but comprehension remains intact.

If a lesion disconnects, Wernicke's area from Broca's area while leaving the two areas intact, a special type of aphasia results. Since Broca's area is preserved, s peech is fluent but abnormal. Comprehension, however, is intact because Wernicke's area is still functioning. But repetition of spoken language is impaired This is called "conduction aphasia".

The other neurologist, Joseph Jules Dejerine, developed Wernicke's model further in 1891. He discusses a disorder called a lexia with agraphia: the loss of the ability to write and read. The patient can, however, speak and underatand spoken language. Postmortem examination shows that there is a lesion in the angular gyrus of the left hemisphere, the area of the brain that acts as a way station between the visual and the auditory region. A lesion here separates the visual and

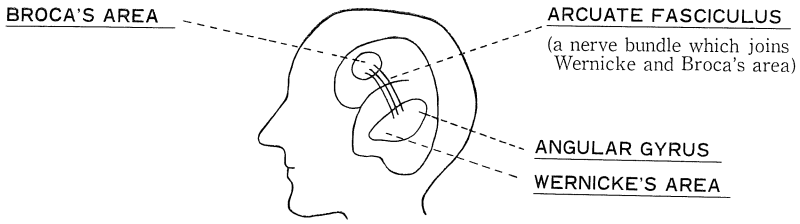
auditory language areas.

Although words and letters are seen correctly, they are meaningless visual patterns, since the visual pattern must first be converted to the auditory form before the word can be comprehended. Conversely, the auditory pattern for a word must be transformed into the visual pattern before the word can be spelled. Patients suffering from alexia with agraphia can not recognize words spelled aloud to them nor can they themselves spell aloud a spoken word.

His second contribution shows the importance of information transfer between the hemispheres. His patient was an intelligent businessman who had awak ened one morning to discover that he could no longer read. It was found that the man was blind in the right half of the visual field. Since the right half of the visual field is projected to the left cerebral hemisphere, it was obvious that the man suffered damage to the visual pathways on the left side of the brain. Postmortem analysis of the man's brain showed that the left visual cortex and the splenium were destroyed as a result of an occlusion of the left posterior cerebral callosum. (The splenium is the section of the corpus callosum that transfers visual information between the two hemispheres.)

He could speak and comprehend spoken language and could write, but he could not read even though he had normal visual acuity. Although he could not comprehend written words, he could copy them correctly.

According to Wernicke's model, it is the left angular gyrus that converts the visual pattern of a word into the auditory pattern. Without such a conversion, a seen word can not be comprehended.



The researches which have been conducted by these three important language pathologists have helped us in understanding the relation between language and the brain function of human beings, and the organization of language functions.

Bibliography

Aitchison, Jean (1976) *The Articulate Mammal.*
Geschwind, N. *Language and Brain* 'Scientific American' April 1972.
Geschwind, N. (1979) *Specializations of the human brain in A Scientific American Book 'the brain'* W. H. Freeman and company
Slobin, D. I. (1979) *Psycholinguistics* Scott, Foresman.