

The Mandate to Listen, Prov 8:6; How the Brain Processes Speech through Wernicke's & Broca's Areas; Choice & Interest Makes Spiritual Growth Possible

20. The methods by which wisdom is gained physiologically are described by Dr. Richard F. Thompson, Keck Professor of Psychology and Biological Sciences and Senior Scientific Advisor to the Neuroscience Program at the University of Southern California, Los Angeles. The phenomena of language, consciousness, and the brain are the subjects of chapter 12 in his book, *The Brain: A Neuroscience Primer*:

Language, Consciousness, and the Brain. Language is the one species-typical behavior that sets humans completely apart from all other animals. [The reason for this phenomenon is that the human race is the only species among God's creation with whom He wishes to communicate.] We use our native language so naturally and fluently that we are completely unaware of the extraordinary complexity of the process.

Primary language areas of the human brain are thought to be located in the left hemisphere, because only rarely does damage to the right hemisphere cause language disorders. Also shown are motor and supplementary motor areas, the somatic sensory area, and the auditory and visual areas. Broca's [braw-kah] area, which is adjacent to the region of the motor cortex that controls the movement of the muscles of the lips, the jaw, the tongue, the soft palate, and the vocal cords, apparently incorporates programs for the coordination of these muscles in speech. Damage to Broca's area results in slow and labored speech, but comprehension of language remains intact. Wernicke's [ver-na-kah] area lies (near) the angular gyrus, which acts as a way station between the auditory and the visual regions. When Wernicke's area is damaged, speech is fluent but has little content, and comprehension is usually lost. Wernicke and Broca areas are joined by a nerve bundle called the arcuate fasciculus [är-qu-wet fa-si-qu-las]. When it is damaged, speech is fluent but abnormal, and the patient can comprehend words but cannot repeat them. (p. 389)

Speech and Language. The most elemental component of language is the *phoneme*, the smallest possible sound distinguishing one word from another. The word "pin" has three phonemes, p, i, and n. All languages are based on various combinations of about 90 phonemes. English uses 40 and other languages have from 15 to 40 of these phonemes or sounds.

Morphemes are combinations of phonemes into elementary units of meaning, usually words.

English has more than 100,000 morphemes, which arranged in various ways yield the million-word English vocabulary. A typical educated adult has a vocabulary of about 40,000 words; an exceptional individual might have a 100,000-word vocabulary.

Finally, words can be combined into sentences according to rules called *syntax*. Many rules have been spelled out—rules of grammar we learned in school. Finally, the most complex aspect of language is *semantics*, the way language expresses meaning.

Consider what has to happen when one person is speaking to another. The speaker has to translate thought into spoken language, using syntax and semantics to construct sentence patterns that convey the desired meanings, using the sounds of speech to pronounce the sentences correctly. The listener must use the sounds of speech to figure out the words being spoken, syntax to figure out the pattern of words, and semantics to interpret the meaning. Amazingly, this complex process from thought to speech and from speech back to meaning occurs virtually without awareness. (p. 390)

Roger Brown at Harvard University completed an extensive analysis of the acquisition of language by children. In his view there is a common semantic and grammatical order of progression for children learning any language. He was able to characterize a series of stages in language learning that all children go through, regardless of their native language. The rate of language learning in young children is quite amazing. Somewhere between 10 and 15 months the first word is spoken. By age 2, children know about 50 words; by age 8 the average vocabulary is 18,000 words. Between the ages of 1 and 8, the child is learning at the rate of 8 new words a day!

Apparently the deep structure of all languages is similar. At an early stage an infant “babbling” essentially all the sounds (phonemes) used in all languages. Children are thought by some linguists to develop a similar initial universal deep grammar. All languages, from English to obscure dialects, have the same degree of complexity and similar general properties. It is as though humans came into the world equipped with a well-elaborated, complex, and biologically determined language system. In short, it would seem that we may have speech and language centers in the brain that are in some ways predetermined or preprogrammed. (p. 391)

NOTE: All languages are the same; they just use different phonemes, morphemes, syntax, and semantics.

Cortical Speech Areas. Virtually all of the information scientists possess about the brain mechanisms of language has come from studies on unfortunate individuals who have suffered damage to the speech areas and have the condition known as *aphasia*, or difficulty in speaking and writing.

The final common path for speech begins at the lower face and mouth area of the primary motor cortex. This area sends its motor commands down the pyramidal tract to the motor neuron nuclei in the brain stem that control the movements of the larynx, tongue, and mouth.

Broca's speech area lies in front of the motor cortex on the lateral part of the hemisphere. The basic problem with damage to Broca's area is in speaking—speech is non-fluent and not much speech is produced. Grammar is also impaired. Broca's area damage is a speech impairment, and not just a motor impairment. It appears that key aspects of syntax may also be coded in Broca's area.

There is important evidence that comprehension of speech is also impaired by damage to Broca's area, particularly where meaning depends on syntax. Consider the following two sentences:

The apple that the boy is eating is crunchy.

The girl that the boy is chasing is tall.

In the first sentence, syntax is not needed to understand the meaning; boys eat apples but apples don't eat boys, and apples can be crunchy but boys are not. In the second sentence, either the girl or the boy could be chasing the other and either one could be tall. Only syntax gives us the information that the boy is chasing the girl and that the girl is tall. Patients with damage to Broca's area have no problem understanding sentences like the first one but have great difficulty understanding sentences like the second, where meaning depends critically on syntax. (p. 398)

Extensive damage to *Wernicke's area*, the posterior speech area, causes massive impairment in understanding and speaking language. Such patients can produce rapid, well-articulated sound and even proper phrases and sequences of words, but what they say is not language. The "speech" of such a person has the correct rhythm and general sound of normal speech but in fact conveys no information. These patients show essentially total failure to understand both spoken and written language, although basic hearing and vision are normal. (pp. 398-99)

Wernicke's area is the critical region for the conceptual formation and production of language. If a phrase is to be spoken, it originates in Wernicke's area, is transmitted by a fiber bundle called the *arcuate fasciculus* to Broca's area, where the correct sequence of articulations is aroused, and is then transmitted to the motor cortex to be spoken. (p. 399)

Visual: Subdivisions of the Cerebral Cortex. The language areas of the brain and how they are thought to interact when a person speaks a heard word or a written word.

When a word is heard, the auditory sensation is received by the primary auditory cortex, but the word cannot be understood until the signal has been processed in Wernicke's area. If the word is to be spoken, some "representation" of it is transmitted from Wernicke's area to Broca's area through a bundle of nerve fibers called the arcuate fasciculus. In Broca's area, a "program" for articulation is activated and supplied to the face area of the motor cortex. The motor cortex in turn drives the muscles of the lips, the tongue, the larynx, and so on.

When a written word is read, the visual sensation is first registered by the primary visual cortex and then presumably related to the angular gyrus, where associations between the visual form of the word and the corresponding auditory pattern in Wernicke's area are thought to be formed. Speaking the word then draws on the same systems of neurons as speaking a heard word.¹ (p. 401)

21. Unless a believer's Wernicke's and Broca's areas have been damaged, he is completely capable of learning information that is spoken or written. IQ is not an issue due to the filling and teaching ministries of the Holy Spirit.
22. All that is necessary for a person to grow in grace are positive volition and a willingness to learn. Positive volition is a decision while willingness to learn is a disposition. The former indicates choice while the latter denotes interest.
23. I communicate and the Holy Spirit teaches. You have all the necessary spiritual, physical, and neural assets to grown in grace. This will not occur if you do not have ears to hear due to lack of interest.

¹ Richard F. Thompson, "Language, Consciousness, and the Brain," chap. 12 in *The Brain: A Neuroscience Primer*, 2d ed. (New York: W. H. Freeman and Co., 1985), 389-91, 397-99, 401.

24. Therefore, Wisdom begins the second stanza with the mandate to listen, the Qal imperative of the verb **שָׁמַע** *shama'*, a command to concentrate, inculcate, and initiate the doctrine communicated.
25. Wisdom then gives the reason she requires the naïve and the fools to listen, introduced by the demonstrative particle **כִּי** *ki*, translated “because.”
- Proverbs 8:6a - Concentrate for the purpose of inculcation, because I continue to communicate orally about noble things, and my lips ...**
26. So far, Wisdom has and will continue to emphasize the use of oral communication to instruct the benighted. In verse 1 she “called out” or “summoned loudly” and “raised her voice.” In verse 3, she “cried out” from above the marketplace.
27. As wisdom is personified in this chapter so also the soul is presented as a popular gathering place in the city where merchandise is bought and sold. The soul is the place where the believer determines what he will buy from the marketplace of ideas.
28. Incoming data are analyzed in the soul and they originate from two sources: (1) divine viewpoint and (2) human viewpoint. The believer must use his volition to determine which product to buy.
29. In verse 6, Wisdom stands at the soul’s marketplace and issues the naïve and the fools the order to “concentrate.” Her sales pitch is that her merchandise is “noble things.”
30. What follows is the first of a series of references to the human capacity for speech, **שָׂפָה** *saphah*: “lips.” In verse 6 Wisdom uses the word lips, in verse 7, mouth and lips, and in verse 8, mouth. This is what took us to our study of the brain’s data processing centers for incoming audible and visual information and converting them into speech:
- The final common path for speech begins at the lower face and mouth area of the primary motor cortex. This area sends its motor commands down the pyramidal tract to the motor neuron nuclei in the brain stem that control the movements of the larynx, tongue, and mouth.²**
31. The emphasis in our passage is on verbal communication. When a person concentrates on the spoken word he cannot avoid hearing its content in contrast to what is written down which he may decide not to read.
32. Wisdom is not only communicating orally, she is shouting her message which she first describes as being “noble things” and last as being “right things”: the masculine plural of the noun **מִישָׁר** *meshar*.
33. *Meshar* is a derivative of the root verb **יָשַׁר** *yashar* which means “straight, upright, just, and straightforward.” It can refer to a path since it is often used with **דֶּרֶךְ** *derek*, the noun for “path” or “way.” Together they are used metaphorically to describe a person’s lifestyle, character traits, or behavior patterns or what we have described as “wheel-tracks of righteousness.”
34. In order to function under an inventory of righteousness the one who hears must express positive volition combined with a willingness to learn.

² Thompson, *The Brain: A Neuroscience Primer*, 398.

Proverbs 8:6 - "Concentrate for the purpose of inculcation, because I continue to communicate orally about noble things, and my lips reveal righteous standards." (CTL)