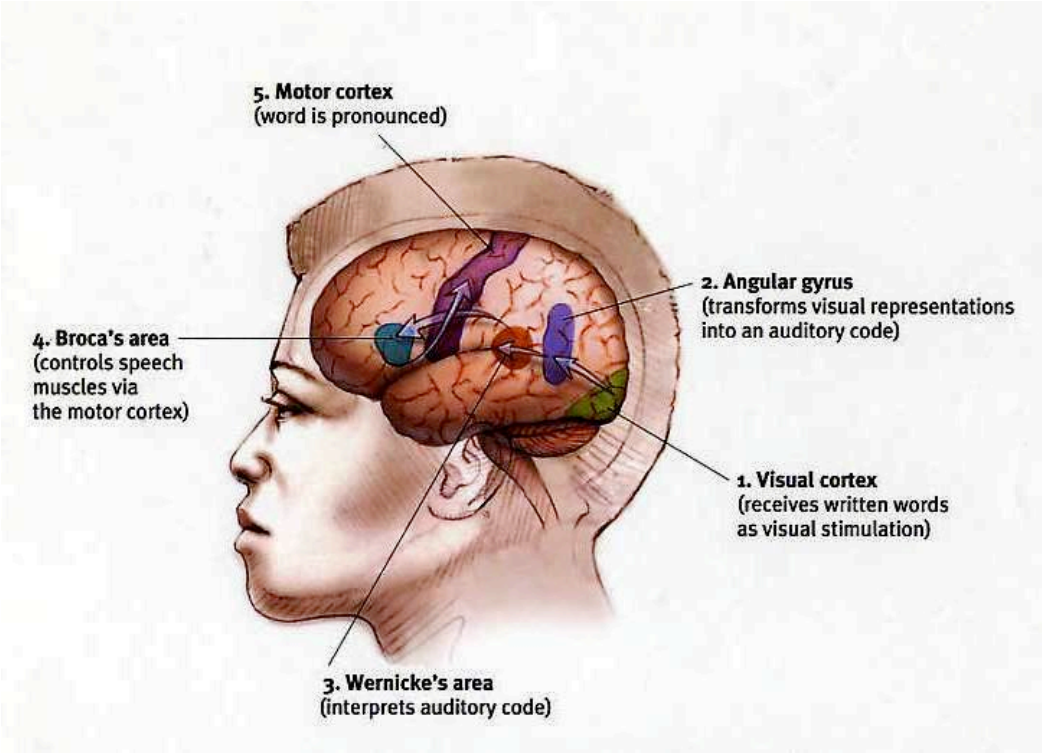
Lecture notes 3.1 **language and brain-general**



- Language, animals, human beings

Some scientists have argued that **language** is what sets humans apart from all other animals. Other researchers wonder if humans are really the only species with *language*. Certainly other animals *communicate*...bees have the ability to communicate with other bees using their special "dance". However, human language is more than just communication. Humans use symbols that have meaning.

It is possible that apes have the ability to learn and communicate with language. However, not all scientists believe that apes have "real" language. Apes cannot talk because they do not have the necessary anatomy in their mouths and throats to speak. However, they apparently can learn to use symbols to communicate.

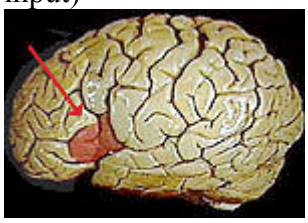
- Brain and language ability

Patients with speech problems gave early researchers the first clues about how the brain is involved with language. The loss of the ability to speak is called "aphasia." The ancient Greeks noticed that brain damage could cause aphasia.

Centuries later, in 1836, **Marc Dax** described a group of patients who could not speak properly. Dax reported that all of these patients had damage to the left side of their brain.

A quarter century later in 1861, **Paul Broca** described a patient who could say only one word: "tan." For this reason, Broca called this patient "Tan." When Tan died, Broca examined his brain and found that there was damage to part of the left frontal cortex. This part of the brain has come to be known as "Broca's Area." (an area in the left frontal lobe responsible for the ability to speak; damage to the left side of the brain much more likely to result in language loss than an injury to the right side)

In 1876, Karl Wernicke found that damage to a different part of the brain also caused language problems. This area of the brain ("Wernicke's Area"), was further back and lower in the brain compared to Broca's area. In fact, Wernicke's area is in the posterior part of the temporal lobe. Broca's area and Wernicke's area are connected by a bundle of nerve fibers called the arcuate fasciculus. Damage to the arcuate fasciculus causes a disorder called conduction aphasia. People with conduction aphasia can understand language, but their speech does not make sense and they cannot repeat words. (an area adjacent to the part of the cortex that processes audio input)



Broca's Area (red)

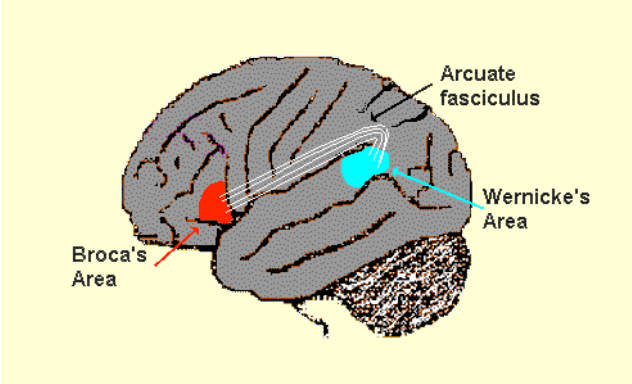


Diagram of pathways involved with language

Language is represented primarily in the left half or hemisphere of the brain within an area including both Broca's area and Wenicke's area around the Sylvian fissure (a cleavage that separates lobes in the brain)

- Language deficiencies

The language problems associated with damage to Broca's and Wernicke's area are quite different from one another:	
Damage to Broca's Area (Broca's aphasia) • prevents a person from producing speech • person can understand language • words are not properly formed • speech is slow and slurred.	Damage to Wernicke's Area (Wernicke's aphasia) • loss of the ability to understand language • person can speak clearly, but the words that are put together make no sense. This way of speaking has been called "word salad" because it appears that the words are all mixed up like the vegetables in a salad.

Broca's Aphasia
https://www.youtube.com/watch?v=f2IiMEbMnPM

Wernicke's Aphasia
https://www.youtube.com/watch?v=aVhYN7NTIKU

Interview with an aphasic person

https://www.youtube.com/watch?v=u09gaosZCVg

The Brain - Language and speech, broca´s and wernicke´s area
https://www.youtube.com/watch?v=5k8JwC1L9_k

- Lateralization

Specialization of the two halves of the brain

More lateralization, less plasticity (one area of the brain becomes less able to assume the functions of another in the event it is damaged)
Critical Period Hypothesis

However, it is not an "all or nothing" situation
Obler and Gjerlow (1999:11–12): *"while localizing language phenomena in the brain is the eventual goal of neurolinguistics, we no longer expect that there are language areas that are entirely "responsible" for language, or even "dominant" for language, to be contrasted with areas that have nothing to do with it"*

- (Bi-)Multilingualism and brain

1). How independent are the languages of multilingual speakers?

Ervin and Osgood (1954; following Weinreich 1953): three-way possibility: coordinate, compound, and subordinate bilingualism

Coordinate refers to parallel linguistic systems, independent of one another; compound to a fused or unified system; and subordinate to one linguistic system accessed through another.

2). How are multilingual language structures organized in relation to one another in the brain? Are both languages stored in the same areas?

Findings: For at least some multilinguals, it appears that L1 and L2 are stored in somewhat different areas of the brain, but both are predominantly in (probably overlapping) areas of the left hemisphere. However, the right hemisphere might be more involved in L2 than in L1.

3). Does the organization of the brain for L2 in relation to L1 differ with age of acquisition, how it is learned, or level of proficiency?

Findings: age of acquisition influences brain organization for many second language learners
Individuals who acquire L2 later in life show more right-hemisphere involvement

It is possible that the organization of L2 knowledge is more diffuse for lower levels of proficiency and more compact for highly fluent L2 users

4). Do two or more languages show the same sort of loss or disruption after brain damage? When there is differential impairment or recovery, which language recovers first?

Not only can different languages be affected differentially by brain damage, but different abilities in the same language many be differentially impaired