**CLASS 4 INTRO to the BRAIN: Injuries, aphasia (SEDIVY ch. 3, part I)**

**GIVEN: J. Elman, 20-35 and 44-53**

***BRAIN*** *is inscrutable;*

*is not static but constantly responding to stimuli;*

*is a lump of dense tissue of interconnected cells;*

*consists of white tissue bundles activated by neural impulses that interconnect regions of grey matter /neocortex involved in processing a function;*

*is not composed of processing centers dedicated to particular tasks but shared in the tasks (e.g. when thinking of running, when comparing objects, etc. etc.);*

*these tasks and functions do not align unambiguously with tissues and pathways but are intertwined;*

*LANGUAGE is a phenomenon organized within these neural pathways;*

*No separate, identifiable language module dedicated to just language and independent of intelligence exists in the brain.*

= THE CURRENT THEORY OF HOW BRAIN FUNCITONS FOR LANGUAGE.

To what cognitive abilities is the emergence of human language linked?

What features of this language support communication and information transfer?

What is the relationship of language usage and functions to the brain?

Are the following hypotheses sound?

Combining sounds into words is housed in the same system as combining words > sentences;

Understanding word meanings belongs to the same system as choosing words to convey what’s intended.

**BRAIN ANATOMY**

**brain** lateralization evident in contra-lateral processing of language:

each brain half controls movement and feeling in the opposite half of the body, and processes information such as language; physical coordination and taking in complex information require both sides of the brain to work together

**SPLIT BRAIN condition causes** FUNCTIONAL DISCONNECT (muted communication) **reflected in language usage**

Experiments of M. Gazzaniga with split-brain patients

**Brain damage early in life gets compensated by other brain areas taking over even if it was in the left hemisphere.**

LEFT HEM WEB 3.2-3

analyzes through right visual cortex

deals with lexicon and syntax, writing and speaking

includes 2 hotspots coordinating linguistic activity in neural tracks

tracts for **how** is an object used vs. **what** is it/ what is seen?

**APHASIA - Broca's, Wernicke's, et al. Elman, 22:20-**

[*https://www.youtube.com/watch?v=eYVKxZszofE*](https://www.youtube.com/watch?v=eYVKxZszofE)

APHASIA = outcome of damage to the visual, auditory or articulatory cortex evident in malfunctioning in producing and understanding language:

e.g. reading involves visual, auditory as well as articulatory cortex…

the visual cortex processes the written word (size, shape, color…)

the auditory cortex transforms the visual into auditory perception

**BROCA’s a. – haulting, dysfluent l. because** BROCA’s is the motor/ expressive region

if injured > problems w. word retrieval, matching word to meaning, speech fluidity, sentential breaks and intonation

articulation for language is impaired (but not lips or tongue movement)

comprehension is not impaired

near BROCA’s region – a region of lip and mouth control for language

a bit further - a region of hand, fingers and arms control (that colonize the next-door region in deaf-mute speakers)

WERNICKE’s area, if injured > problems with comprehension but fluid speech

functional disconnect of articulation and meaning

able to say routine phrases but no thoughtful ideas

**RIGHT HEM** is connected to the left through **corpus callosum**

analyzes through left visual cortex

deals w linguistically expressed emotion

deals w understanding space relations and basic routine speech

**NEOCORTEX**

The six-layer **cortex** is a distinguishing feature of **mammals** forming 76% of the entire brain and distinguishing us from our closest living and extinct relatives.  <http://dev.biologists.org/content/141/1/11>

**WHITE MATTER of the NEOCORTEX**

is the communication network in-between the various gray matter regions where the processing is done, on the one hand, and between the gray matter and the rest of the body, on the other;

**CORPUS CALLOSUM** [https://www.medicalnewstoday.com/articles/318065.php#](https://www.medicalnewstoday.com/articles/318065.php)

… is the connective pathway between the left to the right side of the brain; sitting inthe centerof the brain (10 cm long, shaped like the letter C);

cc gets formed between [12 and 16 weeks](http://nodcc.org/corpus-callosum-disorders/#cc) after conception and near the end of the first trimester of pregnancy, and continues to develop throughout childhood until abt 12 years old, then remains unchanged into adulthood and throughout the rest of life.

**BASAL GANGLIA** – located forebrain internal where it regulates voluntary motor movement and some language functions, e.g. sequencing of sounds and sequencing of words; [procedural learning](https://en.wikipedia.org/wiki/Procedural_memory), [habit learning](https://en.wikipedia.org/wiki/Habituation), [conditional learning](https://en.wikipedia.org/wiki/Conditional_learning); [eye movements](https://en.wikipedia.org/wiki/Eye_movement); [emotion](https://en.wikipedia.org/wiki/Emotion); sequencing of words into a sentence, planning sequence of things to do.

ancestral part of brain recruited for language in Homo sapiens;

dysfunction results in behavior disorders ([Tourette syndrome](https://en.wikipedia.org/wiki/Tourette_syndrome" \o "Tourette syndrome), [obsessive–compulsive disorder](https://en.wikipedia.org/wiki/Obsessive%E2%80%93compulsive_disorder" \o "Obsessive–compulsive disorder), [addiction](https://en.wikipedia.org/wiki/Addiction)) and movement disorders ([Parkinson's disease](https://en.wikipedia.org/wiki/Parkinson%27s_disease" \o "Parkinson's disease)) as well as cognitive deficits similar to those that result from damage to the [prefrontal cortex](https://en.wikipedia.org/wiki/Prefrontal_cortex" \o "Prefrontal cortex).

### **FRONTAL LOBE** [https://www.spinalcord.com/frontal-lobe](https://www.spinalcord.com/frontal-lobe )

the home of much of what makes us human - involved in **higher cognitive functions**;

activated for language very early in life through „joint attention“ and imitation skills;

involved in everything from movement to intelligence;

helps us anticipate the **consequences** of our actions, and aids in the **planning** of future actions; enables overriding or suppressing socially unacceptable responses as well as differentiation tasks, integrating memories associated with emotions (derived from the input of the brain's [limbic system](https://en.wikipedia.org/wiki/Limbic_system" \o "Limbic system)) that get modified to fit socially acceptable norms;

is the newest part of the brain evolutionarily and the last to develop > both highly malleable and susceptible to developmental damage;

is situated just behind the forehead and under the frontal skull bones of each [hemisphere](https://en.wikipedia.org/wiki/Cerebral_hemisphere" \o "Cerebral hemisphere) (in front of the [parietal lobe](https://en.wikipedia.org/wiki/Parietal_lobe" \o "Parietal lobe) and the [temporal lobe](https://en.wikipedia.org/wiki/Temporal_lobe" \o "Temporal lobe)), separated from the parietal lobe by a [groove](https://en.wikipedia.org/wiki/Sulcus_(neuroanatomy)" \o "Sulcus (neuroanatomy)) between tissues - [central sulcus](https://en.wikipedia.org/wiki/Central_sulcus" \o "Central sulcus), and from the temporal lobe by a deeper groove - [lateral sulcus](https://en.wikipedia.org/wiki/Lateral_sulcus" \o "Lateral sulcus) (Sylvian fissure);

central to voluntary movement - houses the primary motor cortex regulating walking, et al.

**That l. is networked throughout w non-linguistic cognition implies that the left hemisphere (in charge of seeing language, hearing l., comprehending, articulating l.) is networked as follows:**

to articulate implies moving lips, imagining how words sound or are written, and linking them to meanings; and activates also an area for analyzing syllables and phonology

to share or comprehend meaning happens in diverse areas

to remember happens in diverse areas depending on what it is to be remembered – shopping list, sequence of #s, an event, a story…

showing and saying what’s *a spiral* activates regions of articulation and comprehension but also the visual cortex imagining spiraling

saying *cow* activates auditory cortex as well as the area of imagining the sound

saying *he kicked me* activates speaking areas and the leg movement area

externalizing thoughts linguistically > **dorsal track** for complex thoughts vs. **ventral track** for simple sentences

hearing sounds is divided > affective tones/sounds vs. language sounds

tones, long sounds, clicks tracked depending on whether linguistic or paralinguistic

hearing *sin* and *thin*, *sit* and *seat* activates also the area for analyzing phonology

language signing activates different cortical areas than gesturing

**Brodman’s anatomy vs. functional anatomy**