**Lateralization**

- Left Hemisphere dominance in speech production in 95% of right handed and 70% of left handed people
- Left -> Timing, Sequence of events
- Right -> Analysis of simultaneous streams of info. Emotion expression and recognition (face and voice)
  Involved in global perceptions (maps)
Language

- Recall the split brain patients: Using words and pictures tests
- Do animals have language: Maybe... to some extent...
- Is sign language lateralized? Yes
- Speech production vs Speech Comprehension

Monkey Language: Up to 400 symbols

Signing Deficits: Left hemisphere
Language: Speech Production

Perception Memories -> Verbal Thoughts -> Broca’s Area (Inferior Frontal Lobe)

- Broca’s Aphasia: Deficit in verbal expression of thought (slow speech) but comprehension is (mostly intact) Deficit in function/ relation
- Normal in content words.
- Function Words (grammar-related); a, some, about, around, below verbs.
- Content Words (object related) Chair, Cookies, Plate
Broca’s Aphasia

- People are aware of their deficits (hear themselves)
- Theory: Broca’s Area controls ‘motor programs’ for word production
- Control of tongue, throat, muscles, jaw, lips
- Other areas involved: Insular cortex and basal ganglia
- Broca’s Aphasia: 3 independent (?) components
- Articulation Deficits: Left insular cortex
- Anomia: Deficit in finding words
- Agrammatism: Deficit in the production/comprehension of word order (subject/complement) in symmetric cases
Wernicke’s Area

1. Deficit in recognizing words (including their own)
2. Deficit in comprehending the meaning of the words
3. Deficit in converting thoughts in words

Normal at producing speech like sounds

Normal at function words

Not aware of their own deficit. Normal at facial expression/face recognition normal prosody

Theory: Deficit in the memory of the sounds that make up words (pattern matching)
Wernicke’s Aphasia

Wernicke’s Aphasia: Deficit in recognition of spoken words. Pure word deafness

Cannot recognize spoken words (as if foreign language)

Due to: Disconnection: Auditory cortex $\rightarrow$ Wernicke’s area or damage to Wenicke’s area

Can read lips, read words, produce speech

Does comprehension involve ‘internal rehearsal’

There are motor neurons (tongue) activated when hearing speech: Mirror Neurons

Experiment: Subjects hear think about or say about that would involve tongue/ lips muscles (e.g. p) or not (‘t’) $\rightarrow$ same brain areas in all conditions
Continued:

Theory: Motor neurons feedback to brain, and help with the ‘recognition’ of words ‘mumbling’ = lack of inhibitory feedback control

Experiment: Subjects with ear plugs -> Auditory cortex activated when words are spoken aloud but not whispered
Theory: we use auditory feedback

Deficit in comprehension of word meaning

Transcortical Sensory Aphasia: Can repeat words (perception intact) but cannot understand/produce meaningful speech. Damage to the posterior language area (= Angular Gyrus)
Direct Pathway: Wernicke -> Broca

Deficit in converting thoughts into words

Attributing meaning to a word involves memories

Indirect Pathway

Wernicke -> Posterior Language Area (Meaning) -> Broca <--> Memories

Ex: Metaphors or ‘moral of the story’ need more than just comprehension also need memories and meaning

Conduction Aphasia: Meaningful speech, good comprehension, repetition is normal except for nonsense/meaningless words or sentences
Summary: Two pathways

Direct pathway: Speech, sounds, no meaning necessary. Foreign language.

Indirect pathway: Meaning Info. no sounds necessary. Need to access money.

Diffusion tensor MRI: Trace large nerve bundles.

Anomic Aphasia: Fluent and have well-formed speech.

Good Comprehension

Difficulty in finding words: Circumlocution

Problem finding verbs/ action (motor cortex)

Problem finding nouns (association cortex)
Aphasia in Deaf People:

Sign Language is a language

Mirror neurons in Broca’s area respond to perception of hand gestures

Speech production is influenced by perception of visual info

Speaking with your hands

Aphasia -> may also result in a deficit in the perception production of hand gesture (left hemi)

Prosody: Use of info to convey info

Grammatical info

Emotional Info
Affected in Broca’s Aphasia but not Wernicke Aphasia right hemp. Specialization

Stuttering:

1% of the population x3 more common in men

Deficit in planning/initiation of speech

Theory: Faulty auditory feedback from subject’s own speech (too fast?)