human communication

language
- language is lateralized
  - left hemisphere dominance in speech production in 95% of right handed people and 70% of left handed people
  - left: timing, sequence of events
  - right: analysis of simultaneous streams of information, emotion expression and recognition (face and voice), involved in global perceptions (maps)

- split brain patients: world and pictures test - trouble transferring information form the left hemisphere to the right hemisphere — they work independent of each other
  - severance of corpus callosum

speech production:
- perceptions/memories -> verbal thoughts -> brook’s area (inferior frontal lobe)
- broca’s aphasia: deficit in verbal expression of thought (slow speech) but comprehension is mostly intact
  - deficient in function/relation words but normal content worlds
  - function words: grammar related
  - content worlds: object related

language production:
- broca’s aphasia: people are aware of their deficits (they 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: three independent components:
  1. articulation deficits: left insular cortex
  2. anomia: deficit in finding words
  3. agrammatism: deficit in the production/comprehension of word order (subject/complements) in symmetric cases

wernicke’s area:
- wernicke’s aphasia
  1. deficit in recognizing words — including their own
  2. deficit in comprehending the meaning of words
  3. deficit in converting thoughts into words
  - normal at producing speech-like words
  - normal at function words. produce nonsensical content
- wernicke’s aphasia: not aware of their deficit. normal at facial expression/tone recognition. normal prosody
- theory: deficits in the memory of the sounds that make up the words — pattern matching of words

1. deficit in recognition of spoken words. pure word deafness
- cannot recognize spoken words— like a foreign language
- either a disconnection: auditory cortex not connected to wernicke’s area OR damage to wernicke’s area
- can read lips, read words, produce speech, recognize meaningful sounds

speech comprehension
- does comprehension involves ‘internal rehearsal’?
- there are motor neurons (tongue) activated when hearing speech: mirror neurons
- experiment: had subjects hear or think about or say words that would involve lips/tongue muscles (“P”) or not (“T”) same brain areas in all conditions
  - 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 in normal speech

2. deficit in comprehension of word meaning
   - transcortical sensory aphasia: can repeat words (perception intact) but cannot understand or produce meaningful speech
   - damage to the posterior language area (angular gyrus)
   - direct pathway: wernicke -> broca

3. deficit in converting throughout into words
   - attributing meaning to a word involves memories
   - indirect pathway: wernicke -> posterior language area (meaning) (associated memories) -> broca

autotopagnosia- difficulty in naming own body parts

conduction aphasia: meaningful speech, good comprehension, repetition is normal except for meaningless words or sentences

two pathways
  1. direct pathway: speech sounds, no meaning necessary. foreign language
     - arciate facetious, able to repeat unfamiliar words
  2. indirect pathway: meaning information, no sounds necessary. need to access memory
     - based on word meaning, not sounds
diffusion tensor mri: trace large nerve bundles

anomic aphasia:
  - fluent and have well formed speech— good comprehension
  - difficulty in finding words: circumlocutions
    - problem finding verbs or actions (motor cortex)
    - problems in finding nouns (association cortex)

aphasia in deaf people
  - also happens with sign language
  - mirror neurons in broca’s area respond to perception of hand gestures
-speech production is influenced by perception of visual/hand information—
speaking with your hands
aphasia: may also result in a deficit in the perception and production of hand gesture
(left hemisphere)

other aspects of speech:
- prosody:
  - use of inflection and intonation to convey information
  - grammatical information — ?
  - emotional information
- affected in broca’s aphasia but not in wernicke’s aphasia
- right hemisphere specialization

stuttering:
- 1% of the population; 3 times more in men than women
- deficit in planning/initiation of speech
- theory: faulty auditory feedback form subject’s own speech (too fast?)
- delayed auditory feedback decrease stuttering

reading:
- disorder of reading: alexia
  - inability to read (but not write). can recognize spelled words said aloud
  - perceptual disorder— damage to the primary visual cortex

the normal reading process:
- whole word: whole word recognition
- phonetic reading: letter recognition and phonetic coding (sounds of letters)

surface dyslexia
- deficit in whole word recognition. deficit in reading ‘exceptions’ to the pronunciation rules- knight as k-night not night
  - cannot use whole-word recognition
- left lateral temporal lobe damage

phonological dyslexia:
- deficit in reading unfamiliar words or non-words
  - able to use whole-word recognition but cannot read unfamiliar words
- damage left frontal lobe

neural substrate of reading
- primary visual cortex:
  1. ventral-> fusiform cortex (visual word form area) — whole word reading
  2. dorsal -> parietal cortex -> broca’s area — phonological reading