Language, Speech

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language is **brain's use of symbols for communication**; i.e. cognitive aspect of symbolic communication.

* *animal models* have limited role (in study of human language).
* **anatominės struktūros**, reikalingos kalbai, atsirado jau prieš 500.000 metų, tačiau ***kalba per se*** turbūt atsirado prieš 100.000 metų rytų Afrikoje.
* language is one of fundamental bases of *human intelligence* and key part of *human culture*.
* humans receive language through ***listening / reading***.

humans express language through ***speaking / writing***;

N.B. *speech* is vocal expression of language.

pediatric development stages

**6 months** – beginning of distinct **babbling**.

**1 year** – **1-word speaker** (language understanding, 1 or more poorly pronounced words).

**2 years** – **2-word (telegraphic) speaker** (žodynas > 50 žodžių, kalba dvižodėmis frazėmis).

**3 years** – **3 word sentences** (žodynas ≈ **1000 žodžių**).

**4 years** – close to **adult** speech competence.

anatomical basis

* localized to **neocortex**! (vs. **memory** and **learning** are functions of large parts of brain).
* human neocortical mantle is highly developed → speech and other intellectual functions.
* primary language areas are in **parasylvian area** of dominant (categorical) hemisphere:

**Wernicke center** – **auditory association cortex** - memory of images that represent word as heard / seen (*receptive speech*), i.e. comprehension of auditory / visual information (visual information prieš tai turi būti apdorota in angular gyrus).

*Planum temporale* (superior surface of temporal lobe posterior to Heschl's gyrus and extending to posterior end of sylvian fissure), is slightly larger on left (Wernicke center).

***Arcuate fasciculus*** – projection from Wernicke to Broca.

**Broca center** – **motor association cortex** - memory for word articulation (*expressive speech*);

processes information received from Wernicke area into detailed coordinated pattern for vocalization → projects pattern (via speech articulation area in insula) to motor cortex → appropriate movements of lips, tongue, larynx → speech.

**Angular gyrus** (behind Wernicke area and connected to it) processes information from ***read words*** in such a way that they can be converted into ***auditory forms*** of words in Wernicke area.

* į angular gyrus patenka informacija iš **unimodal association cortices** (tiek iš visual, tiek iš auditory); jei išgirstą / pamatytą žodį tereikia pakartoti, informacija iš Wernicke / visual association cortex į Broca eina aplenkdama angular gyrus.
* angular gyrus is **heteromodal association cortex** - semantic interpretation (meaning) and integration with other sensory modalities and passed experiences.



Second language & Broca area

* if individual learns second language in **adulthood**, portion of Broca area associated with it is ***adjacent to but separate*** from area associated with native language.
* in **children** who learn two languages **early in life**, there is only ***single*** area involved with both (children acquire fluency in second language more easily than adults!).

**Wernicke-geschwind model** for language & gestures

Person **names visual object**:



|  |  |
| --- | --- |
| Person is asked to **raise right hand**: | Person is asked to **raise left hand**: |
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N.B. norint pagal komandą pakelti kairę ranką, reikalingas corpus callosum

(jei jis pažeistas → kairės rankos **ideomotorinė apraksija**).

PET of left cerebral hemisphere:

**A:** **Looking at words** activates *primary visual cortex* and part of *visual association cortex*.

**B:** **Listening to words** activates area at *junction of temporal and parietal cortex*.

**C:** **Speaking words** activated *Broca's area* and adjacent frontal lobe.

**D:** **Thinking about words** activates *large areas* (including much of frontal lobe).



Disorders

If patient cannot talk properly consider five Ds:

1. Deafness
2. Dementia
3. Dysphasia
4. Dysarthria
5. Dysphonia.
6. **Language disorders** – kalbos, kaip *bendravimo priemonės*, sutrikimas. see S2 p.
7. **Speech disorders** – mechanical disorders of oral communication: see S3 p.

**dysphonia** – disturbance in *phonation-vocalization* (voice production).

**dysarthria** – disturbance in *articulation* of individual sounds.

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