

ENG124A: Language and Society

Lecture Notes –III

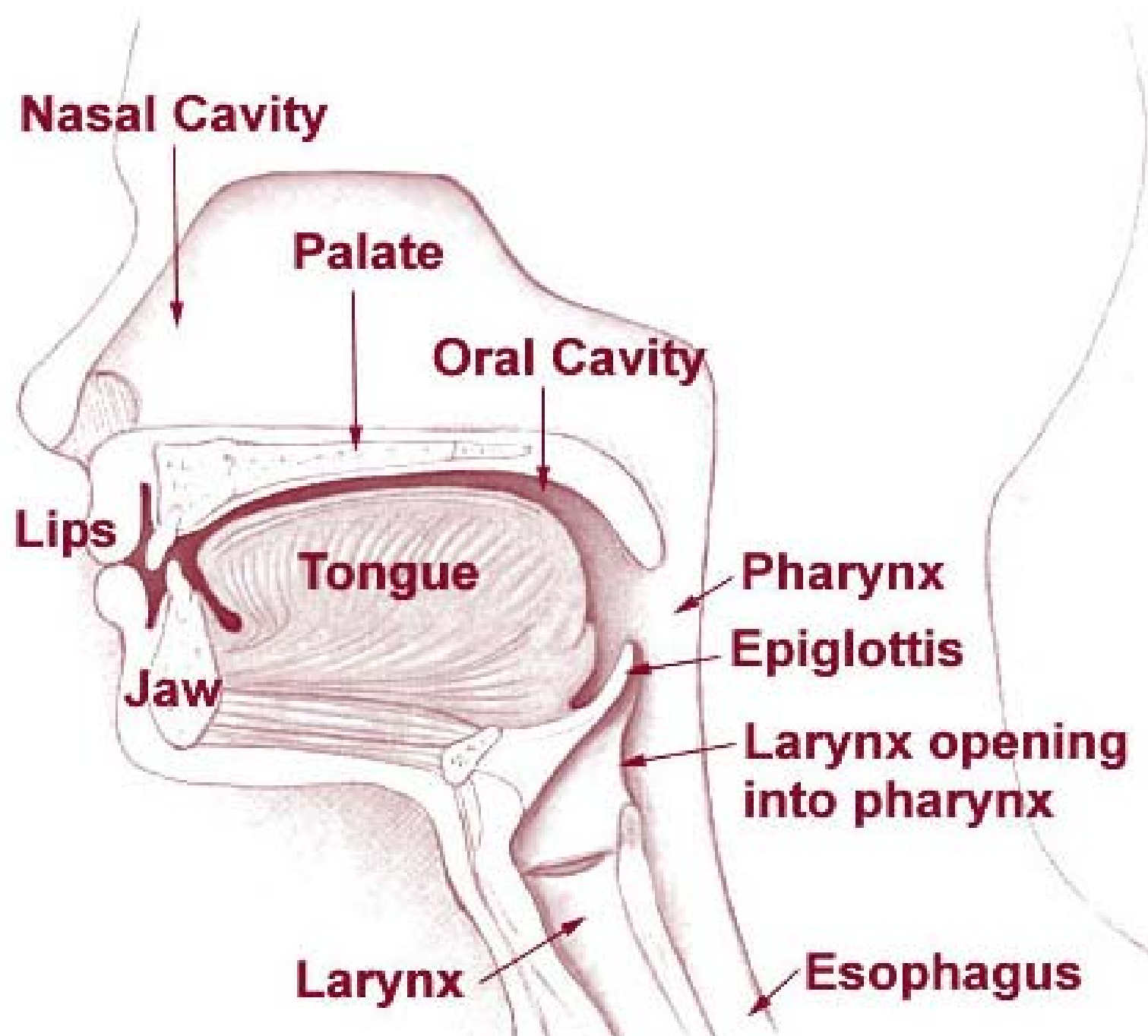
1. Anatomy of Speech
2. Neural basis of language

Modalities of Language

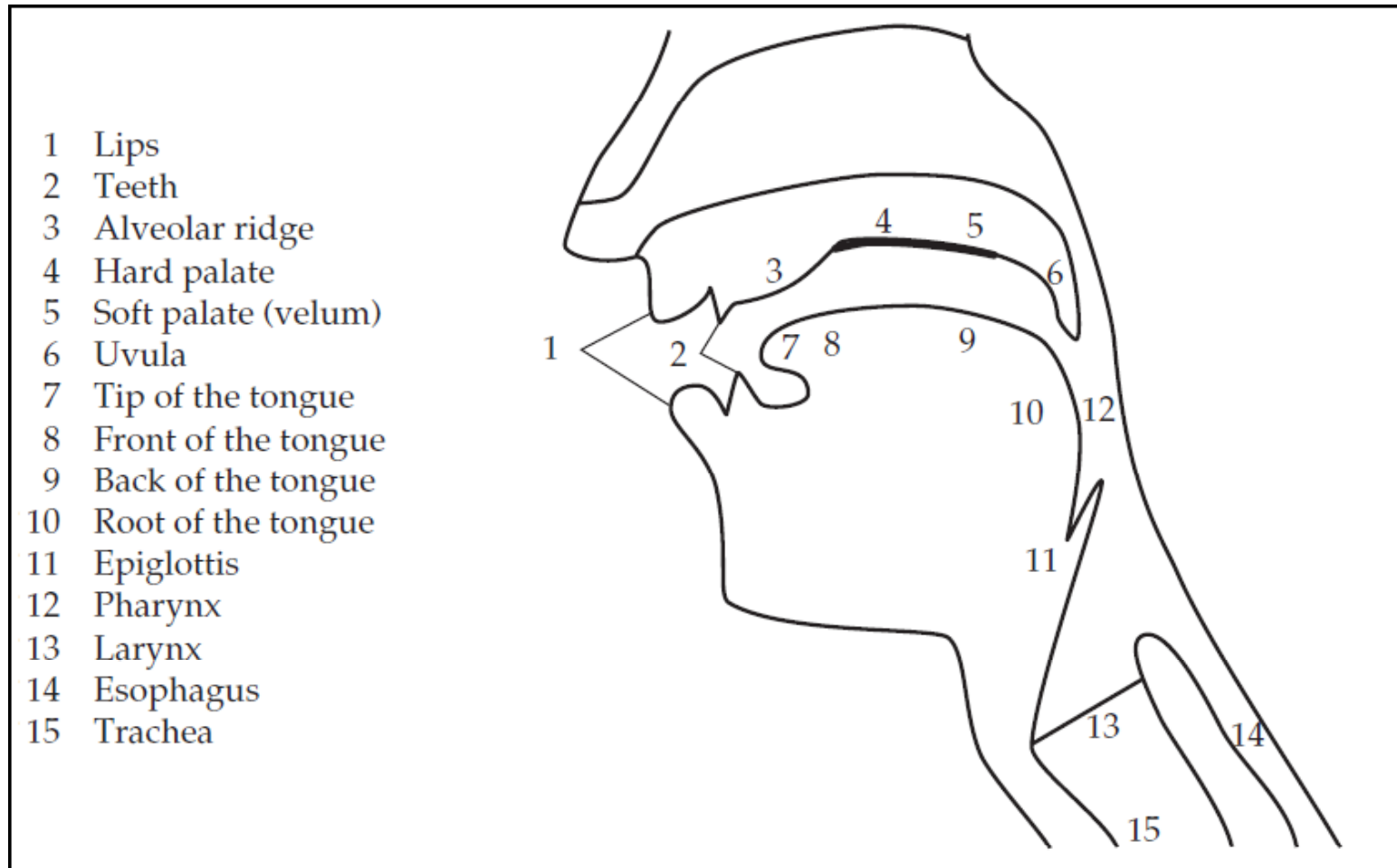
- Language and writing?
 - Primacy of speech/sign
 - Writing an accessory, a tool
- Anatomical architecture of language
 - Phonetics and Phonology: sound structure of language
 - International Phonetic Alphabet (IPA)
- Neural architecture of language
 - Neurolinguistics
 - Areas in the brain which are specialised for language

Anatomy of Speech

- Anatomical or physiological architecture of language
- A specialized articulatory apparatus
 - Vocal tract
 - Manipulation of airstream in the vocal tract
 - Various possibilities of articulation
- A universal set of sounds (as captured in the International Phonetic Alphabet (IPA))
- Specific languages choose a subset of these.



The Vocal Tract



Articulatory Phonetics

- **Vowels and Consonants**
- **Vowels** are sounds that have **no audible friction** caused by the narrowing or obstruction of some part of the upper vocal tract.
- **Vowels** vary in quality according to the degree of **lip aperture** and the placement of **the tongue** within the oral cavity.

Place of articulation

- **Consonants** are those sounds that have **audible friction** or **closure** at some point within the upper vocal tract.
- Consonant sounds may vary by **place of articulation**, i.e. the place in the vocal tract where the airflow is obstructed, commonly at the lips, teeth, alveolar ridge, palate, velum, uvula, glottis or epiglottis.

Manner of articulation

- **Consonants** are further distinguished by **manner of articulation**, or the kind of friction, whether full closure, in which case the consonant is called *a plosive*, or different degrees of aperture creating *fricatives, approximants* etc.
- Examples from English

Voicing

- Consonants can also be either **voiced** or **unvoiced**, depending on whether the vocal cords are set in vibration by airflow during the production of the sound.
- Voicing is what separates English [s] in *bus* from [z] in *buzz*, or the Hindi [क] from [ग] and [प] from [ब]
- Hindi *varnamala* is one of the most systematic alphabetical representations of articulatory phonetics.

Articulatory basis of Hindi Varnamala

- **Place of Articulation:** *kaṇṭhya* [क] series, *tālavya* [च] series, *mūrdhanya* [ट] series, *dantya* [त] series, *oṣṭhya* [प] series
- **Manner of articulation:** *sparśa* (Plosive): [क] etc.
anunāsika (Nasal): [ङ], [ञ], [ण], [न], [म]
antastha (Approximant): [य], [र], [ल], [व]
ūṣma/saṃghaṣhri (Fricative): [श], [ष], [स], [ह]
- **Voicing:** *aghoṣa* [क] and *ghoṣa* [ग] etc.
- **Aspiration:** *alpaprāṇa* [क] and *mahāprāṇa* [ख] etc.

Hindi Varnamala

- The study of articulatory phonetics was an ancient discipline in India – *śikṣā* as one of the *vedāṅgas*. (Others: *vyākaraṇa*, *nirukta*, *chandasa*, *kalpa*, *jyotiṣa*)
- The writing system for Sanskrit and its derivative languages is based on this study.
- The study of articulatory phonetics in The West is a 19th C phenomenon associated with Henry Sweet. The Writing System was already in place.

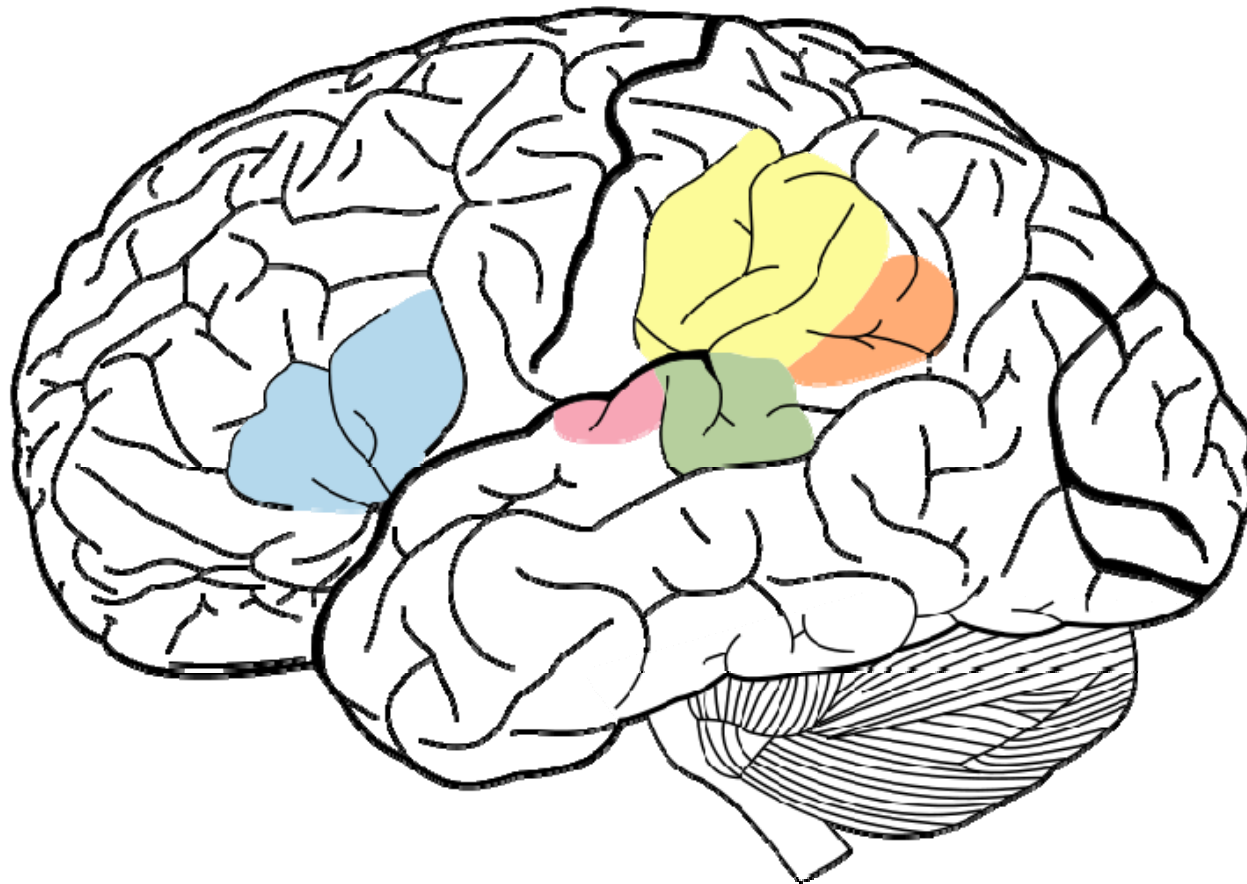
Sign Language

- The main articulators in sign language:
- hand shape, orientation, location, and motion, which correspond to manner of articulation in spoken language
- Shoulder movement, eyes, eyebrows
- Signing space

Neural architecture of language

- Where is language located in the brain?
- Earlier investigations: language impairments and the correlation with brain regions - Aphasiology
- With recent technological advances, neurolinguists use non-invasive techniques such as functional magnetic resonance imaging (fMRI) to study language processing in individuals without impairments.

Language areas in the brain



Language areas in the brain

- The **Angular Gyrus** is represented in orange.
- The **Supramarginal Gyrus** is represented in yellow.
- **Broca's area** is represented in blue.
Wernicke's area is represented in green.
- The **Primary Auditory Cortex** is represented in pink.

Language areas in the brain

- The brain is the coordinating center of all language activity; it controls both the mechanics of speech production and meaning comprehension.
- The **angular gyrus** (represented in Orange) is a region of the brain in the parietal lobe; it is involved in a number of processes related to language, numerical processing and spatial cognition, memory retrieval, attention, and theory of mind.
- The **supramarginal gyrus** (represented in Yellow) is involved with language perception and processing, and lesions in this region may cause receptive aphasia.

Language areas in the brain

- **Wernicke's area** ((represented in green), located in the left posterior superior temporal gyrus (or sometimes more generally posterior temporal lobe), is one of the two parts of the cerebral cortex linked, since the late 19th C, to speech.
- The region is associated with receptive aphasia, a condition in which there is a major impairment of language comprehension, while speech retains a natural-sounding rhythm and a relatively normal sentence structure.

Language areas in the brain

- **Broca's area** (represented in blue), located in the inferior frontal gyrus, is associated with expressive aphasia in which the patient knows what he/she wants to say, but cannot get it out.
- The patients are typically able to understand what is being said to them, but unable to speak fluently.

Language areas in the brain

- The **primary auditory cortex** (represented in pink) is the part of the temporal lobe that processes auditory information in humans and other vertebrates.
- It is a part of the auditory system, performing basic and higher functions in hearing.

Language areas in the brain

- Both expressive and receptive aphasia also affect the use of sign, in analogous ways to how they affect speech.
- Expressive aphasia causes signers to sign slowly and with incorrect grammar, whereas a signer with receptive aphasia will sign fluently, but make little sense to others and have difficulties comprehending others' signs.