# **Sign Languages**

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Core 103, USC

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## Learning and using two languages

## Consequences of bilingualism

# **Phonology of signs**

## Signs are made up of a small set of articulatory components

* hand shapes, locations, movements, orientations, etc.
* other sign morphemes
* Changes in one (or more) of these sign components create contrastive units

# **Signs are arbitrary**

* Signs do not reflect the form of movement of the object, or concept they represent

**Signs are iconic**

* Some signs do reveal information that directly represent some aspect of the concept being referred to

# **Biological differences between sign vs speech**

## Different modes of linguistic articulators

* Speech: Vocal tracts (tongue, lips, velum, larynx)
* Sign: Hands, arms, head, shoulder, face
* Perceptual comprehension systems
* Speech: Auditory (& visual)
* Sign: 100% visual

# **Categorical Perception in Handshape**

# **Sign Perception between signers and non-signers (speakers)**

* Similar perceptual boundaries between signers and non-signers
* But discrimination is different
* Peak accuracy occurs at the category boundary **only for signers**

# **Discrimination paradigm with infants**

* Around 3-5 months, both hearing and ASL babies discriminate handshapes in sign
* Sign-exposed babies (ASL infants) become perceptually sensitive to handshape categories that are relevant to sign language
* Non-sign-exposed babies (hearing infants) lose the ability to perceive handshape contrasts
* Signers develop special abilities for sign perception that are similar to speech perception

# **Slips of the hand (aka sign errors)**

* Errors in speech (or **slips of the tongue**) provide evidence for phonological units
* e.g., Handshape anticipation errors
* **Signs are not holistic gestures but are composed of smaller parts**

# **The bases of human language**

## Sign and speech exhibit common structural properties and cognitive systems

## **Are key brain areas for spoken languages also recruited for signed languages?**

## **Broca’s area:** Important for speech perception

## **Wernicke’s area:** Important for speech comprehension

## Both Broca’s area and Wernicke’s areas are active in sign production & perception

## **The key brain areas for speech are also recruited for sign**

# **Spatial system in sign languages**

* **Spoken languages:** prepositions & locative affixes express location
* **Signed languages:** The location of the hands in space express location
* No single sign to mean *in, on, under*
* **What are the neural consequences of the spatial language system found in sign languages?**
* No recruitment of brain areas for human language for **location signs**
* Also no categorical perception on location (point of articulation) of signs

# **Summary so far**

## **Signs have sub-lexical structures**

## **Sign Perception of Handshapes** are **categorical**

### 3-5 months-old babies (both hearing and ASL) have **universal sign categories**

* Around 1-year-old, **only ASL infants** continue to perceive handshape contrasts
* (But location signs do not show categorical perception)
* **Slips of the Hands** (Sign errors): anticipation error
* **Same key brain regions** for human language are recruited for **spoken and signed language processing**
* **Spatial system in sign languages**
* No recruitment of brain areas for language in processing **location signs**

# **Signs and pantomimes**

### For **pantomimes**, gesture forms are determined by the properties of the object to be manipulated

### For **sign language**, form is determined by the phonological specification stored in the lexicon

*Results*

### Pantomime generation (Deaf vs. Hearing): more activation for signers in general

* Handling verbs for signers: Activation in the language area
* “Handling verb” pantomimes for speakers: No activation in the language area
* Handling verb signs vs. Non-pantomimic signs: No difference in activation for different verb types
* **The neural substrates for signed language and gesture production (i.e., pantomimes) are NOT identical**
* Signs: Activation in the Broca’s area
* Pantomimes: Activation in the spatial attention cortex (for action planning & motor control)

# **How do “bimodal” bilinguals exploit the parallel activation of two languages?**

### Bimodal bilinguals utilize both signed and spoken languages

## Language mixing in bilinguals

* **Inhibition:** Unimodal bilinguals must code-switch between languages
* **Dual lexical selection:** Bimodal bilinguals can also code-blend (produce two modes simultaneously)

# **ASL-English bilinguals prefer to *code-blend***

### **Dual lexical selection** is less costly than language **inhibition**

* Bimodal bilinguals often produce ASL signs when talking to a non-signer

**The face of bimodal bilinguals**

* **Raised eyebrows** mark ***if*-clauses** & **Furrowed eyebrows** mark ***wh*-clauses**
* When bimodal bilinguals produce English, grammatical ASL facial expressions leak out
* Bilinguals time their facial expressions with ***the onset of the clause***, unlike monolingual non-signers (irregular & variable timing)

# **Co-activation between sign and speech**

* Unimodal bilinguals: language co-activation occurs during auditory word recognition
* **Do bimodal bilinguals look at phonologically related words in ASL when hearing a spoken English word?**
* Bimodal bilinguals look more to the **ASL competitor**

# **Today’s summary**

## **Sign perception** is like speech perception (categorical handshape perception)

## Key brain regions for speech processing are recruited for sign production/perception

* Only **signed languages** (iconic handling verbs & non-pantomimic verbs), but not **pantomimes**, show **neural activation in the language area**
* Bimodal bilinguals prefer **code-blends** over **code-switches**
* When bimodal bilinguals produce English, manual and facial ASL leak out
* **Language co-activation** (sign) occurs during auditory word recognition (speech) for bimodal bilinguals