

Sign language & the brain

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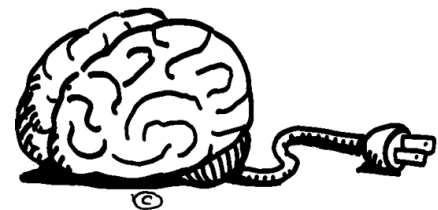
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Overview of topics

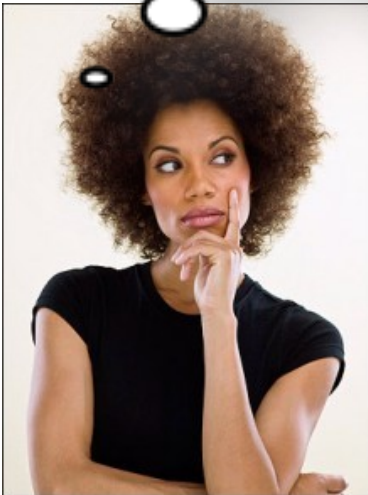
- Sign language research as a window into the brain
- Aphasias and hemispheric damage:
Does brain damage affect sign languages the same way it does spoken language?
- Coda/Koda research:
What do bimodal bilinguals tell us about how bilingualism works?



Questions we might ask

Can sign+speech bilinguals really produce two languages at the same time? What does that tell us about their brains?

The left hemisphere is specialized for language, while the right hemisphere is specialized for visual-spatial information. What about visual-spatially organized languages like ASL?



Brain studies: Quick review

Lateralization

- Left hemisphere controls right side of body, right hemisphere controls left side of body
- Left hemisphere important for:
 - Perception and production at **local** level (details)
 - Selection and combination of sounds into words
- Right hemisphere important for:
 - Perception and production at **global** level (big pic)
 - Visual-spatial orientation
 - Maintenance and comprehension of discourse

Brain studies: Quick review

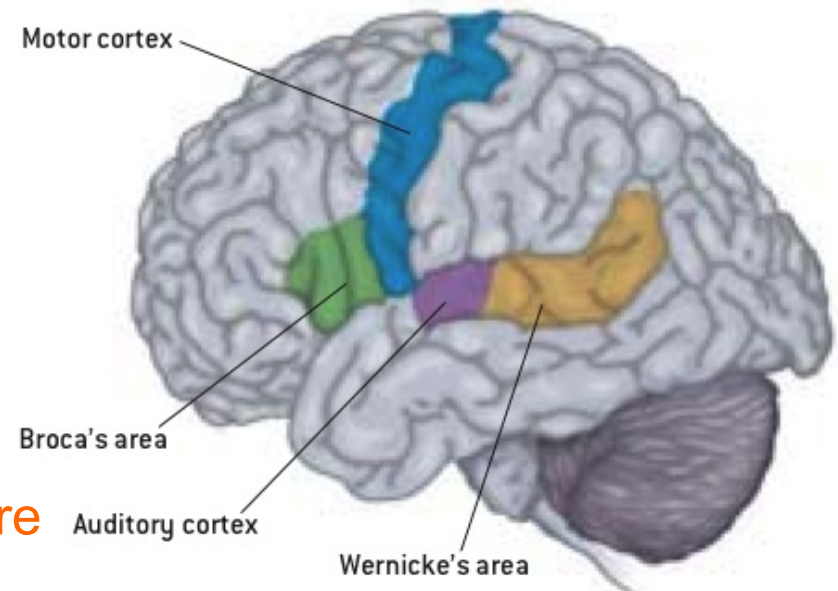
Aphasia for spoken language (left hemisphere damage)

- **Broca's aphasia**

- near motor cortex for speech articulators
- **slow and laborious speech, but comprehension mostly normal**
- loss of grammatical features of language

- **Wernicke's aphasia**

- near auditory cortex
- **rapid and fluent speech, but severe difficulty with comprehension**
- intact grammatical structure, but makes no sense



Broca's and Wernicke's: Deaf patients

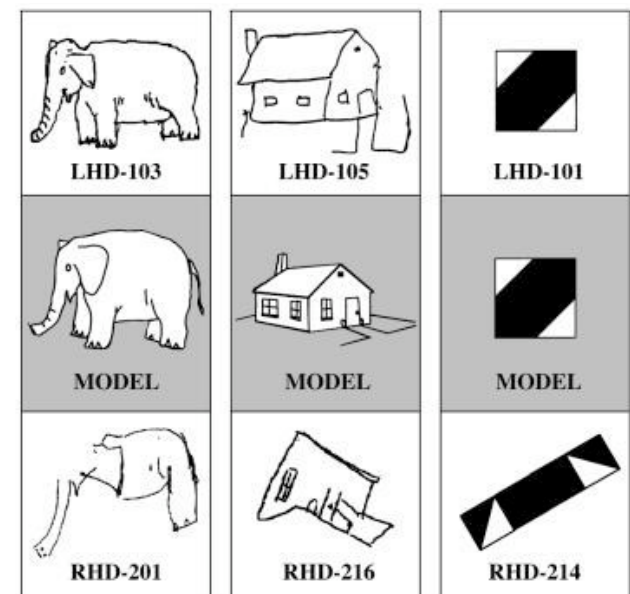
Hickok, Klima & Bellugi 1996

- Deaf Broca's aphasics
 - sign with great difficulty, but can use hands to do non-linguistic tasks (eg. drawing, meaningless gestures)
 - have excellent comprehension
- Deaf Wernicke's aphasics
 - sign fluently but incoherently
 - have difficulty comprehending others' signing
- ➡ Aphasias are not specific to speech, but rather to *language*.

Different effects of LHD and RHD

Visuospatial impairment

- RHD signers have impaired visuospatial abilities:
 - Perception of spatial orientation
 - Creating spatial perspective in drawings
 - Interpreting spatial configurations
- LHD signers omit details
- RHD signers struggle with global configuration



Different effects of LHD and RHD

Discourse processes

- RHD have difficulty with extended discourse [Hickok et al. 1999]
 - Difficulty sticking to topic; tangential utterances
 - Difficulty maintaining spatial locations for referents across discourse
 - Problems with referential shift and nonmanuals
 - compensate by overusing full NP labels
- ➡ Discourse cohesion depends on global level organization, which is RH dominant.

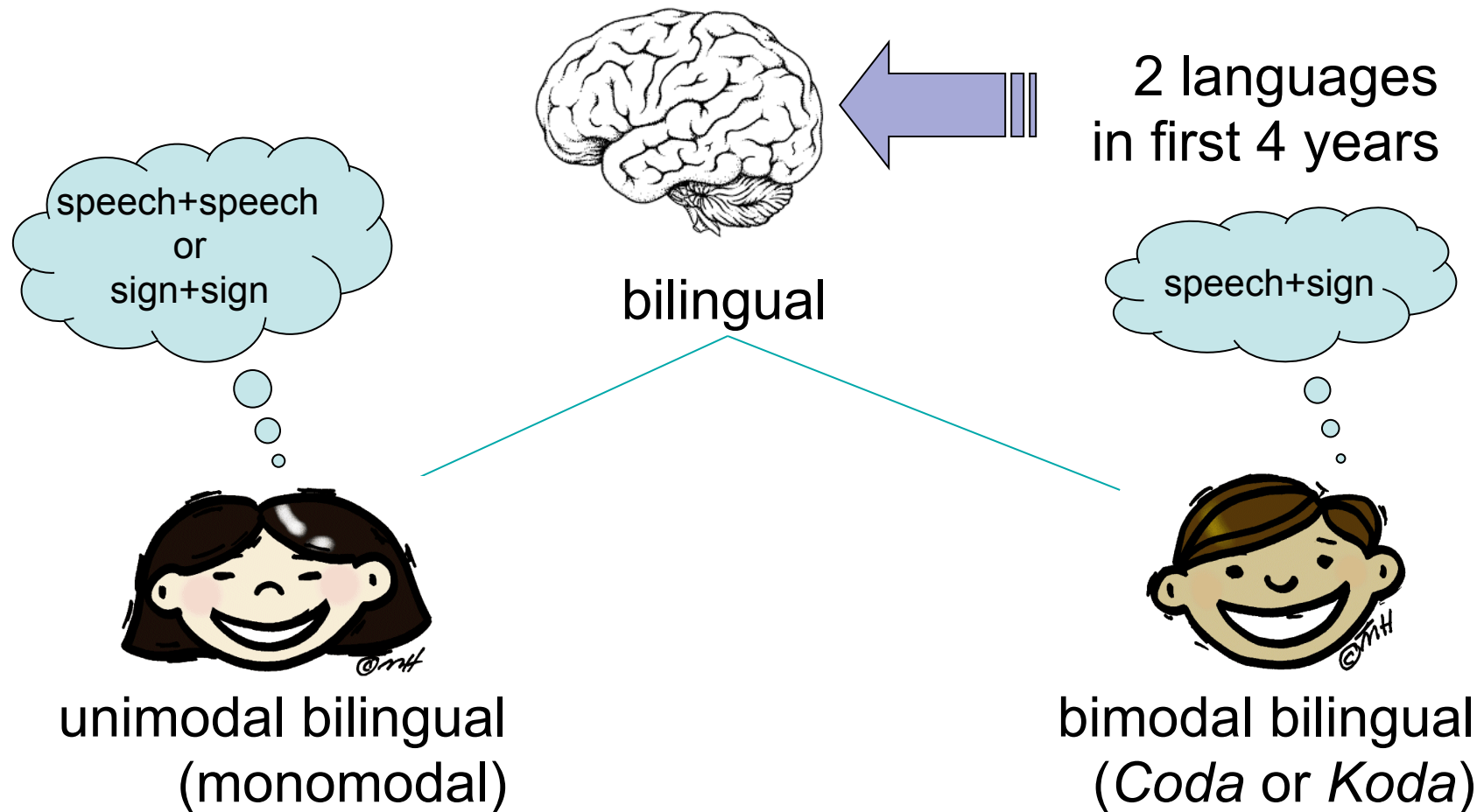
Sign language and the brain

Conclusions

- The LH is specialized for all language, whether spoken or signed. This tells us that its importance for language is not due to relationships to speech and hearing.
- Comprehension and production of sign language, although a visuospatial system, is independent of non-linguistic visuospatial abilities such as copying a drawing.

Bilingual acquisition (BFLA)

Unimodal vs. Bimodal bilingualism



Some bilingual phenomena that sign language linguist types talk about

- Language mixing (code-switching)
 - What kind of mixing goes on for bimodal bilinguals?
- The “Bilingual Cognitive Advantage” (Ellen Bialystock)
 - What’s really behind these advantages? Do they apply to bimodal bilinguals?
- Priming from one language to the other
 - Can a sign language prime a spoken language, and vice versa?

Bimodal bilingual code blending (NB: this is NOT Sim-Com)

Code blends are much more common than code switches for both adult and child bimodal bilinguals (Emmorey et al. 2008; Petitto et al. 2001).

“So Sylvester, who’s on the ledge, **[jumps into]** the apartment.”



JUMP



NOW



**WALK-BACK-AND-FORTH-
HUNCHED-OVER**

“So **[now]** he’s like **[you know scanning y’know the streets. He’s walking back and forth]** trying to figure out what to do.”

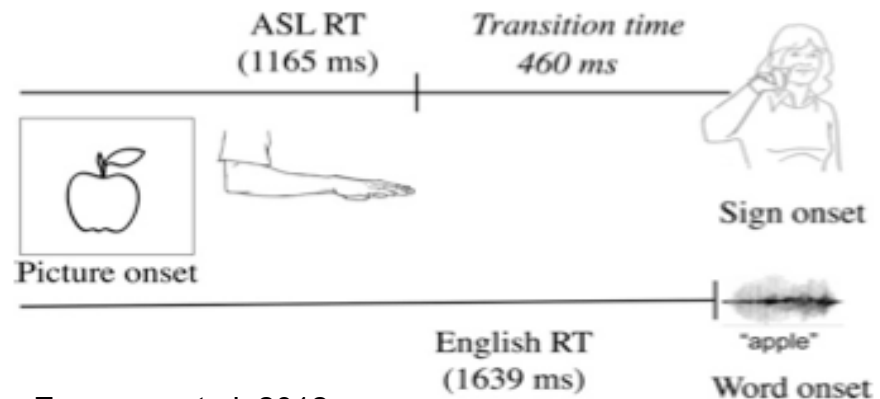
Bilingual Cognitive Advantage

- Unimodal bilinguals
 - Must constantly suppress one language to produce the other
 - Perform better than monolinguals on *executive function* tasks that require you to ignore extraneous or distracting information (e.g. Stroop task)
- In contrast, Emmorey et al. (2008) found that bimodal bilinguals:
 - did not perform better than monolingual controls.
 - have the option of code blending, so have less practice suppressing one language, thus no benefit?

Bimodal bilinguals: Dual activation

- Inhibition of one language is more costly than just leaving both “on”
 - Codas asked to identify drawn objects in code-blend were as fast/faster than in ASL alone (Emmorey et al. 2012)
 - Codas “leak” certain NMS while talking to nonsigners (Pyers and Emmorey 2008)

- Koda voicing when signing with Deaf (Petroj et al. 2013)



Emmorey et al. 2012

Bimodal bilinguals: Cross-modal activation

- More evidence for both languages being “on” at all times: cross-modal priming
 - Deaf readers slower to judge English words as semantically unrelated when the ASL TEs are similar (Morford et al. 2011)



MOVIE



PAPER

Are “paper” and “movie” semantically related?



Conclusions

- Research on sign languages and sign language users has increasingly demonstrated that at a fundamental level, language is language, no matter what its modality. [UNIVERSALITY]
- At the same time, signing brains present fascinating differences from speaking brains, broadening our view of how we expect languages to look and behave. [MODALITY EFFECTS]

Some useful references

on sign language, brain studies & bimodal bilingualism

- Boudreault, P. & Mayberry, R. I. (2006). Grammatical processing in American Sign Language: Age of first-language acquisition effects in relation to syntactic structure. *Language and Cognitive Processes*, 21, 608-635.
- Emmorey, K. (2001). *Language, cognition, and the brain: Insights from sign language research*. Psychology Press.
- Hickok, G., Bellugi, U., & Klima, E.S. (1998). The neural organization of language: Evidence from sign language aphasia. *Trends in Cognitive Sciences*, 2, 129-136.
- Klima, E.S. & Bellugi, U. (1979). *The signs of language*. Cambridge, MA: Harvard University Press. (Reprinted in Paperback, 1988.)
- Lillo-Martin, D., de Quadros, R. M., Pichler, D. C., & Fieldsteel, Z. (2014). Language choice in bimodal bilingual development.
- Visit bibibi.uconn.edu for more publications on bimodal bilingual kids