

Psych 56L/ Ling 51: Acquisition of Language

Lecture 3 Biological Bases of Language I

Announcements

No office hours 10/7 or 10/9. (Sorry!)

Please email me (lpearl@uci.edu) to schedule an appointment if you need to see me outside of class this week.

Language as a Human Universal



Language as a Human Instinct



Fish pretty much always swim.



Birds pretty much always fly.

Humans pretty much always....talk.



More than culture

Language is more than simply a cultural habit that one generation copies from previous ones.

If there is no language model to learn from, humans will spontaneously *create* language.

pidgins & creoles

the case of Nicaraguan Sign Language



Pidgins

Pidgin: language created by adults from different language backgrounds who need to communicate with each other

Example:

Hawaiian Pidgin English: created by immigrant workers from Japan, Korea, and the Philippines who worked for English speakers

Ifu laik meiki, mo beta make time, mani no kaen hapai.

If like make, more better die time, money no can carry.

"If you want to build (a temple), you should do it before you die - you can't take it with you!"

Pidgins

Pidgin: language created by adults from different language backgrounds who need to communicate with each other

Another example:

Russenorsk: from Russian and Norwegian fishermen who had to communicate with each other



(More than 100 pidgin languages currently in use)

Creoles

Pidgins tend to be structurally simple.

However, when children born into a community where a pidgin is the only language acquire that pidgin as their native language, they create a *creole*.

Creoles are grammatically more complex, containing structures that are not in the pidgin language the children had as a model. Creoles often share the same features.

Put simply: children add something that wasn't already there!

What creoles tell us

- (1) The existence of language in a community does *not* depend on someone importing a language for a community to learn. (Vocabulary may be borrowed, grammar is not.)
- (2) When children acquire language, they sometimes add *something extra*, which is sometimes thought to be universal to human languages and part of children's innate endowment for language.
- (3) Creoles tend to share the same features - which suggests human minds may tend to construct languages the same way.

From pidgin to creole: Nicaraguan Sign Language

In 1978, the Nicaraguan government opened the nation's first public schools for the deaf. The deaf children who entered had no common sign language, but did have their own individual *home sign* systems.

Once the children were in contact with each other, a new common sign language emerged: Nicaraguan Sign Language.



From pidgin to creole: Nicaraguan Sign Language

Ann Senghas (Senghas & Coppola 2001) studied the language of children who arrived to the school at a young age vs. children who arrived when they were older.

Language of younger children:
structurally complex (more like creole)



Language of older children: structurally simpler (more like pidgin)

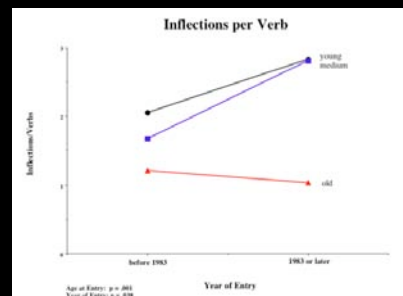


Figure 2. The number of inflections per verb is greater overall for signers who entered the community in 1983 or later, and for signers who were exposed to the language at a young or medium age. The young and medium Age at Entry signers are particularly affected by a later Year of Entry.

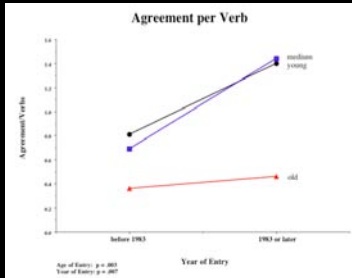


Figure 3. The number of inflections showing agreement per verb is greater overall for signers who entered the community in 1983 or later, and for signers who were exposed to the language at a young or medium age. The young and medium Age at Entry signers are particularly affected by a later Year of Entry.

From pidgin to creole: Nicaraguan Sign Language

Use of spatial modification: if two signs are made in the same spatial location, it indicates that one sign modifies the other (ex: "tall" in same location as "king" = "tall king")

Language of younger children: more spatial modification (the younger they were, the more they used it)



Language of older children: less spatial modification

From pidgin to creole: Nicaraguan Sign Language

Implication: (young) children are the driving force of language creation here; they are the innovators and the ones who retain the more complex structures that result from these innovations



Language Bioprogram Hypothesis

Proposed by Derek Bickerton: the capacity for language creation seen in creolization and the development of NSL is the same capacity that underlies language acquisition.

Humans have an innate core knowledge about the structural properties human languages have.



In accord with nativist/generativist approach to language acquisition.

Language Bioprogram Hypothesis

Proposed by Derek Bickerton: the capacity for language creation seen in creolization and the development of NSL is the same capacity that underlies language acquisition.

But the knowledge may not be language-specific! It could be statistical learning or pattern analysis abilities.

Some support from Hudsom-Kam & Newport (2005): children given inconsistent input make it more regular; adults given inconsistent input match the inconsistency



Elizabeth Bates

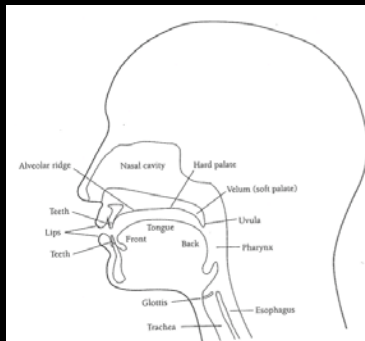


Anatomy & Language



The Human Vocal Tract: A Finely Honed Instrument

Speech is produced when air from the lungs exits the larynx and is filtered by the vocal tract above the larynx: glottis, pharynx, uvula, velum, hard palate, tongue, nasal cavity, alveolar ridge, teeth, lips.



Human Speech Apparatus: Pros and Cons

Larynx: most speech-specific feature of the human vocal tract. Compared to other mammals, human larynx is very low.

The good: Low larynx helps produce a wider variety of speech sounds.

The bad: Humans are more likely to get food caught in the trachea and choke.

Lower mouth shape: accommodate the lower larynx

The good: Help support lower larynx.

The bad: Lead to overcrowded teeth and impacted wisdom teeth.

Functional Architecture

Functional architecture: how the brain is organized to do what it does

Neurolinguistics: study of the brain with relation to language functioning. One big question: is there a separate chunk of brain (a functional "organ") specifically for language?



Methods of Neurolinguistic Investigation

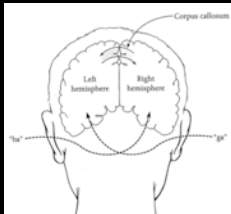
Lesion studies: correlate missing bits of brain (lesions) with missing bits of psychological functioning.

One very interesting kind of missing brain bit: split or damaged corpus callosum, found in split brain patients



Methods of Neurolinguistic Investigation

Dichotic listening tasks: use the fact that contralateral connections from the ears to the brain are stronger than ipsilateral connections. Experimenters present two tasks at the same time, one to each ear, and ask subjects which one is perceived.



If they say the left ear's stimulus, then the right side of the brain processes that info. If they say the right ear's stimulus, then the left side of the brain processes that info.

Methods of Neurolinguistic Investigation

ERPs: Event-related brain potentials, gauged via electrode caps. The location of ERPs associated with different mental activities is taken as a clue to the area of the brain responsible for those activities.



Good: non-invasive, relatively undemanding on the subject, provide precise timing on brain events

Bad: poor information on exact location of ERP since just monitoring the scalp

Methods of Neurolinguistic Investigation

Brain-imaging techniques: gauge what part of the brain is active as subjects perform certain tasks

PET scans: Positron emission topography scans

- subjects inhale low-level radioactive gas or injected with glucose tagged with radioactive substance
- experimenters can see which parts of the brain are using more glucose (requiring the most energy)

fMRI scans: functional magnetic resonance imaging

- subjects have to be very still inside MRI machine, which is expensive to operate
- experimenters can see which parts of the brain are getting more blood flow or consuming more oxygen

Methods of Neurolinguistic Investigation

Brain-imaging techniques: gauge what part of the brain is active as subjects perform certain tasks

MEG: Magnetoencephalography

- subjects have to be very still
- experimenters can see which parts of the brain are active



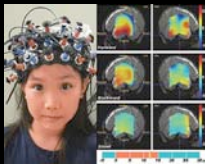
Video of word recognition in brain:
<http://www.mrc-cbu.cam.ac.uk/facilities/meg/>

Methods of Neurolinguistic Investigation

Brain-imaging techniques: gauge what part of the brain is active as subjects perform certain tasks

Optical Topography: Near-infrared spectroscopy (NIRS)

- newest technique
- transmission of light through the tissues of the brain is affected by hemoglobin concentration changes, which can be detected



Where is language located? Left hemisphere evidence

From brain injury and aphasia (**when language is severely impaired**):

Paul Broca's lesion studies

- "Tan", who had left hemisphere lesion and loss of language abilities



Functional asymmetry: damage to the left hemisphere seems to cause language problems (whether it is spoken or signed) while damage to the right hemisphere seems to cause non-linguistic visual-spatial information processing problems.

About Aphasia

Different kinds

Broca's: trouble producing speech, mostly content words (nouns and verbs) with few grammatical morphemes

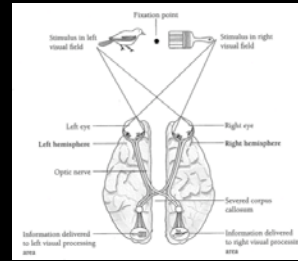
"Yes... ah... Monday... er... Dad and Peter H... [his own name], and Dad... er... hospital... and... ah... Wednesday... Wednesday, nine o'clock..."

Wernicke's: speech that is "syntactically full but semantically empty"

"I feel very well. My hearing, writing been doing well. Things that I couldn't hear from. In other words, I used to be able to work cigarettes I didn't know how..."

Where is language located? Left hemisphere evidence

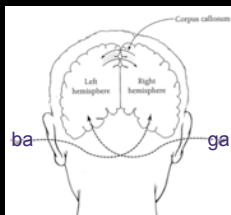
From split-brain patients (with severed corpus callosum - no communication between hemispheres)



Can't say what they saw on the left side, but can draw with their left hand.

Where is language located? Left hemisphere evidence

From normal adults: dichotic-listening experiments



Normal adults have a right-ear advantage

Why the left hemisphere?

Left hemisphere may process information more analytically.

Trained musicians process music in the left hemisphere.
Normal (untrained) people process it on the right.



Left hemisphere may be better at executing well-practiced routines, while right is better at responding to novel stimuli.

Language, for adults, is a well-practiced routine.

Questions?

