Ling 51/Psych 56L: Acquisition of Language

Lecture 6
Biological bases of language acquisition III
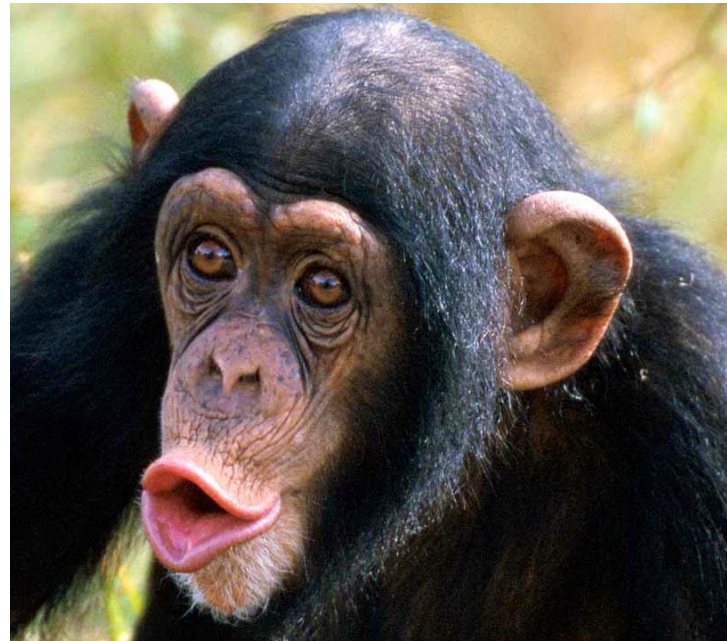
Announcements

Be working on review questions for biological bases of language acquisition

Be working on HW2 (due: 10/16/17)

Learning human language

How much of a *human* instinct is language?

Are other animals capable of learning human language?

Alex the parrot

Grey parrot, born 1976, died 2007

Trained by Dr Irene Pepperberg (U. Arizona) since 1977

Impressive ability to speak/understand
…for a parrot

http://www.youtube.com/watch?v=7yGOgs_UlEc

Alex's language

- Speech sounded remarkably accurate …produced *very* differently from humans
- Knew names of about 150 objects plus some fixed expressions
- Answered simple questions about objects (e.g. about size, color, material)
- Required *immense* amounts of training

Another African Grey Parrot: Einstein

http://www.ted.com/speakers/einstein_the_parrot
Einstein, the African grey parrot, has a vocabulary of more than 200 words and sounds; she can perform nearly half on a cue from her trainer, Stephanie White. She can also impersonate a spaceship, a monkey and even a skunk.

Einstein in action: http://www.ted.com/talks/einstein_the_parrot_talks_and_squawks
[3:25-3:35]

Parrot points

The parrot language acquisition process seems to be very different from a human child's. The output of that process certainly seem to be much more limited than a human's.

For example, the average adult human knows tens of thousands of words, not just a few hundred.

Human vocabulary

"Most people know...about 50,000 - easily. A reasonably educated person about 75,000..."

"An ordinary person, one who has not been to university say, would know about 35,000 quite easily."
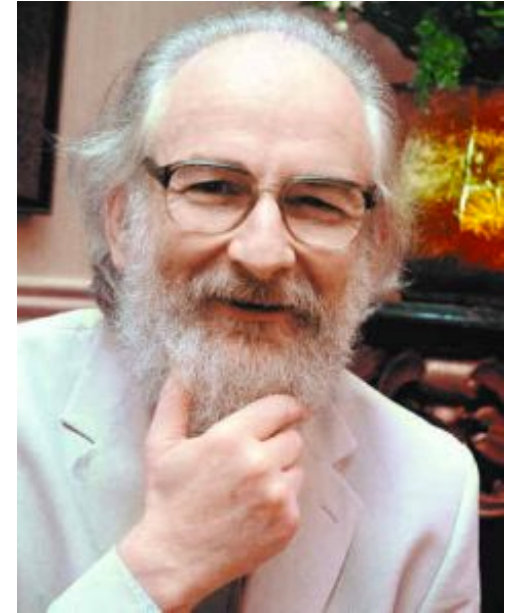
David Crystal

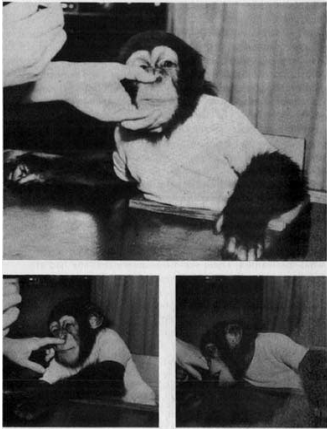http://news.bbc.co.uk/2/hi/uk_news/magazine/8013859.stm
"The words in the mental cupboard"

Non-human primates

"He's pretty good at rote categorization and single-object relational tasks, but he's not so hot at differentiating between representational and associational signs, and he's <u>very</u> weak on syntax."
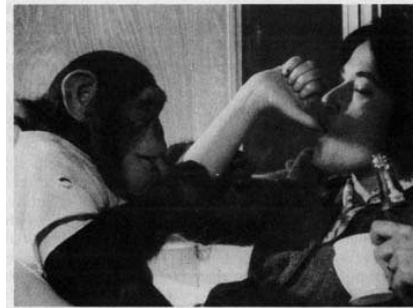
Non-human primates
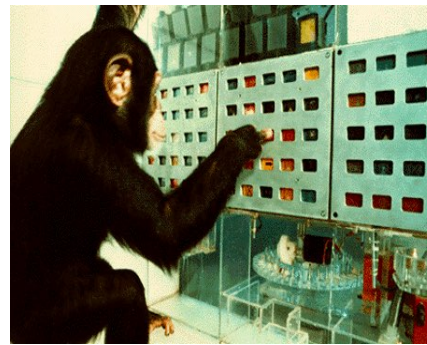

sarah & co.

washoe

washoe & loulis

vicki

Koko

nim chimpsky

lana & co.

kanzi & co.
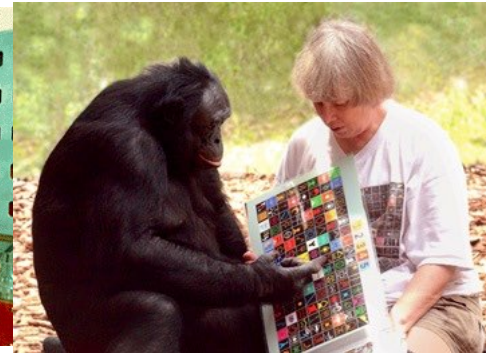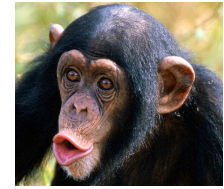
Teaching chimpanzees

Teaching chimpanzees to speak didn't work out very well

1930s: Gua, raised in a human home and treated like human infant along with the couple's son

- motor skills surpassed child's, but never learned to speak (while the child did)

1940s and 50s: Viki, raised in a human home and actively taught to produce words

- by 6, Viki could say "mama", "papa", "cup", and "up"

Teaching chimpanzees
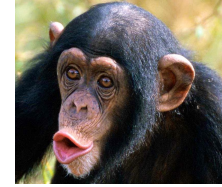
Why the problem with spoken language?

For a long time, researchers thought the issue was that chimpanzees have a vocal tract that makes speech production essentially impossible.

Fitch, De Boer, Mathur, & Ghazanfar (2016) showed that this wasn't true: "…looked inside monkeys' vocal tracts with x-rays, and found them to be much more flexible than thought…"

https://www.sciencedaily.com/releases/2016/12/161209144919.htm

Teaching chimpanzees

Why the problem with spoken language?

Fitch, De Boer, Mathur, & Ghazanfar (2016)

Not really a vocal tract issue

"The key conclusion from our study is that the basic primate vocal production apparatus is easily capable of producing five clearly distinguishable vowels (for example, those in the English words "bit," "bet," "bat," "but," and "bought"). Five vowels are the worldwide norm for human languages, and many of the world's languages make do with only three vowels."
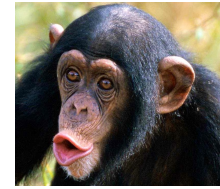
Teaching chimpanzees

Why the problem with spoken language?

Fitch, De Boer, Mathur, & Ghazanfar (2016)

Not really a vocal tract issue

"Will you marry me?"

Synthesized human female
with noisy background

Synthesized macaque
with noisy background

Teaching chimpanzees
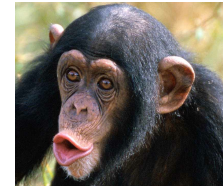
Teaching chimps to sign using ASL

1960s: Washoe, lived in trailer in backyard, people always communicated via ASL, taught by molding hands into the appropriate signs

- June 1965: born
- 1-yr-old: Begins training
- 2-yrs-old: 13 signs
- 3-yrs-old: 34 signs
- 4-yrs-old: 85 signs
- 5-yrs-old: 132 signs
- 27-yrs-old: 240 signs
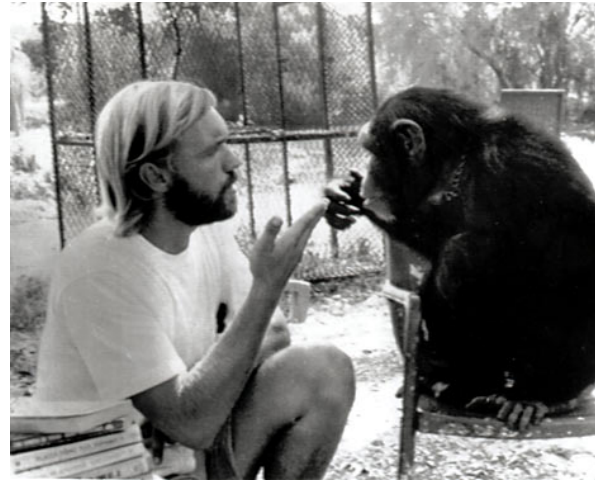
Findings (though controversial)
New extensions
    e.g., "dirty", "red"
New word combination & syntax
    e.g., "water bird", "baby in my drink."
Transmitted 50 signs to Loulis (adopted son).

Conversations with Koko

- *Moderator*: Koko are you going to have a baby in the future?
- *Koko*: Pink.
- *Dr. Patterson*: We've had earlier discussion about colors today.
- *Koko*: Listen! Koko loves eat.

....

- *Moderator*: What are the names of your kittens? (and dogs?)
- *Koko*: foot
- *Dr. Patterson*: Foot isn't the name of your kitty.
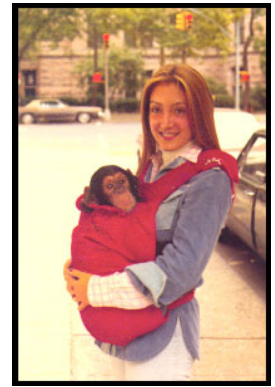- *Moderator*: Koko, what's the name of your cat?
- *Koko*: no

....

- *Moderator:* Do you like to chat with other people?
- *Koko*: fine nipple
- *Dr. Patterson*: Nipple rhymes with people, she doesn't sign people per se, she was trying to do a "sounds like …"

Teaching chimpanzees

Teaching chimps to sign using ASL

1979: Nim Chimpsky, raised in private home, taught signs by having hands molded into them

   - learned 100 signs and produced some combinations

But combinations produced are very different from those of a human child - very repetitive, no additional complexity:

2-sign	3-sign	4-sign
"eat drink"	"eat me Nim"	"eat drink eat drink"
"tickle me"	"me Nim eat"	"play me Nim play"

Teaching chimpanzees
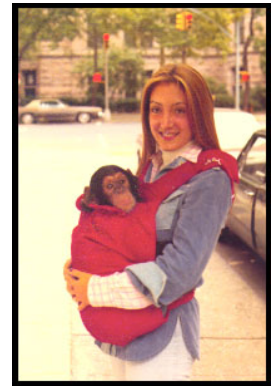
Teaching chimps to sign using ASL

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  - learned 100 signs and produced some combinations

A quantitative analysis of combinatorial ability (called *productivity*) from Yang (2013) also demonstrates that Nim's productions are *not* compatible with a combinatorial system. Instead, they are much more likely to be imitations of whole chunks from the surrounding input. This is corroborated by reports of how Nim's sign combinations originated: All of them were imitations of his teachers - no novel combinations, unlike human children.

Teaching chimpanzees

Teaching chimps to sign using ASL

Nim's longest utterance: "give orange me give eat orange me eat orange give me eat orange give me you"
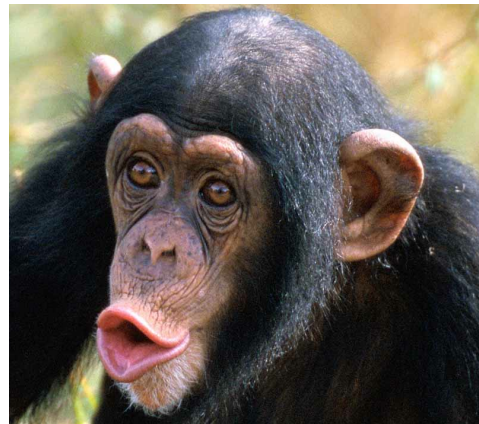
Lana & friends

- The Lana Project (or LANguage Analog) established in 1971.
- Yerkish: Artificial language

LEXIGRAMS

Teaching bonobos

http://www.ted.com/talks/susan_savage_rumbaugh_on_apes_that_write?language=en
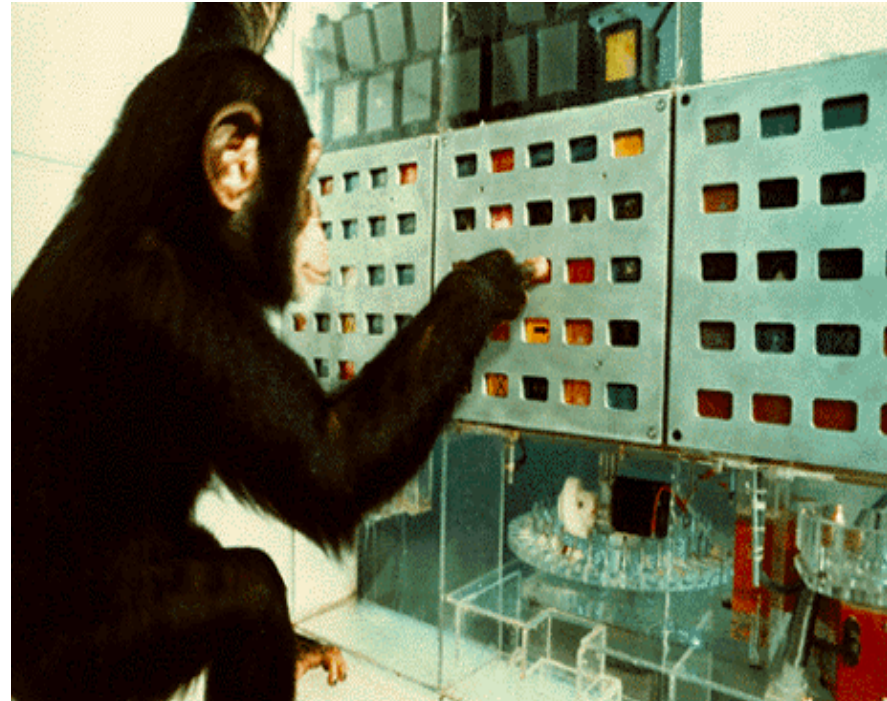Total length = 17:25, look at 2:32 - 7:32 especially

Teaching bonobos

Bonobos (pygmy chimpanzees) vocalize in communication more frequently than common chimps do.

1981: adult bonobo Matata instructed with an artificial language and utterly failed

However, her infant bonobo Kanzi - who wasn't explicitly instructed in anything, but accompanied his mother when she was instructed - learned the artificial language and was also able to understand some spoken English (presumably because he was within the critical/sensitive period).

http://www.youtube.com/watch?v=wRM7vTrIIis (Lexigrams)
http://www.youtube.com/watch?v=2Dhc2zePJFE (Novel Sentences)

Teaching bonobos

Kanzi's spoken English: comparable to a 2-year-old child's performance (but a 2-year-old's syntactic knowledge is fairly limited)

Also, Kanzi was 8 years old when he was tested, and was unlikely to improve his performance any further with age….unlike human children.

A linguist's concluding remarks in 2006

"I do not believe that there has ever been an example anywhere of a nonhuman expressing an opinion, or asking a question. Not ever...It would be wonderful if animals could say things about the world, as opposed to just signaling a direct emotional state or need. But they just don't."

— Geoff Pullum

http://www.smithsonianmagazine.com/issues/2006/november/speakingbonobo.php

So what's the problem?

Not a lack of intelligence -
chimpanzees are highly intelligent.

One answer: language is an expression of a domain-specific mental faculty that humans have and other primates do not

(linguistic nativist, generativist).

So what's the problem?

Not a lack of intelligence - chimpanzees are highly intelligent.

Another answer: language results from better domain-general abilities (non-linguistic nativist, constructionist).

"...humans have evolved a superior capacity to deal with sequential information..."

https://www.sciencedaily.com/releases/2017/06/170620200012.htm

So what's the problem?

data from 108 experiments on birds and mammals

"...humans have evolved a superior capacity to deal with sequential information..."

https://www.sciencedaily.com/releases/2017/06/170620200012.htm

"We found that the limited capacities of non-human animals can be explained by a simpler kind of memory that does not faithfully represent sequential information."

So what's the problem?

data from 108 experiments on birds and mammals

"…humans have evolved a superior capacity to deal with sequential information…"

https://www.sciencedaily.com/releases/2017/06/170620200012.htm

"…can explain why no language-trained animal has successfully mastered sequential aspects of language, such as the difference between 'the dog bit the lady' and 'the lady bit the dog.'"

A more detailed look at the nativist idea

Hauser, Chomsky, & Fitch 2002:

Faculty of Language – Broad (FLB): biological capacity for acquiring language that humans have and other animals don't. However, much of the biological capacity is assumed to derive from shared origins with animal communication.

Ex: Parts of the human conceptual system such as causal, spatial, and social reasoning are shared with other primates (Buttelman et al. 2007)
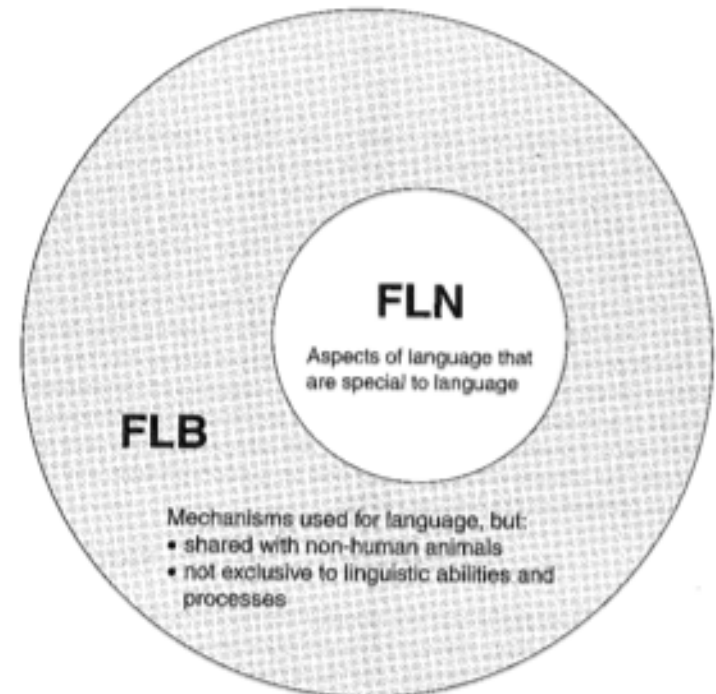
Difference between humans and animals is assumed to be more about "quantity" – humans have more power to drive these abilities than other animals, but the fundamental ability is basically the same.

A more detailed look at the nativist idea

Hauser, Chomsky, & Fitch 2002:

Faculty of Language – Narrow (FLN): A subset of Faculty of Language abilities that only humans have. Biological underpinnings not shared with other animals. A difference of "quality" not just "quantity".

Pinker & Jackendoff (2005) suggest these might be in the FLN: properties of speech perception, speech production, words (as referential), grammar, complex conceptual understanding that requires words (ex: *week, 10 feet from the blue wall, half past five next Tuesday*)

FLN
Aspects of language that are special to language

FLB
Mechanisms used for language, but:
• shared with non-human animals
• not exclusive to linguistic abilities and processes

Recap: Animal communication

When other animals try to learn human language, they are much slower and do not achieve a level of competency that a human child does.

Current ideas for this barrier suggest a biological component, where humans differ either quantitatively or qualitatively from other animals in their cognitive abilities when it comes to learning language.
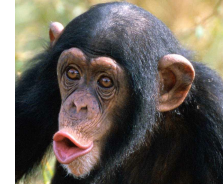
Questions?

Remember: You should be able to do up through question 20 in HW 2 and up through 26 in the review questions for the biological bases of language acquisition.

Extra Material

Teaching chimpanzees

Teaching chimps to sign using ASL

No symbolic reference:

"For Nim, meaning seemed to have no role outside of the specific association between a form and its referent that had been explicitly taught to him….for Nim, signs did not refer; he did not have words - signs, or names - for things." - Laura Petitto, one of Nim's teachers, 1988

Teaching bonobos

Did Kanzi have reference? Unclear.

"strawberry" = "I want to go to the place where strawberries are found", "I want a strawberry to eat", "There's a picture of strawberries", …

Kanzi's spoken English: comparable to a 2-year-old child's performance (but a 2-year-old's syntactic knowledge is fairly limited)

Also, Kanzi was 8 years old when he was tested, and was unlikely to improve his performance any further with age….unlike human children.