

Psych 56L/ Ling 51:  
Acquisition of Language

Lecture 5  
Biological Bases of Language III

Announcements

Review questions for biological basis of language available

Homework 1 assigned, due next Monday (10/20/08) in class.

Class Reader:

Jacquece Fradue, JFradue1@aol.com

Language and Other Species



Language and Other Species

Are we special among the animal species?

What are other species capable of?

Could language have evolved gradually?

## Communication Systems

Human language does enable communication, but it has several features that separate it from other animal communication systems:

reference: symbols stand for things in the world

syntax: productive system for combining symbols to express new meanings

intentionality: speakers use language for the purpose of communicating with others

## Primate Communication

Vervet monkeys



Predator alarm calls:

"leopard" = run to the trees

"eagle" = look up, run into the bushes

"snake" = stand up on hind legs & look around

No evidence for complex combinatorial system or that monkeys produce calls with the intent to modify the mental state of their listener.

## Primate Communication

Vervet monkeys



What they can't say:

"What a large eagle up in the sky over there! We'd better take cover. C'mon!"

"I doubt there are any leopards around here. The field looks pretty clear."

"Did you see that whopping big snake yesterday? It was so scary!"

## Bee Communication

Honey Bees



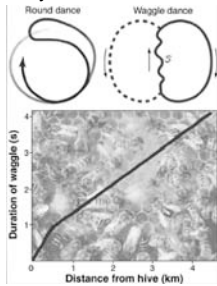
Dance to communicate the location of food (nectar)

Can indicate: nearby vs. far, direction, richness of the food source (dance harder for the good stuff)

Though bees can create novel messages, they're always about the location of food.

## Bee Communication

Under 50 m away



Over 50 m away:  
encodes distance  
& direction - is  
encoding of 2D  
space (a bee's  
"mental map")

'deciphered' by Karl von Frisch, 1919 & onward

## Bee Communication

Honey Bees



What bees can't communicate:

"Have you seen the flowers in the next field over? They totally rock. I've never seen such brilliant colors."

"This hive is lookin' gooooooood lately."

## Bird Communication

Songbirds



Males use songs to attract and acquire mates. In many species, the development of the song requires exposure to adult birds who model the song.

## Bird Communication

Songbirds



Note: even though there is a learned part and a genetic part, we still classify birdsong as an instinct.

## Bird Communication

### Sparrow Song



song



call



Song is highly structured - notes, syllables, phrases

## Bird Communication

### Variation in Song

Bird 1



Bird 2



## Bird Communication



Songbird communication is thought to be similar to human children needing exposure to adult language. Both human language and birdsong:

- (1) have early stages prior to the appearance of the adult form (babbling vs. subsong)
- (2) require the babies to be able to hear their own productions
- (3) have sensitive periods
- (4) are lateralized in the left hemisphere

## Learning Human Language

Just because other animals' communication systems aren't as complex as human language, does that mean that they're incapable of learning human language (reference, syntax, intentional communication)?



### 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=R6KvPN\\_Wt8I](http://www.youtube.com/watch?v=R6KvPN_Wt8I)

### 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

### 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"

Problem: Chimpanzees have a vocal tract that makes speech production essentially impossible.

### 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  
- learned to produce 132 signs after 4 years, correctly label a variety of objects and sign small expressions like "more fruit", "Washoe sorry", and "Please tickle"



## 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

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

Also, all Nim's sign combinations were imitations of his teachers - no novel combinations, unlike human children.

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

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 - learned the artificial language and also to understand some spoken English.

<http://www.greatapetrust.org/media/video-bonobo-kanzi.php>

## Teaching bonobos

Did Kanzi have reference?

"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-yr 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.

### 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 (nativist).

Specific abilities: syntax & referential semantics

Another answer: language must be learned through social interaction with others, and chimpanzees' ability to learn from others is limited - can't seem to collaborate

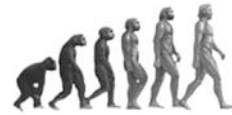
### So what is it humans learn?

#### Option 1 (~Constructivist):

Other species can master the rudiments of human language

Human language is not a major departure from other species

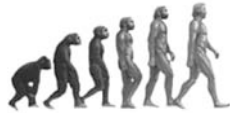
There should be evolutionary precursors to human language



### Language as an evolved capacity

#### Adaptionist view:

Humans have language because having it gave our hominid ancestors an advantage in survival and reproduction over those who did not have it.



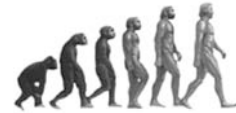
#### Descent with modification:

Human capacities that underlie language should have precursors in the capacities of our nonlinguistic ancestors.

### Language as a modification of other capacities

Language as a "new machine built out of old parts" - Elizabeth Bates

No unique linguistic capacity because made up of lots of other general-purpose cognitive functions.



Lexical/semantic system may have appeared ~200 to 300,000 years ago, with enlarged temporal lobe

Syntactic system may have appeared ~10 to 100,000 years ago with FOXP2 gene.

## So what is it humans learn?

Option 2 (Nativist):

Very little - similar to teaching bees the bee dance!

Other species are not 'designed' for human language

Learn how human instincts work by studying humans!



## Language as a module + adaptation

Modular Adaptionist view:

Language is a separate cognitive module that conferred an evolutionary advantage to its possessors.



"The mind is like a Swiss army knife with many different special-purpose tools." - Hoff, p.84

## A Famous Nativist's Words: Language as a By-Product



"These skills may well have arisen concomitant to structural properties of the brain that developed for other reasons. Suppose there was selection for bigger brains, more cortical surface, hemispherical specialization for analytic processing, or many other structural properties than can be imagined. The brain evolved might well have all sorts of special properties that are not individually selected." - Chomsky, 1982

## Questions?

