

Language & the Mind
LING240
Summer Session II 2005

Lecture 2
Animal Communication &
Human Instincts

Animal Communication

- Are we *special* among species?
- What are other species capable of?
- Are language-learning abilities related to general cognitive capacities?
- Could language have evolved *gradually*?

Naturally-Occurring Systems

- Monkey alarm calls
- Bee Dance
- Birdsong

Vervet Monkey Alarm Calls

- 3 classes of predators
- 3 distinct alarm calls
- Packmates respond appropriately even if predator is not visible
- Loud bark (leopard alarm) = run for tree
- "cough" (eagle alarm) = rush into the bushes
- "chutter" (snake alarm) = stand up & scan ground



What a vervet cannot express

- "I saw a snake near that tree just the other day, so watch your feet."
- "Where did you say that leopard was?"
- "Can you say that again? - I didn't hear you."



Dance of the Honeybees

'deciphered' by Karl von Frisch, 1919 & onward

Under 50 m away

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

- Conveys location of source of nectar - every message is unique

Honeybee Conversations

- Honeybees can express more than vervets - but the conceptual content is always "the location of what we are all looking for right now"

What a honeybee cannot express

- "There's going to be some great nectar at this really nice spot I know soon since the flowers are all in bloom."
- "I saw a really swank hive a little ways from here - we should totally take over and get ourselves some better digs."

Sparrow Song



- Song is highly structured - notes, syllables, phrases
- Regional variation
- Sensitive period
- Fixed meaning

Variation in Sparrow Song

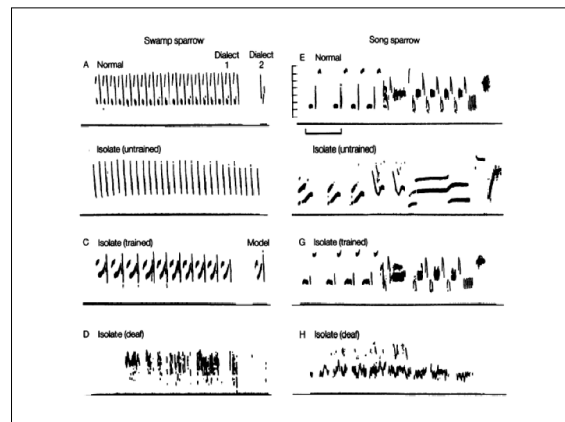
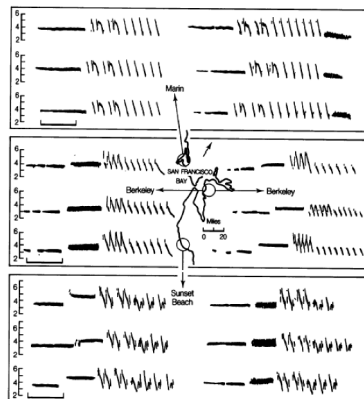
Bird 1



Bird 2



Dialects of the White-Crowned Sparrow (Marler, 1970)



Nature & Nurture

- So birdsong seems to have both an innate component and a learned component
- We still classify it as an instinct

Features of Human Language

- Creativity
- Arbitrariness
- Systematicity (e.g. word order, structure)
- Displaced reference
- Pretense

Some Thoughts

- Animal communication systems are quite varied
- Many features of human language found in other species
- Features of human language never *combined* in other species
- Extent of human linguistic creativity far surpasses any other species
- But... interesting lessons for human language from studying related systems, e.g. birdsong

Teaching Human-like Language

- Can other species master properties of human language such as...
 - sounds
 - arbitrary words/signs to refer to object
 - systematic combinations of signs
 - creative use of sign combinations
- Are humans unique in the ability to do this?

Alex



- Grey parrot, born 1976
- Trained by Dr Irene Pepperberg (U. Arizona) since 1977
- Impressive ability to speak/understand ...for a parrot

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Alex's Language

- Speech sounds remarkably accurate
...produced *very* differently from humans
- Knows names of 100+ objects plus some fixed expressions
- Answers simple questions about objects (e.g. about size, color, material)
- Requires *immense* amounts of training

Washoe & Nim Chimpsky

- Apes taught modified sign language in 1960s & 1970s



Washoe & Nim Chimpsky

- Learned many signs
- Able to combine signs
- Sign combinations lacked systematic use of word order etc.
- Impressive, but far behind 2-year olds

Kanzi



- Benobo ('pygmy chimp')
- Born 1980
- Yerkes Regional Primate Center, Atlanta
Trained by Sue Savage-Rumbaugh & others
- Grew up with an adult benobo, who was being trained to communicate with 'pictograms', with little success
- Kanzi quickly surpassed his guardian

Kanzi



- Pictograms remove articulation difficulty
- Impressive creativity and systematicity - best shown to-date
- Still falls short of 2-year olds

Creativity in Human Language

- Animal languages have a fixed, limited range of messages (vervet calls, bee dance, bird song)
- Human language is infinitely creative
- Increased expressive power of human language is not just a difference of *degree* - human language is fundamentally different

Creativity in Human Language

- Creativity of human language results from its *combinatorial properties*
- Small number of memorized "pieces" yield vast range of possible messages
- Human "pieces" are sounds, words, and phrases

Language vs. Communication

- Communication: conveying information between a message-sender and a message-receiver
- Language: one type of communication system used by human beings, and the only one we are aware of in any species that takes a finite number of "pieces" and combines them with a finite set of combinatorial rules to yield an infinite number of messages about any topic.

So what is it that humans learn?

Option 1:

- Other species can master the rudiments of human language
- Human language is not a major departure from other species
- Evolutionary precursors to human language

So what is it that humans learn?

Option 2:

- 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!

Some More Thoughts

- Examination of other species clarifies how unusual human language is
- Other species have interesting communicative tricks - different from ours
- Some species can learn some impressive 'language tricks' ... doesn't teach us much about how human language works

Someone Else's Thoughts

The fact that a dog can be trained to walk on its hind legs does not prejudice the claim that bipedal gait is genetically coded in humans. The fact that we can learn to whistle like a lark does not prejudice the species-specificity of birdsong.

(Fodor, Bever & Garrett, 1974
The Psychology of Language)

So let's talk about this "instinct" thing...

- Bats use sonar to echolocate; homing pigeons know where home is; deer rub antlers against trees; spiders spin webs; dolphins play; some primates walk
- Special properties of individual species, not related to "general intelligence", develop automatically
- Another "instinct": human language

Why do humans have language?

- Because we're smarter than other animals?
- Because we have a bigger brain?
- Because our mouths have a special shape?
- Because somebody took the time to teach us?

- ...or because that's just something that humans do?

Why call language an instinct?

- Species specificity
- Uniformity throughout human species
- Humans *spontaneously* create languages
- Independence from other mental abilities
- Sensitive period for learning language

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Species Specificity



- Other species simply can't learn human language
- The communication systems of other animals are not even remotely as complex as human language.

The point

"We may not be able to take flight by flapping our upper extremities, but we are the only species known that can rationally discuss our inability to do so."
-Stephen Anderson, *Doctor Dolittle's Delusion*

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Uniformity

- All humans master a human language ... except in extreme circumstances
- All human languages are remarkably similar in their basic properties.

Uniformity

- All human languages are able to express an infinite number of never-before-expressed sentences
- All are able to express ideas of a similar level of complexity
- Even the form of languages seems to vary in restricted ways

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Humans Spontaneously Create Language: Everyday cases

- Poverty of the Stimulus: *Every* child has to go beyond the data heard in the environment.
- Children acquire many linguistic generalizations that experience could not have made available

Something heard & learned...

- Who did Jareth see Sarah with in his crystal?



Something unheard but still learned...

- *Who did Jareth see Sarah and in his crystal?



Every child has to go beyond the environment

- Children cannot hear every possible sentence of their native language
- Children *never* hear impossible sentences
- Both of these sets are infinitely large, yet we all end up generally agreeing about which ones are possible and which ones are impossible

Children create their own system

"It brokeed."

"Don't giggle me!"

"Does she doesn't like that?"

"What she does eat?"

Children spontaneously create language: Extreme cases

- Input is totally absent - home sign systems of deaf children
- Input is inconsistent - Simon
- Input is not a full language - pidgins and creoles

Children spontaneously create language: Extreme Cases

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Simon (Singleton & Newport)

Input:

- Parents were late learners of ASL
- Parents used required ASL verb inflections 60% of the time (either omitted them or used the wrong ones)
- In school, only exposed to a signed English system

Output:

- As good as "native of native" children on most aspects of ASL inflection
- Simon's own use of verbs of motion surpasses the performance of his parents
- Simon does not acquire the "noise" of his parents - he regularizes the irregular input from his parents.

Children spontaneously create language: Extreme Cases

- Input is totally absent - home sign systems of deaf children
- Input is inconsistent - Simon
- Input is not a full language - pidgins and creoles



Pidgins & Creoles: The Case of Nicaraguan Sign Language

- 1977: Center for special education opened (100 children by 1979)
- 1980: Vocational school for adolescents opened (400 students in the two schools by 1983)
- 1986: Social club for deaf adolescents and adults formed (by 1990, this was the National Association of Deaf Nicaraguans)
- "First Cohort" of children formed a pidgin based on their collective homesign systems: Lenguaje de Signos Nicaraguense (LSN)
- "Second Cohort" received pidgin LSN as input and nativized this "inconsistent and insufficient input" to produce a creole: Idioma de Signos Nicaraguense (ISN)



Nicaraguan Sign Language: A Test of Performance

- 25 children, aged 7-31 yrs at time of testing
- Age of entry into community:
 - Young (birth to 6;6), n=8
 - Medium (6;7 to 10;0), n=8
 - Old (10;1 to 27;5), n= 9
- Year of entry into community:
 - Before 1983
 - 1983 or earlier

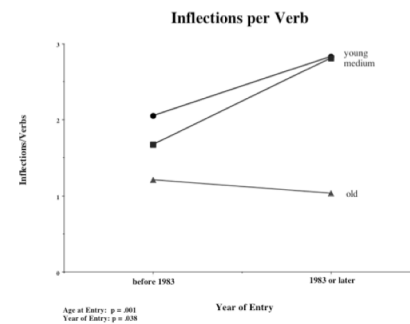


Figure 2. The number of inflections per verb is greater overall for signers who entered the community in 1983 or later, and for signers who were exposed to the language at a *young* or *medium* age. The *young* and *medium* Age at Entry signers are particularly affected by a later Year of Entry.

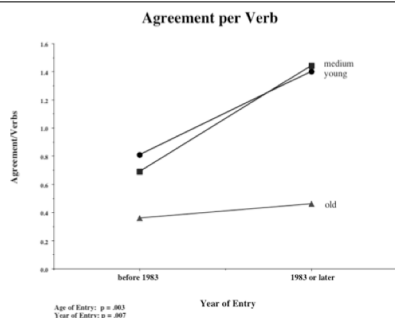


Figure 3. The number of inflections showing agreement per verb is greater overall for signers who entered the community in 1983 or later, and for signers who were exposed to the language at a *young* or *medium* age. The *young* and *medium* Age at Entry signers are particularly affected by a later Year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

To Sum Up

- Signers who entered the community at a younger age...
 - Express more events overall
 - Express more verbs per unit of time
 - Inflect more verbs (location, person, number, agreement)
 - Use more classifiers (size-and-shape, object-category)
 - Use fewer pantomimed (body-anchored) gestures

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Language & General Intelligence

- Good language with poor overall cognitive profile:
 - Williams Syndrome
- Poor language with good overall cognitive profile:
 - Pure Word Deafness
 - Broca's Aphasia
 - Specific Language Impairment.
- "Double Dissociation" argument

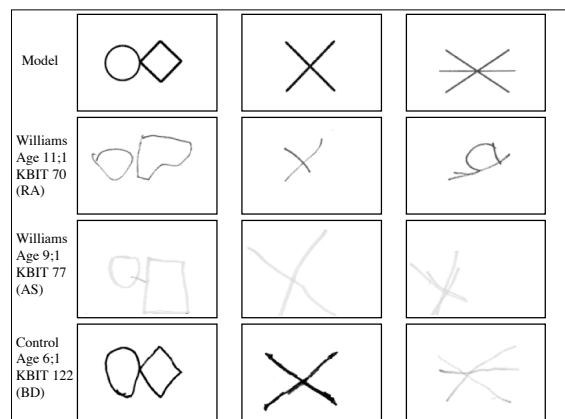
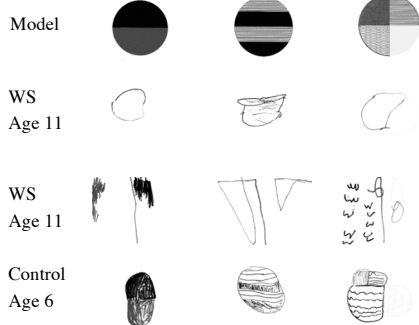
Williams Syndrome



Cognitive Characteristics of Williams Syndrome

- Low general IQ (50-60)
- Poor math
- Poor *visuospatial* reconstruction abilities
- Good language
- Often good with music
- Highly social

Copying Simple Pictures



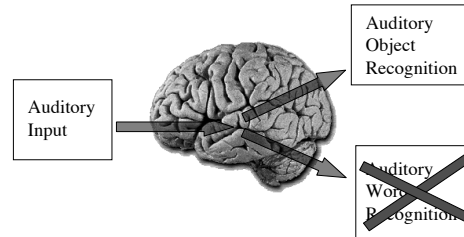
Describing Complex Pictures



“Bill is looking at the cow that the boy is pointing, and Max is looking at the cow that the girl is pointing at.”
(WS, IQ approx. 40)

(Zukowski 2001)

Pure Word Deafness



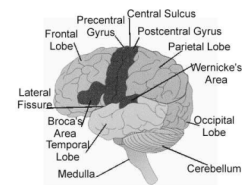
Normally functioning people,
Unable to hear words

Broca's Aphasia

- Identified 1861, Paul Broca
- Patient “Tan”: intelligent, good language comprehension, severe speech deficit
- Died soon afterwards: brain showed selective damage at junction of frontal, parietal, temporal lobes, left hemisphere



Broca's Aphasia



Broca's Aphasia - Production

Typical clinical symptoms of Broca's aphasics:

“Yes ... Monday ... Dad, and Dad ... hospital, and ... Wednesday, Wednesday, nine o'clock and ... Thursday, ten o'clock ... doctors, two, two ... doctors and ... teeth, yah. And a doctor ... girl, and gums, and I.”

“Me ... build-ing ... chairs, no, no cab-in-ets. One, saw ... then, cutting wood ... working ...”

Broca's Aphasia - Comprehension

- | | | |
|-----|--|----------------|
| 1a. | “The cat chased the dog.” | active |
| 1b. | “The cat was chased by the dog.” | passive |
| 2a. | “I showed her baby pictures.” | ambiguous |
| 2b. | “I showed her baby the pictures.” | unambiguous |
| 2c. | “I showed her the baby pictures.” | unambiguous |

‘Function Words’

Specific Language Impairment

- Genetic disorder, currently poorly understood
- Good general cognitive abilities, poor language
 - “It’s a flying finches, they are.”
 - “She remembered when she hurts herself the other day.”
 - “The neighbors phone the ambulance because the man fall off the tree.”
 - “The boys eat four cookie.”
 - “Carol is cry in the church.”

Why call language an instinct?

- Species specificity
- Uniformity throughout human species
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- Independence from other mental abilities
- Sensitive period for learning language

Sensitive Period for Learning Language

- Language learning is *effortless* before puberty, extremely effortful later in life
- Applies to both first and second language learning
- Applies to spoken and signed languages
- Sensitive periods familiar from ‘instincts’ in other species

What is a “sensitive” or “critical” period?

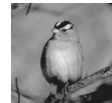
“A period of development during which some crucial experience will have its peak effect on development or learning, resulting in normal behavior attuned to the particular environment to which the organism has been exposed.” - Newport

Examples of critical periods in other species



- Species: ducks
- What they learn: attachment to their mothers (imprinting)
- Critical period for this “learning”:
 - 9-21 hours after hatching
 - After 21 hours, less likely to form an attachment

Examples of critical periods in other species



- Species: White-crowned sparrow
- What they learn: their species’ mating song (from hearing adults sing it)
- Critical period for “learning”:
 - 7-60 days after birth (to fully acquire song)
 - 60-100 days after birth (to acquire skeletal basics of song)
 - After 100 days of age, bird will never sing normally

A critical period for FIRST language acquisition

- Case Studies:
 - Isabelle
 - Genie
 - Chelsea
- A special population: deaf children born to hearing parents

Case Studies: Isabelle (Davis, 1947)

- Family background: Hidden in attic by deranged mother, never spoken to
- Discovered at age 6: had no speech, at cognitive level of 2 year old
- Outcome: Within 1 year, she caught up with other 7 year olds

Case Studies: Genie (Curtiss, 1977)

- Family background: From 18 months onward, lived tied to a chair in a darkened room, frequently beaten, never spoken to
- Discovered at age 13, had no speech
- Outcome: Learned a large vocabulary, but syntax and morphology never fully developed
 - "Man motorcycle have"
 - "Genie full stomach"
 - "Want Curtiss play piano"

Case Studies: Chelsea (Curtiss, 1989)

- Family background: A partially deaf woman incorrectly diagnosed as "retarded"
- Discovered at age 31, and fitted with hearing aids
- Outcome: Learned a large vocabulary, but syntax and morphology even worse than Genie
 - "Breakfast eating girl"
 - "Banana the eat"

A Special Population: Deaf children born to hearing parents (Newport, 1990)

- Examined ASL proficiency in people who had been using ASL for 30 years
- *But* different ages of first exposure to ASL:
 - Native/early learners: between birth and age 6
 - Late learners: after age 12

A Special Population: Deaf children born to hearing parents (Newport, 1990)

- Basic result: Before age 6 > After age 12
- One Exception: Word order uniformly good for all learners

A Critical Period for SECOND Language Acquisition (Johnson and Newport, 1989)

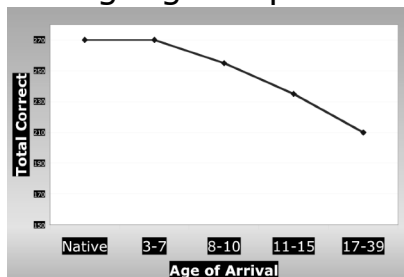
- Examined English proficiency in Korean and Chinese immigrants to the U.S. who had lived here at least 5 years
- Again, different ages of first exposure (anywhere between 3 and 39 years old)

Test from Johnson and Newport (1989)

- Hear recorded sentences & judge whether GOOD or BAD

"The farmer bought two pig at the market."
"Tom is reading book in bathtub."

Results: Second Language Acquisition



Sum Up: Critical Period

- Language learning is *effortless* before puberty, extremely effortful after
- Applies to both first and second language learning
- Applies to spoken and signed languages
- Critical periods familiar from biologically-programmed abilities in other species

Concluding Thoughts

- Language is specific to humans, and extremely uniform among humans
- Humans create language without instruction
- Language abilities are partly independent of other cognitive abilities
- Language learning requires a young brain
- Therefore...language seems to have the properties of an 'instinct'

But...

- Identifying language as a human instinct is just the first step
- It tells us nothing about how this instinct works, how it develops, how it is encoded in the brain or in the genome...