

Language



"I won't say what word I'm thinking of"

the mouse was scared
of the large cat



Nature vs. Nurture

Human Uniqueness

Cultural Relativism

Linguistics at JHU



Questions + Themes

How does language **work**?

Is language “**innate**”?

Can other **animals** learn (human) languages?

What is language?



What isn't language?



Some properties of language

Rules

not everything goes

Arbitrariness

no necessary connection between word & referent

Displacement

can refer to things that aren't there

Creativity

produce & understand **new** sentences

Infinity

no limit to number and length of possible sentences

our first exam better not be about how everyone was annoyed by the fact that Prof. Firestone spent way too much time discussing how I was upset when nobody believed me when I said that I read somewhere that the mouse was scared of the large cat

Structure of Language

Phonology
(≈sounds)

Morphology
(≈words)

Syntax
(≈grammar)

Structure of Language

Phonology
(≈sounds)

Morphology
(≈words)

Syntax
(≈grammar)

Structure of Language

Phonology
(≈sounds)

phoneme



Structure of Language

Phonology
(≈sounds)

Phonology vs. Phonetics

rules governing which sounds
are permissible/meaningful

how speech sounds are
physically produced

Structure of Language

Phonology
(≈sounds)

Word Boundaries

“Wow, look at Jim’s plum pie!”

“Wow, look at Jim’s plump eye!”

Structure of Language

Phonology
(≈sounds)



How Many Finnish Words?

A. **4**

B. **6**

C. **8**

D. **10**

Structure of Language

Phonology
(≈sounds)

4 Words

Ilmatyynyalukseni on täynnä ankeriaita
(*"My hovercraft is full of eels"*)

Structure of Language

Phonology
(≈sounds)

A Problem:

Speech sounds are **variable** and **ambiguous**

Structure of Language

Phonology
(≈sounds)

A Solution *(one of many):*
“top-down” processing

Structure of Language

Phonology
(≈sounds)

“Legislature”

Structure of Language

Phonology
(≈sounds)

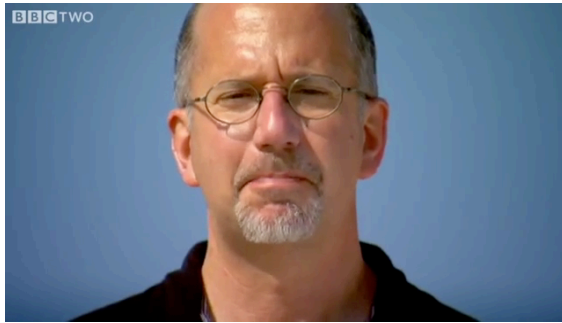
“Sinewave Speech”

Structure of Language

Phonology
(≈sounds)

“Sinewave Speech”

Structure of Language

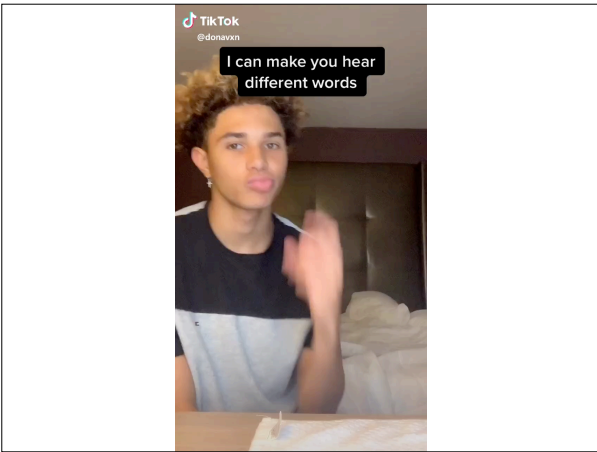


Structure of Language

Phonology
(≈sounds)

For good?





Structure of Language

Phonology
(≈sounds)

Morphology
(≈words)

Syntax
(≈grammar)

Structure of Language

Phonology
(≈sounds)

Morphology
(≈words)

Syntax
(≈grammar)

Structure of Language

Morphology
(≈words)

faces

morphemes

Structure of Language

Phonology
(≈sounds)

Morphology
(≈words)

Syntax
(≈grammar)

Structure of Language

Phonology
(≈sounds)

Morphology
(≈words)

Syntax
(≈grammar)

Structure of Language

Syntax
(≈grammar)

how words are combined
into phrases & sentences

Structure of Language

Syntax
(≈grammar)

mouse was cat of scared the large the

Structure of Language

Syntax
(≈grammar)

the mouse was scared of the large cat

Structure of Language

Syntax
(≈grammar)

the mouse scared the large cat

Structure of Language

Syntax
(≈grammar)

Chomsky: "Colorless green ideas sleep furiously"

Structure of Language

Syntax

(≈grammar)

Groucho Marx:

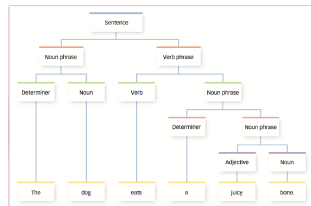
“I once shot an elephant in my pajamas.”
“How it got into my pajamas I’ll never know.”

Shot [an elephant] [in my pajamas]
Shot [an elephant in my pajamas]

Structure of Language

Syntax

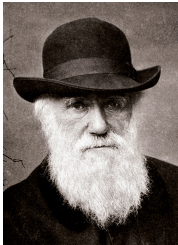
(≈grammar)



What language is

vs

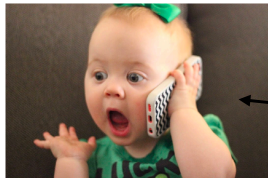
Where language
comes from



“Man has an instinctive tendency to speak, as we see in the babble of our young children; whilst no child has an instinctive tendency to brew, bake, or write.” (*The Descent of Man*, p.58)

Innate?

Innate \approx **Present at Birth**



Problem:
this doesn't happen

Analogy: Puberty

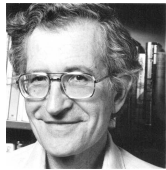


Innate?

Innate \approx **Present at Birth**

~~Languages~~ **Language**
(English, French, Russian, Arabic...) *The capacity and inclination*

Innate?



Noam Chomsky

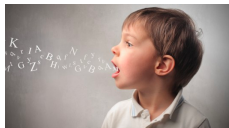
“No one would take seriously the proposal that the human organism learns through experience to have arms rather than wings, or that the basic structure of particular organs results from accidental experience. [Language] proves to be no less marvelous and intricate than these physical structures ... Why, then, should we not study the acquisition of a cognitive structure like language more or less as we study some complex bodily organ?”

Some Facts About Language

Every culture has it
(with no exceptions)



Every **person** has it
(with telling exceptions)



Automaticity

XXXX "RED"

XXXX "GREEN"

XXXX

XXXX

XXXX

XXXX

XXXX

XXXX

Red
Green
Blue
Yellow
Red
Blue

Red
Green
Blue
Yellow
Red
Blue

Some Facts About Language

Red		Red
Green	“Stroop Effect”	Green
Blue		Blue
Yellow	<i>Automaticity</i>	Yellow
Red		Red
Blue		Blue

Dissociations

Broca's Aphasia

Content without fluency



Specific Language Impairment

advance online publication

letters to nature

Molecular evolution of FOXP2, a gene involved in speech and language

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Language is a uniquely human trait likely to have been a prerequisite for the development of human culture. The ability to develop articulate speech relies on capabilities, such as fine control of the larynx and mouth¹, that are absent in chimpanzees and other great apes. FOXP2 is the first gene relevant to the human ability to develop language. A point mutation in FOXP2 co-segregates with a disorder in a family in which half of the members have severe articulation difficulties accompanied by linguistic and grammatical impairment². This gene is disrupted by translocation in an unrelated individual who has a similar disorder. Thus, two functional copies of FOXP2 seem to be required for acquisition of normal spoken language. We sequenced the complementary DNAs that encode the FOXP2 protein in the chimpanzee, gorilla, orang-utan, rhesus macaque and mouse, and compared them with the human cDNA. We also investigated intraspecific variations of the human FOXP2 gene. Here we show that human FOXP2 contains changes in amino-acid coding and a pattern of nucleotide polymorphism, which strongly suggest that this gene has been the target of selection during recent human evolution.

FOXP2 (forkhead box P2) is located on human chromosome

We compared the FOXP2 protein structures predicted by a variety of methods³ for humans, chimpanzees, orang-utans and mice. Whereas the chimpanzee and mouse structures were essentially identical and the orang-utan showed only a minor change in secondary structure, the human-specific change at position 325 creates a potential target site for phosphorylation by protein kinase C together with a minor change in predicted secondary structure. Several studies have shown that phosphorylation of forkhead transcription factors can be an important mechanism mediating transcriptional regulation⁴. Thus, although the FOXP2 protein is extremely conserved among mammals, it acquired two amino-acid changes on the human lineage, at least one of which may have functional consequences. This is an intriguing finding, because FOXP2 is the first gene known to be involved in the development of speech and language.

To investigate whether the amino acids encoded in exon 7 are polymorphic in humans, we sequenced this exon from 44 human chromosomes originating from all major continents. In no case was any amino-acid polymorphism found. Further, a study that analysed the complete coding region of FOXP2 in 91 unrelated individuals of mainly European descent found no amino-acid replacements except for one case of an insertion of two glutamine codons in the second polyglutamine stretch⁵. Because the two amino-acid variants specific to humans occur in 226 human chromosomes, this suggests that they are fixed among humans.

The evolutionary lineages leading to humans and mice diverged about 70 million years (Myr) ago^{6,7}. Thus, during the roughly 130 Myr of evolution that separates the common ancestor of humans and chimpanzees from the mouse, a single amino-acid change occurred in the FOXP2 protein. By contrast, since the human and chimpanzee lineages diverged about 4.6–6.2 Myr ago⁸, two fixed amino-acid changes occurred on the human lineage whereas none occurred on the chimpanzee and the other primate lineages, except

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Williams Syndrome

Williams Syndrome

- *OVERVIEW*
- Symptoms
- Causes
- Medication
- Difficulties
- WS vs. Autism
- Role Of Music
- How To Support
- Encouragement
- For My Friends





Prof. Barbara Landau
Dept. of Cognitive Science

Creolization



Pidgin
(often lacks embedding,
arbitrariness, etc.)



Creole
(a full-blown language)

Learning vs. Teaching





Uniquely Human?

A hypothesis with a checkered past...

Tools

Uniquely Human?

ECOLOGY AND BEHAVIOR
BREVIA

Shaping of Hooks in New Caledonian Crows

Alex A. S. Weir, Jackie Chappell, Alex Kacelnik*

Many animals use tools, but their understanding of physical forces or causal relations is unclear (1, 2). Primates are considered the most versatile and complex tool users, but observations of New Caledonian crows (*Corvus moneduloides*) (3–7) raise the possibility that these birds may rival nonhuman primates in tool-related cognitive capabilities.

We report here an experiment inspired by the observation that a captive female apparently bent a piece of straight wire into a hook and successfully used it to lift a hooker containing food from a vertical pipe (Fig. 1A). This occurred on the fifth trial of an experiment in which the crows had to choose between a hooked and a straight wire and only after the hooked wire had been removed by the other subject in each trial. The animals had prior experience with the apparatus, but their only previous experience with plant material was 1 hour of free manipulation with flexible pipe-cleaners a week before this experiment, and they were not



different from those previously reported and would be unlikely to be effective with natural materials. She had little exposure to and no prior training with plant material, and we have never observed her to perform similar actions with other plant or inanimate objects. The behavior probably has a developmental history that includes experience with objects in their environment (just as infant humans learn about ev-

mailed for use as tools, without extensive prior experience, in almost arbitrary, in experiments by Povungil (experiments 24 to 26 in (2)), chimpanzees (*Pan troglodytes*) repeatedly failed to subvert piping and insert it through a hole to obtain an apple, unless they received explicit coaching. Further experiments (exp. 27 in (2)) (8) have shown a similar lack of adhesion, specific tool modification in primates. There are, however, numerous suggestive field observations (9) and one report of a male capuchin monkey (*Cebus apella*) subverting a piece of wire to obtain honey (10).

Our findings in a species so distantly related to humans and lacking symbolic language, raise numerous questions about the limits of understanding of “folk physics” and causality available to nonhumans, the conditions for these abilities to evolve, and their associated neural adaptations. Comparisons between New Caledonian crows and their relatives, as well as between other cognitively exceptional birds and their relatives (11), offer a unique natural experiment to evaluate hypotheses about the ecological and neural preconditions for complex cognition to evolve. It is not yet known if New Caledonian crows are also exceptional in cognitively demanding tasks not involving tools.

References and Notes

1. C. M. Lewis, *Science* 296, 1629 (2002).
2. D. L. Hummel, *Acta Psychol. Sin.* 36, 101 (2005).

Uniquely Human?



Uniquely Human?

Aesthetics

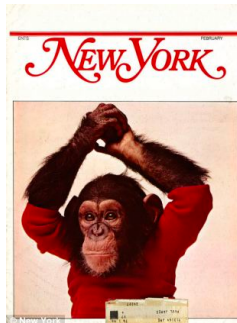
Uniquely Human?



Bowerbirds “decorate” their homes

Uniquely Human?

Language?



Nim Chimpsky



Typical chimpanzee utterances, after several years of training

- Nim eat Nim eat
 - Drink eat me Nim
 - Nut Nim nut
 - Tickle me Nim play
 - Grape eat Nim eat
 - Eat Nim me
 - Eat me Nim
 - Me banana you banana me you give
 - Give orange me give eat orange me eat orange give me eat orange give me you
- Human children do **much** better
- 100x larger vocabulary
Not just concrete nouns and verbs
Grammatically complex sentences
Know "more milk" > "milk more"

Why did we think otherwise?

- **Chimps are so smart!**
 - But being smart isn't enough. (Consider SLI)
- **Chimps are our nearest neighbors!**
 - But still 5 million years of separation.
- **Language isn't special; it's like any other skill!**
 - But it isn't!

Today's **Grand Ideas**

Human nature exists...

we are not blank slates
we are shaped by evolution, as any creature is

...so do internal mental states

we have thoughts and desires and goals, not just behaviors

...& we can study both scientifically!

just like we can study the internal states of computers

Reading Response

Complete by Tuesday 9/10 by 1pm;

In class today, Prof. Firestone gave an example of an important difference between understanding language and doing calculus. What was that difference, and how did we demonstrate it in class?
