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
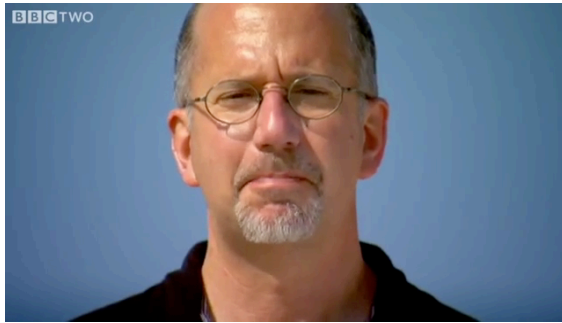
Structure of Language

Phonology
(≈sounds)

For good?
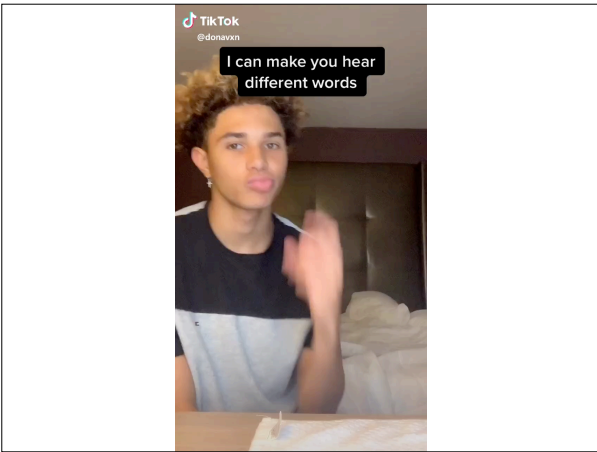
Structure of Language

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)
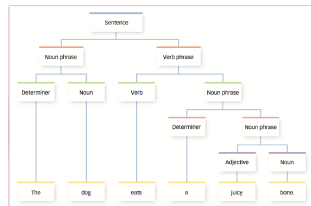
What language is

vs

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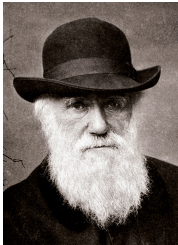
"Man has an instinctive tendency to speak, as we see in the babble of our young children; whilst no child has an instinctive tendency to brew, bake, or write." *(The Descent of Man, p.58)*

Innate?

Innate ≈ **Present at Birth**
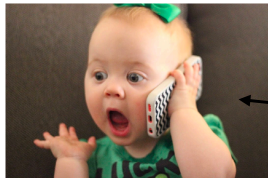
Problem: this doesn't happen

Analogy: Puberty

2009   2016

Innate?

Innate ≈ **Present at Birth**

~~**Languages**~~
(English, French, Russian, Arabic…)

Language
The capacity and inclination

Innate?
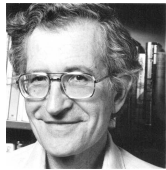
Noam
Chomsky

"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)
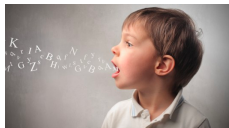
Automaticity

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

Green

Blue

Yellow

Red

Blue

"Stroop Effect"

Automaticity

Red

Green

Blue

Yellow

Red

Blue

Dissociations

Broca's Aphasia

Content without fluency

damage

Specific Language Impairment

letters to nature

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

Wolfgang Enard*, Molly Przeworski*, Simon E. Fisher†, Cecilia S. L. Lai†, Victor Wiebe*, Takashi Kitano*, Anthony P. Monaco† & Svante Pääbo*

* Max Planck Institute for Evolutionary Anthropology, Inselstrasse 22, D-04103 Leipzig, Germany
† Wellcome Trust Centre for Human Genetics, University of Oxford, Roosevelt Drive, Oxford OX3 7BN, UK

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 mouth[1], that are absent in chimpanzees and other great apes. *FOXP2* is the first gene relevant to the human ability to develop language[2]. 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 impairment[3]. 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 variation 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 methods[6] for humans, chimpanzees, orang-utans and mice. Whereas the chimpanzee and mouse structures were essentially identical and the orang-utan structure 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 regulation[7,8]. 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 stretch[3]. 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[9,10]. Thus, during the roughly 130 Myr of evolution that separate 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 ago[11], two fixed amino-acid changes occurred on the human lineage whereas none occurred on the chimpanzee and the other primate lineages, except

Williams Syndrome

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?

Uniquely Human?

Uniquely Human?
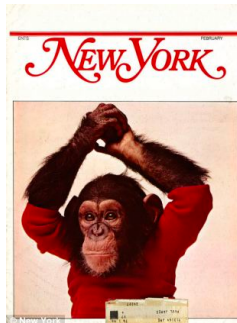
Aesthetics

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?