

# Psycholinguistics: Introduction

9.59 / 24.905

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# Why Study Language?

- Whirs, pops, beeps  $\Rightarrow$  ideas

*When a male octopus spots a female, his normally grayish body suddenly becomes striped. He swims above the female and begins caressing her with seven of his arms. If she allows this, he will quickly reach toward her and slip his 8<sup>th</sup> arm into her breathing tube. A series of sperm packets move slowly through a groove in his arm, finally to slip into the mantle cavity of the female.*

- Whirs, pops, beeps  $\Rightarrow$  ideas

*When Dixie opens the door to Tad, she is stunned, because she thought he was dead. She slams it in his face and then tries to escape. However, when Tad says "I love you", she lets him in. Tad comforts her and they become passionate. When Brian interrupts, Dixie tells a stunned Tad that she and Brian were married earlier that day. With much difficulty, Dixie informs Brian that things are nowhere near finished between her and Tad. Then she spills the news that Jamie is Tad's son. "My what?" says a shocked Tad.*

Puzzle: How do we process sentences?

Sometimes the context helps:

Please pass me the book on the table.

Puzzle: How do we process sentences?

Often the context does not help:

Giant lizard-like creatures are descending from spaceships and attacking Boston.

A body-building Austrian nicknamed "The Terminator" will be elected to a major political office.

# The structure of language

Sound structure: phonetics and phonology

"cat" = /k/ + /æ/ + /t/

"eat" = /i/ + /t/

"rough" = /r/ + /ʌ/ + /f/

Minimal meaning units: morphemes

"cat", "dog", "eat", "go", "-s", "-ing"

# The structure of language

Words: cat, cats, eat, eating, eats

Sentence structure: syntax

The cat is eating the mouse.

\* mouse cat the is the eating.

The dog which the cat scratched ran away.

\* scratched the which away dog cat the ran.

# The structure of language

## Discourse structure

ok: The cat chased the mouse. Then the cat caught the mouse.

Not good: The cat chased the mouse. The Dow Jones fell 200 points today in heavy trading.



# Psycholinguistics: The course

- Language processing: language comprehension and language production.
- Plus some lectures on:
  - The structure of language (syntax, speech, etc.)
  - Language acquisition
  - The neural basis of language

# Course topics

- syntax;
- sentence comprehension
  - Word order; word frequency; world knowledge; non-literal implicatures; context
- discourse coherence;
- intonation;
- neural networks and language processing;
- neural imaging and language processing;
- language production;
- language acquisition;
- speech;
- speech comprehension;
- visual word recognition;
- the relationship between language and thought

# Why do we care how language is processed?

## **Understanding cognition**

Understanding language is part of understanding cognition, a fundamentally human part of cognition.

## **Language is uniquely human**

No other creature or device is capable of accomplishing what we do with human language.

## **Engineering applications**

- (1) Automatic translation: understanding and generation
- (2) Information retrieval
- (3) Readability in text-to-speech systems; Grammatical style checking

## **Other applications**

- (1) Learning to read;
- (2) Re-learning language for aphasics.

# Properties of Human Language

(1) Specialized use of the auditory channel.

- Our mouths and ears are built for speech

# Properties of Human Language

(2) Displaced Reference – The ability to refer to things that are not in the immediate environment

*I saw a show at the wharf yesterday  
John might have to get surgery*

# Properties of Human Language

## (3) Discreteness

- Language is made up of little units that combine to make bigger units

<b>Unit</b>	<b>Number</b>	<b>Meaning</b>
<b>phonemes</b>	<b>20-40</b>	<b>none</b>
<b>morphemes</b>	<b>10,000+</b>	<b>single chunk</b>
<b>words</b>	<b>50,000+</b>	<b>simple combinations</b>
<b>sentences</b>	<b>infinite</b>	<b>complete thought</b>

# Properties of Human Language

(4) Non-Iconicity – Arbitrary reference for sounds and words

- *whale (small word, big referent) vs. microorganism (small referent, big thing)*
- *bug vs. bus*
- *cat, act, tac*
- What about onomatopoeia?

English	Japanese	Tagalog
cock-a-doodle-doo	kokekokko	kuk-kukauk
meow	njaa	njijaw
chirp	pii-pii	Tiritit
bow-wow	wan-wan	aw-aw

# Properties of Human Language

(5) Productivity - Language is not just a memorized set of sentences

*Colorless green ideas sleep furiously.*

*\*Furiously sleep ideas green colorless.*

- There are *rules* that govern sentence structure



# Properties of Human Language

- What kind of rules?

- Not prescriptive rules.

Prescriptive rules: What your English teacher told you

*Don't say "ain't"*

*Don't end sentences in prepositions:*

*\*That is something up with which I cannot put.*

*Don't split infinitives:*

*To boldly go where no man has gone before.*

# Properties of Human Language

- Descriptive Rules: Rules obeyed implicitly.

*Sentence formation rules:*

*A noun phrase (NP) rule:*

*NP → Det (Adj\*) Noun*

*The cat; The big cat; The big grey cat; The big ugly nasty grey cat ...*

# Properties of Human Language

➤ *More sentence formation rules:*

$S \rightarrow NP VP$

*"A sentence (S) consists of an NP and a verb phrase (VP)"*

$VP \rightarrow V NP$

$VP \rightarrow V \text{ that } S$

*John likes cheese.*

*Mario said that John likes cheese.*

*Jill thought that Mario said that John likes cheese.*

*...*

*(Note: this is a **recursive** rule: The category S expands to another S further along)*

# Properties of Human Language

- Descriptive Rules: Rules obeyed implicitly.

*Absolutely*

*Abso-fucking-lutely*

*\*Ab-fucking-solutely*

*Spectacular*

*Kangaroo*

“fucking”-insertion rule (Aronoff, 1972)

# Properties of Human Language

## (6) Equipotentiality

- Every human community has language
- All languages are similarly complex and expressive
- No language is easier to learn than any other
- All languages are internally consistent

# Properties of Human Language

- African American Vernacular English
  - Ebonics (not a substandard version of English)
  - It's OK to omit "be"  
*She \_\_\_ the first one that started us off.*
  - Only where you can contract "is"  
*SE: \*He's as nice as he says he's.*  
*AAVE: \*He's as nice as he says he \_\_\_.*

# Differences between 24.900 (intro to linguistics) and 9.59/24.905 (this class)

- Topic of inquiry:
  - 24.900: the structure of human language
  - 9.59/24.905: how language is processed

# Differences between 24.900 (intro to linguistics) and 9.59/24.905 (this class)

- Methods:

- 24.900: grammaticality judgments on a few individuals
- 9.59/24.905: statistically evaluated experiments with many items and participants; many different dependent measures:
  - Acceptability judgments (how good does this sound?);
  - Reaction times:
    - Reading times;
    - Looking times to visual scenes, given auditory input;
    - Lexical decision times, etc.
  - Brain imaging:
    - Event-related potentials (EEG)
    - Magneto-encephalography (MEG)
    - Functional MRI



# Example from grammaticality judgments method

- Chomsky (1986):
  - “?What do you wonder who saw?” is about the same badness as
  - “?Who do you wonder whether the Red Sox beat?”
  - “\*Who do you think that left?” (compare to “Who do you think left?”) is supposedly much worse
  - **But:** There is no measure of difficulty, other than Chomsky’s intuitions. (Could be ok, but might not generalize)

# Example from Reaction Time method

- Research question: Do crossed-dependencies make sentences hard to understand in English? (Gibson & Breen, 2003)
  - (1) ??? The chairman consulted the executive [pp about the companies ] [RC that was making lots of money ].
  - (2) The chairman consulted the executives [pp about the company ] [RC that was making lots of money ].

# Alternative hypothesis: Local connections are easier than less local connections

- (3) The chairman consulted the executives [<sub>PP</sub> of the company ] [<sub>RC</sub> that was making lots of money ].
- (4) The chairman consulted the executive [<sub>PP</sub> of the companies ] [<sub>RC</sub> that was making lots of money ].

# All four conditions:

(1) The chairman consulted the executive [PP about the companies ] [RC that was making lots of money ].



(2) The chairman consulted the executives [PP about the company ] [RC that was making lots of money ].



(3) The chairman consulted the executive [PP of the companies ] [RC that was making lots of money ].



(4) The chairman consulted the executives [PP of the company ] [RC that was making lots of money ].



## Method: Self-paced reading

- 42 participants
- 24 items

