Psych 156A/ Ling 150: Psychology of Language Learning

Lecture 13
Introduction to Language Structure

Announcements

HW3 due today
Please pick up previous assignments if you haven’t done so already
Review questions for structure posted
Start thinking about the final assignment (see webpage for details on writing a paper instead of taking the exam)

Computational Problem:
Figure out the order of words (syntax)

Jareth juggles crystals
Subject Verb Object
Noun Verb Noun NP

Depends on grammatical categories like Nouns and Verbs (and their associated phrases (NP)), but also on more precise distinctions like Subjects and Objects.

Some Noun Phrase distinctions:
Subject = usually the agent/actor of the action, “doer”: Jareth
Object = usually the recipient of the action, “done to”: crystals

Important idea: The observable word order speakers produce (like Subject Object Verb) is the result of a system of word order rules that speakers unconsciously use when they speak. This system of word order rules is called syntax.
Computational Problem: Figure out the order of words (syntax)

One way to generate Subject Verb Object order:
The linguistic system specifies that order as the general pattern of the language. An example of this kind of system is English.

Jareth juggles crystals
Subject  Verb  Object

Another way to generate Subject Verb Object order:
The linguistic system specifies Subject Object Verb as the general pattern, but the Verb in main clauses moves to the second position and some other phrase (like the Subject) moves to the first position. An example language like this is German.

Jareth juggles crystals
Subject  Verb  Object

The movement rules

German
Verb  Subject  Object  Verb

movement rules

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The movement rules

German
Verb  Subject  Object  Verb

movement rules
A third way to generate Subject Verb Object order:
The linguistic system specifies Subject Object Verb as the general pattern, but the Object moves after the Verb in certain contexts (the Object is unexpected information). Kannada is a language like this.

The learning problem: How do children know which system their language uses?

This is a hard question!
Children only see the output of the system (the observable word order of Subject Verb Object).
Humans are good at language - how good are computers?

Translation is not so easy: more than just word-by-word

Word-by-word translation to Japanese is poor. Japanese structure is very different from English structure at this level.
Translation is not so easy: more than just word-by-word


Translation is not as poor. Russian structure is not as different from English structure at this level, though it is still different.

Translation is not so easy: more than just word-by-word


The translation is fairly poor. Arabic structure is fairly different from English structure at this level.

Solving the Language Problem (Artificial Intelligence)

HAL 9000 from 2001: A Space Odyssey (1968)

Perfect production and comprehension of English.

1960s: Language not considered one of the “hard” problems of artificial intelligence.


Contrast: Chess-playing. In 1997, a program named Deep Blue beat the reigning world champion in chess. It did this by having enough computational resources to investigate every move option before it actually made the chess move. This shows that computers’ poor performance on language is not about insufficient computational power, since there is enough computational power to solve the chess-playing problem.
Navajo Code Talker Paradox (Baker 2001)

English must be very different from Navajo
Japanese could decode English, but couldn't decode Navajo when they didn't know it was Navajo.

English must be similar to Navajo
English can be translated into Navajo and back with no loss of meaning. (Languages are not just a product of the culture - pastoral Arizona lifestyle couldn't have prepared the codetalkers for Pacific Island high tech warfare. Yet, translation was still possible.)

Types of Variation

Vocabulary

English "think" verbs: think, know, wonder, suppose, assume, ...

Multiple types of the action verb "think". Each has certain uses that are appropriate.

*I wonder whether the girl saved her little brother from the goblins." [grammatical]

*I suppose whether the girl saved her little brother from the goblins." [ungrammatical]

Navajo "carry" verbs: depends on object being carried

aash (carry a solid round-ish object)

kaah (carry an open container with contents)

lé (carry a flexible object)
Types of Variation

Sounds: Each language uses a particular subset of the sounds in the International Phonetic Alphabet, which represents all the sounds used in all human languages. There’s often overlap (ex: “m”, “p” are used in many languages), but languages also may make use of the less common sounds.

- less common English sounds: “th” [θ], “th” [ð]
- less common Navajo sounds: “whispered l”, “nasalized a”, …

Types of Variation

Morphology (word forms)

English: invariant word forms
- “the girl is crying”, “I am crying”

Navajo: no invariant forms (there may be 100-200 prefixes for verb stems)
- At’édéd yicha. “Girl crying”
- Yishcha. “I am crying” (yi + sh + cha)
- Nináhwişdílaad, “I am again plowing” (ni + náá + ho + hi + sh + l + dílaad)

Types of Variation

Word order (syntax)

English: Subject Verb Object (invariant word order)
- “The boy saw the girl”

Navajo: Subject Object Verb, Object Subject Verb (varying word orders, meaning depends only on verb’s form)

Ashkii a’édéd bhistá
- boy girl saw
- “The girl saw the boy”

This one prefix changes the entire meaning of the sentence
Thinking About Syntactic Variation

**Similarities & Differences: Parameters**

Chomsky: Different combinations of different basic elements (parameters) would yield the observable languages (similar to the way different combinations of different basic elements in chemistry yield many different-seeming substances).

**Big Idea:** A relatively small number of syntax parameters yields a large number of different languages’ syntactic systems.

![Diagram of 5 different parameters of variation](image)

2 different parameter values of one parameter

Chomsky: Different combinations of different basic elements (parameters) would yield the observable languages (similar to the way different combinations of different basic elements in chemistry yield many different-seeming substances).

Big Idea: A relatively small number of syntax parameters yields a large number of different languages' syntactic systems.

Total languages that can be represented = $2^5 = 32$

Chomsky: Children are born knowing the parameters of variation. This is part of Universal Grammar. Input from the native linguistic environment determines what values these parameters should have.

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Learning Language Structure
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Japanese

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Navajo

Greenberg's Word Order Generalizations

Navajo

Japanese
Despite the differences in the languages (and their cultural histories), both Japanese and Navajo are very similar when viewed through these three structural descriptions.
<table>
<thead>
<tr>
<th>Greenberg's Word Order Generalizations</th>
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</tr>
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<tbody>
<tr>
<td><strong>English</strong></td>
<td><strong>Edo (Nigeria)</strong></td>
</tr>
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</table>

### Basic word order:
- **Subject** Verb **Object**

- **Sarah** found **Toby**

- **Òzó mién Adésuwá** (Ozo found Adesuwa)

### Prepositions:
- **Preposition** **Noun Phrase**

- Jareth gave the crystal **to Sarah**

- **Ozo** gave **the book to Adésuwa**

### Possessed before Possessor:
- **Possession** **Possessor**

- **Sarah**'s quest

- Omó **Ozó** child **Ozo**

- "child of Ozo"
Greenberg’s Word Order Generalizations

English

Basic word order:
Subject Verb Object

Prepositions:
Preposition Noun Phrase

Possessed before Possessor Possession Possessor

Again, despite the differences in the languages (and their cultural histories), both English and Edo are very similar when viewed through these three structural descriptions.

Greenberg’s Word Order Generalizations

Edo (Nigeria)

Basic word order:
Subject Verb Object

Prepositions:
Preposition Noun Phrase

Possessed before Possessor Possession Possessor

Greenberg found forty-five “universals” of languages - patterns overwhelmingly followed by languages with unshared history (Navajo & Japanese, English & Edo)

Not all combinations are possible - some patterns rarely appear
Ex: Subject Verb Object language (English/Edo-like) + postpositions (Navajo/Japanese-like)

Moral: Languages may be more similar than they first appear “on the surface”, especially if we consider their structural properties.

More Language Comparisons

French

Subject Verb
Jareth arrivera
Jareth will-come

“Jareth will come.”
grammatical

Italian

Subject Verb
Jareth verré
Jareth will-come

“Jareth will come.”
grammatical

French

*Verb Subject
*[Arrivera Jareth
*[Will-arrive Jareth

“Jareth will arrive”
grammatical

Italian

Verb Subject
Verrà Jareth
Will-arrive Jareth

“Jareth will arrive”
grammatical
More Language Comparisons

**French**  |  **Italian**
---|---
*Verb* | Verb
*Arrivera* | Verrà
*He will come* | *He will come*
ungrammatical | grammatical

These word order patterns might be fairly easy to notice. They involve the combinations of Subject and Verb that are grammatical in the language. A child might be able to notice the prevalence of some patterns and the absence of others.

More Language Comparisons

**French**  |  **Italian**
---|---
Subject Verb | Subject Verb
*Verb Subject* | Verb Subject
*Verb* | Verb

Expletive subjects: words without content (may be more difficult to notice)

**French**  |  **Italian**
---|---
*Pleut* | Piove
It-rains. | It-rains.
"It’s raining" | “It’s raining.”
Il pleut. | Okay to leave out expletive subject “it”.
It rains. | "It’s raining."
"It’s raining." |
Not okay to leave out expletive subject "it".

Embedded Subject-Question Formation (easy to miss)

**French**  |  **Italian**
---|---
Tu veux que Marie épouse Jay. | "You want Marie to marry Jay."
You want that Marie marries Jay. | "You want Marie to marry Jay." 
*Qui veux-tu que ___ épouse Jay? Who want-you that ___ marry Jay?"
Qui veux-tu qui ___ épouse Jay? | "Who do you want to marry Jay?"
Who want-you that marry Jay? | Requires a special "that" form: qui.
More Language Comparisons
Embedded Subject-Question Formation (easy to miss)

French

Credi che Jareth verrá.
You think that Jareth will come.
"You think that Jareth will come."

Che credi che verrá?
Who think you that will come?
"Who do you think will come?"

Does not require a special "that" form: use the same one as normally is used - che.

Italian

More Language Comparisons

French

Subject Verb
*Verb Subject
*Verb

Not okay to leave out expletive subject "it".
Requires special action for embedded subject questions.

Italian

Subject Verb
Verb Subject
Verb

Okay to leave out expletive subject "it".
Does not require special action for embedded subject questions.

All these involve the subject in some way - coincidence?
Idea: No! There's a language parameter involving the subject.

The Value of Parameters: Learning the Hard Stuff by Noticing the Easy Patterns

French vs. Italian: Subject Parameter

French

Subject Verb
*Verb Subject
*Verb

Embedded Subject-question formation (easy to miss)

*Qui veut-la qu'épouse Jean?
Who want you that marries Jean?
Que veux-tu qui épouse Jean?
Who think you that will come?

Italian

Subject Verb
Verb Subject
Verb

Easier to notice
Hard to notice

Big idea: If all these structural patterns are generated from the same linguistic parameter (e.g. a "subject" parameter), then children can learn the hard-to-notice patterns (like the patterns of embedded subject questions) by being exposed to the easy-to-notice patterns (like the optional use of subjects with verbs). The hard-to-notice patterns are generated by one setting of the parameter, which children can learn from the easy-to-notice patterns.

Children’s knowledge of language structure variation is believed by nativists to be part of Universal Grammar, which children are born with.
Universal Grammar: Principles & Parameters

Principles: Apply to all human languages. Ex: Language has hierarchical structure. Smaller units are chunked into larger units.

- sounds: gablin
- syllables: gablin
- words: goblin
- phrases: Noun Phrase (NP) Verb Phrase (VP) Ex: The sneaky goblin stole the baby
- sentences: NP VP Ex: The sneaky goblin stole the baby

Universal Grammar: Principles & Parameters

Parameters: Constrained variation across languages. Children must learn which option their native language uses.

- Japanese/Navajo: Basic word order: Subject Object Verb
  Postpositions: Noun Phrase Postposition Possessor before Possessed
  Possession Possessor

- Edo/English: Basic word order: Subject Verb Object
  Prepositions: Preposition Noun Phrase Possessed before Possessor
  Possession Possessor

At this level of structural analysis (parameters), languages differ minimally from each other. This makes language structure much easier for children to learn. All they need to do is set the right parameters for their language, based on the data that are easy to observe.
Language Variation: Summary

While languages may differ on many levels, they have many similarities at the level of language structure (syntax). Even languages with no shared history seem to share similar structural patterns.

One way for children to learn the complex structures of their language is to have them already be aware of the ways in which human languages can vary. Nativists believe this is knowledge contained in Universal Grammar. Then, children listen to their native language data to decide which patterns their native language follows.

Languages can be thought to vary structurally on a number of linguistic parameters. One purpose of parameters is to explain how children learn some hard-to-notice structural properties.

Questions?