Psych 156A/ Ling 150: Acquisition of Language II

Lecture 15
Introduction to Language Structure

Announcements

Please pick up HW1 and HW2 if you haven’t done so yet
HW3 is due by the end of class today
Review questions are available for structure
Online course evaluations are available for this class - please fill them out! :)

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

Jareth juggles crystals
Subject Verb Object
Noun Verb Noun
NP 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.
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.

English  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.

German  Subject  Object  Verb

German  movement rules

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German  movement rules

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

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.

Kannada Subject Object Verb

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

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

[Image 1]

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 as 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.

2010: Still not very close to human-like performance.


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 (which some people might consider a very difficult problem).

Update for 2011 on a machine’s abilities to do what humans do:

Man vs. Machine (Watson) in Jeopardy & how hard a problem language comprehension and production is

http://www.youtube.com/watch?v=d7r7ixQeX7g
(approximately 9 min video)

About Human Knowledge:
Language & Variation
Navajo Code Talkers

Crucial cryptographic method used in World War II


"...Johnston saw Navajo as answering the military requirement for an undecipherable code. Navajo was spoken only on the Navajo lands of the American Southwest, and its syntax and tonal qualities, not to mention dialects, made it unintelligible to anyone without extensive exposure and training. One estimate indicates that at the outbreak of World War II fewer than 30 non-Navajos could understand the language...."

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 code talkers 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]
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” ə “th” ɔ

less common Navajo sounds: “whispered l”, “nasalized a”, …

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’ééd yicha. “Girl crying”

Yishcha. “I am crying”
(yi + sh + cha)

Ninááhwiishdlaad. “I am again plowing”
(ni + náá + ho + hi + sh + l + dlaad)

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 at’ééd  ylipisía
boy  girl  saw
“The boy saw the girl”

Ashkii at’ééd  bilistá
boy  girl  saw
“The girl saw the boy”

Thinking About Syntactic Variation
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 = \(2^5 = 32\)
Similarities & Differences: Parameters

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

<table>
<thead>
<tr>
<th>English</th>
<th>French</th>
<th>Japanese</th>
<th>Navajo</th>
<th>Tagalog</th>
</tr>
</thead>
</table>

Learning Language Structure

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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Greenberg's Word Order Generalizations

<table>
<thead>
<tr>
<th>Navajo</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic word order:</td>
<td>Basic word order:</td>
</tr>
<tr>
<td>Subject Object Verb</td>
<td>Subject Object Verb</td>
</tr>
<tr>
<td>Ashkii at'éd yiylitsá</td>
<td>Jareth-ga Hoggle-o butta</td>
</tr>
<tr>
<td>boy girl saw</td>
<td>Jareth Hoggle hit</td>
</tr>
<tr>
<td>“The boy saw the girl”</td>
<td>“Jareth hit Hoggle”</td>
</tr>
</tbody>
</table>
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>Basic word order:</th>
<th>Subject Verb Object</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>Edo (Nigeria)</td>
</tr>
<tr>
<td>Sarah found Toby</td>
<td>Özó mién Adésuwá</td>
</tr>
<tr>
<td></td>
<td>Ozo found Adesuwa</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prepositions:</th>
<th>Preposition Noun Phrase</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>Edo (Nigeria)</td>
</tr>
<tr>
<td>Jareth gave the crystal to Sarah</td>
<td>Òzó rhé néné ebé né Adésuwá</td>
</tr>
<tr>
<td></td>
<td>Ozo gave the book to Adesuwa</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possessed before Possessor</th>
<th>Possession Possessor</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>Edo (Nigeria)</td>
</tr>
<tr>
<td>quest of Sarah</td>
<td>Omo Ozó</td>
</tr>
<tr>
<td>(alternative: Sarah’s quest)</td>
<td>child Ozó</td>
</tr>
<tr>
<td></td>
<td>“child of Ozó”</td>
</tr>
</tbody>
</table>

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

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.
### One potential parameter

<table>
<thead>
<tr>
<th>English</th>
<th>Italian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject Verb</td>
<td>Subject Verb</td>
</tr>
<tr>
<td>&quot;Verb Subject&quot;</td>
<td>&quot;Verb Subject&quot;</td>
</tr>
<tr>
<td>&quot;Verb&quot;</td>
<td>&quot;Verb&quot;</td>
</tr>
</tbody>
</table>

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.

### One potential parameter

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

<table>
<thead>
<tr>
<th>English</th>
<th>Italian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raining.</td>
<td>Piove.</td>
</tr>
<tr>
<td>&quot;It's raining.&quot;</td>
<td>&quot;It's raining.&quot;</td>
</tr>
</tbody>
</table>

Not okay to leave out expletive subject "it". Okay to leave out expletive subject "it".

### One potential parameter

**That-trace effect for subject questions**

<table>
<thead>
<tr>
<th>English</th>
<th>Italian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who do you think (*that) will come?</td>
<td>Credi che Jareth verrá.</td>
</tr>
<tr>
<td>Requires no &quot;that&quot; in embedded clause, despite allowing &quot;that&quot; in declaratives and object questions</td>
<td>You think that Jareth will come. &quot;You think that Jareth will come.&quot;</td>
</tr>
<tr>
<td>I think (that) Hoggle will save Sarah.</td>
<td>Che credi che Hoggle __ verrá?</td>
</tr>
<tr>
<td>Who did you think (that) Hoggle would save?</td>
<td>Who do you think will come? &quot;Who do you think will come?&quot;</td>
</tr>
</tbody>
</table>

 Allows "that" in the embedded clause of a subject question (and declarative clauses).
The Value of Parameters: Learning the Hard Stuff by Noticing the Easy Patterns

English vs. Italian: Subject Parameter

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 linguistic nativists to be part of Universal Grammar, which children are born with.

Another possible parameter

Syntax: the Head Directionality parameter (Baker 2001, Cook & Newson 1996): heads of phrases (e.g., Nouns of Noun Phrases, Verbs of Verb Phrases, Prepositions of Preposition Phrases) are consistently either the leftmost or rightmost position.

Japanese/Navajo: Head-Last

Postpositions:
Noun Phrase Postposition
NP P

Object
Another possible parameter

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Edo/English: Head-First
Verb Phrase:
Verb Object
Prepositions:
Preposition Noun Phrase
Preposition Object

Universal Grammar: Parameters

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 parameter values for their language, based on the data that are easy to observe.

Japanese/Navajo

Edo/English

Questions?

You should be able to do up through question 9 on the structure review questions.