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

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

Jareth juggles crystals
Subject Verb Object

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.

Slide 1:

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

Jareth juggles crystals
Subject Verb Object

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

Slide 2:

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

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.

German   Subject Object Verb

Slide 3:

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

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.

movement rules

German   ____ Verb Subject Object *Verb*

Slide 4:

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

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.

movement rules

German   Subject Verb *Subject* Object *Verb*

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

Jareth juggles crystals
Subject Verb Object

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

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

Jareth juggles crystals
Subject Verb Object

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.

movement rule

Kannada   Subject *Object* Verb Object

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

Jareth juggles crystals
Subject Verb Object

German

English
Subject Verb Object   Subject Verb *Subject* Object *Verb*

Kannada
Subject *Object* Verb Object

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

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

Jareth juggles crystals
Subject Verb Object

German

English
Subject Verb Object   Subject Verb *Subject* Object *Verb*

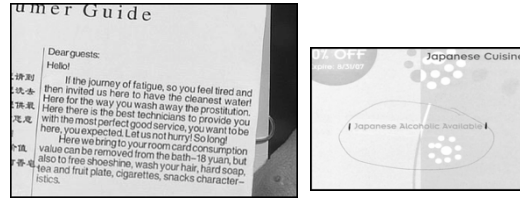Kannada
Subject *Object* Verb Object

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

http://www.nbc.com/nbc/The_Tonight_Show_with_Jay_Leno/headlines/

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

http://www.worldlingo.com/en/products_services/worldlingo_translator.html

Translation (Japanese):

柄かでない危険および番号なしあなたが盗んだ子供を取り戻す困難によって私によっては小悪魔都市を越える城に私の方法がここに戦った。

Original (English):

Through dangers untold and hardships unnumbered, I have fought my way here to the castle beyond the goblin city to take back the child you have stolen.

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

http://www.worldlingo.com/en/products_services/worldlingo_translator.html

Translation (Japanese):

柄かでない危険および番号なしあなたが盗んだ子供を取り戻す困難によって私によっては小悪魔都市を越える城に私の方法がここに戦った。

Translation (English):

My method fought here in the castle which exceeds the small demoniac city danger and the number which are not distinct it is not depending upon me with difficultly recovers the child whom you steal.

Original (English):

Through dangers untold and hardships unnumbered, I have fought my way here to the castle beyond the goblin city to take back the child you have stolen.

Original (Japanese):

柄かでない危険および番号なしあなたが盗んだ子供を取り戻す困難によって私によっては小悪魔都市を越える城に私の方法がここに戦った。

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

http://www.worldlingo.com/en/products_services/worldlingo_translator.html

Translation (Russian):

Через untold и hardships опасностей незанумерованные, я воевал мою дорогу здесь к замоку за городом goblin принять назад ребенка, котор вы крали.

Original (English):

Through dangers untold and hardships unnumbered, I have fought my way here to the castle beyond the goblin city to take back the child you have stolen.

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

http://www.worldlingo.com/en/products_services/worldlingo_translator.html

Translation (Russian):

Через untold и hardships опасностей незанумерованные, я воевал мою дорогу здесь к замоку за городом goblin принять назад ребенка, котор вы крали.

Original (English):

Through dangers untold and hardships unnumbered, I have fought my way here to the castle beyond the goblin city to take back the child you have stolen.

Translation (English):

Through untold and hardships of dangers unnumbered, I warred my road here to [zamoku] after the city of goblin to accept back child, you was which they stole

Original (Russian):

Через untold и hardships опасностей незанумерованные, я воевал мою дорогу здесь к замоку за городом goblin принять назад ребенка, котор вы крали

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

http://www.worldlingo.com/en/products_services/worldlingo_translator.html

Translation (Arabic):

من خلال لَخطار [أونتولد] وشدات [أونّومبرد], قد تنازع أنا طريقي هنا إلى القصر, إلى ما بعد المَدِينة مدينة أن يأخذ إلى الخلف الطفلة أنّ أنت قد سرقت

Original (English):

Through dangers untold and hardships unnumbered, I have fought my way here to the castle beyond the goblin city to take back the child that you have stolen.

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

http://www.worldlingo.com/en/products_services/worldlingo_translator.html

Translation (Arabic):

من خلال لَخطار [أونتولد] وشدات [أونّومبرد], قد تنازع أنا طريقي هنا إلى القصر, إلى ما بعد المَدِينة مدينة أن يأخذ إلى الخلف الطفلة أنّ أنت قد سرقت

Original (English):

Through dangers untold and hardships unnumbered, I have fought my way here to the castle beyond the goblin city to take back the child that you have stolen.

Translation (English):

Through dangers [['awntwld] and pulls [['awnnwmbrd]], already I dispute roads here to the palace beyond the demon is city to the back takes to the child that you stole

Original (Arabic):

من خلال لَخطار [أونتولد] وشدات [أونّومبرد], قد تنازع أنا طريقي هنا إلى القصر, إلى ما بعد المَدِينة مدينة أن يأخذ إلى الخلف الطفلة أنّ أنت قد سرقت

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.

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

http://www.research.att.com/~ttsweb/tts/demo.php

Solving the Language Problem
(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 (which some people might consider a very difficult problem).

Solving the Language Problem
(Artificial Intelligence)

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=dr7IxQeXr7g
(approximately 9 min video)

About Human Knowledge:
Language & Variation

Navajo Code Talkers

Crucial crytographic method used in World War II

http://en.wikipedia.org/wiki/Code_talker#Use_of_Navajo

"…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

Vocabulary
English "think" verbs: think, know, wonder, suppose, assume, …
Navajo "carry" verbs: depends on object being carried
   aah (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", …

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k g	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	N		
Trill	B			r					R		
Tap or Flap				ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	L			

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'ééd yicha. "Girl crying"

  Yishcha. "I am crying"
  (yi + sh + cha)

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

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   at'ééd   **yiyi**il**ts**á
  boy   *girl*   *saw*
  "The boy saw the girl"

  Ashkii   at'ééd   **bi**il**st**á
  boy   *girl*   *saw*
  "The girl saw the boy"

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.
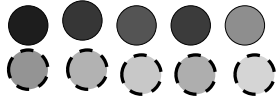

Similarities & Differences: Parameters

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.
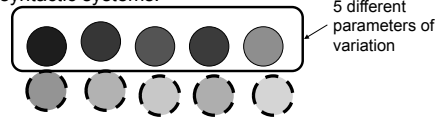
5 different parameters of variation

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.

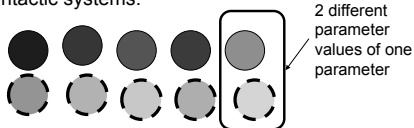2 different parameter values of one parameter

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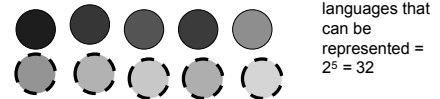
Total languages that can be represented = $2^5 = 32$

Similarities & Differences: Parameters

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

English

Japanese

Tagalog

French

Navajo

…

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.

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.

English

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.

Japanese

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.

Navajo

Generalizations About Language Structure

Greenberg's Word Order Generalizations

Navajo   Japanese

Greenberg's Word Order Generalizations

Navajo   Japanese

Basic word order: Basic word order:
Subject Object Verb   Subject Object Verb

Ashkii at'ééd yiyiiltsá   Jareth-ga Hoggle-o butta
boy   girl   saw   *Jareth   Hoggle   hit*

"The boy saw the girl"   "Jareth hit Hoggle"

Greenberg's Word Order Generalizations

Navajo	Japanese
Postpositions:	Postpositions:
Noun Phrase Postposition	Noun Phrase Postposition

'éé'   biih   náásdzá
clothing   into   I-got-back
"I got back into (my) clothes."

Jareth-ga Sarah to   kuruma da
Jareth   Sarah with   car   by

London ni itta
London to went

"Jareth went to London with Sarah by car."

Greenberg's Word Order Generalizations

Navajo	Japanese
Possessor before Possessed	Possessor before Possessed
Possessor Possession	Possessor Possession

Chidí   bi-jáád
Car   its-leg

Toby-no   imooto-ga
Toby's   sister

"the car's wheel"

"Toby's sister"

Greenberg's Word Order Generalizations

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

Despite the differences in the languages (and their cultural histories), both Japanese and Navajo are very similar when viewed through these three structural descriptions.

Greenberg's Word Order Generalizations

English   Edo (Nigeria)

Greenberg's Word Order Generalizations

English	Edo (Nigeria)
Basic word order: Subject Verb Object	Basic word order: Subject Verb Object
Sarah found Toby	Òzó mién Adésuwá *Ozo found Adesuwa*

Greenberg's Word Order Generalizations

English	Edo (Nigeria)
Prepositions: Preposition Noun Phrase	Prepositions: Preposition Noun Phrase
Jareth gave the crystal to Sarah	Òzó rhié néné ebé né Adésuwá *Ozo gave the book to Adesuwa*

Greenberg's Word Order Generalizations

English	Edo (Nigeria)
Possessed before Possessor	Possessed before Possessor
Possession Possessor	Possession Possessor
quest of Sarah	Omo Ozó child Ozo
(alternative: Sarah's quest)	"child of Ozo"

Greenberg's Word Order Generalizations

English	Edo (Nigeria)
Basic word order: Subject Verb Object	Basic word order: Subject Verb Object
Prepositions: Preposition Noun Phrase	Prepositions: Preposition Noun Phrase
Possessed before Possessor Possession Possessor	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.

13

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

English   Italian

Subject Verb   Subject Verb
                                   Jareth   verrá
                                   Jareth   will-come

"Jareth will come."   "Jareth will come."

 grammatical   grammatical

One potential parameter

English   Italian

 *Verb   Subject   Verb   Subject
                                   Verrá   Jareth
Will arrive Jareth   *Will-arrive Jareth*

                                   "Jareth will arrive"

 ungrammatical   grammatical

One potential parameter

English   Italian

 *Verb   Verb
                                   Verrá
Will come   *He-will-come*

                                   "He will come"

 ungrammatical   grammatical

One potential parameter

English	Italian
Subject Verb	Subject Verb
*Verb Subject	Verb Subject
*Verb	Verb

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)

English	Italian
	Piove.
	It-rains.
	"It's raining."
Raining.	
"It's raining."	

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

One potential parameter

That-trace effect for subject questions

English   Italian

Who do you think (*that) will come?

Requires no "that" in embedded clause, despite allowing "that" in declaratives and object questions

I think (that) Hoggle will save Sarah.
Who did you think (that) Hoggle would save?

One potential parameter

That-trace effect for subject questions

English   Italian

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?"

Allows "that" in the embedded clause of a subject question (and declarative clauses).

One potential parameter

English

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

English vs. Italian: Subject Parameter

English	Italian	
Subject Verb	Subject Verb	Easier to notice
*Verb Subject	Verb Subject	Hard to notice
*Verb	Verb	

Expletives

It rains   Piove.
                         It-rains.

Embedded Subject-question formation (easy to miss)

Who do you think (*that) will come?   Che credi   che __ verrá?
                                        Who think-you that   will-come?

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 (ex: Nouns of Noun Phrases, Verbs of Verb Phrases, Prepositions of Preposition Phrases) are consistently in either the leftmost or rightmost position

Japanese/Navajo: Head-Last

Verb Phrase:
Object Verb

VP
NP   Verb
Object

Postpositions:
Noun Phrase Postposition

PP
NP   P
Object   postposition

Another possible parameter

Syntax: the Head Directionality parameter (Baker 2001, Cook & Newson 1996): heads of phrases (ex: Nouns of Noun Phrases, Verbs of Verb Phrases, Prepositions of Preposition Phrases) are consistently in either the leftmost or rightmost position
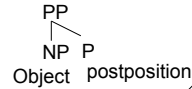
Edo/English: Head-First
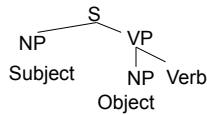Verb Phrase:
Verb Object

VP
Verb   NP
            Object

Prepositions:
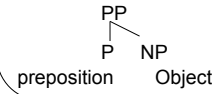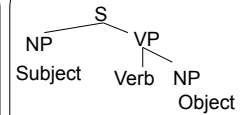Preposition Noun Phrase

PP
P   NP
Preposition   Object
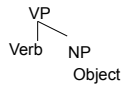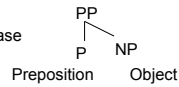
Universal Grammar: Parameters

At this level of structural analysis (parameters), languages differ vary 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

S
NP   VP
Subject   NP   Verb
            Object

PP
NP   P
Object   postposition

Edo/English

S
NP   VP
Subject   Verb   NP
                Object

PP
P   NP
preposition   Object

Questions?

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