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		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

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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.

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

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

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

Jareth juggles crystals
Subject Verb Object

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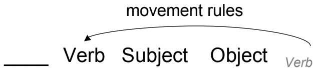
German



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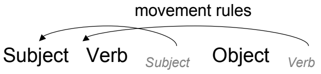

Computational Problem:
Figure out the order of words (syntax)

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:
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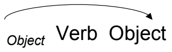


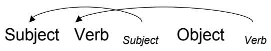
movement rule

Kannada Subject *Object* Verb Object

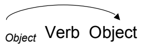
Computational Problem:
Figure out the order of words (syntax)

Jareth juggles crystals
Subject Verb Object

English
Subject Verb Object



German
Subject Verb *Subject* Object *Verb*



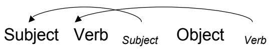
Kannada
Subject *Object* Verb Object

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

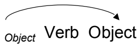
Computational Problem:
Figure out the order of words (syntax)

Jareth juggles crystals
Subject Verb Object

English
Subject Verb Object



German
Subject Verb *Subject* Object *Verb*



Kannada
Subject *Object* Verb Object

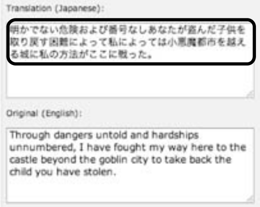
This is a hard question!

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.worldlingo.com/en/products_services/worldlingo_translator.html



明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。

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

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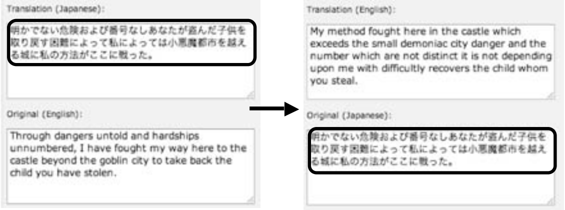

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Through dangers untold and hardships unnumbered, I have fought my way here to the castle beyond the goblin city to take back the child you have stolen.

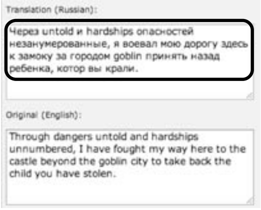
My method fought here in the castle which exceeds the small demoniac city danger and the number which are not distinct it is not depending upon me with difficultly recovers the child whom you steal.

明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



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

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

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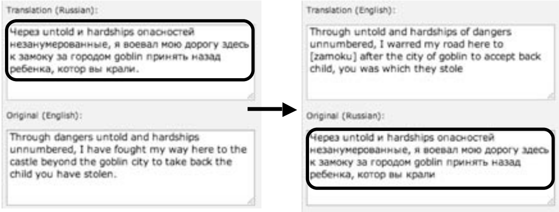

Translation (Russian):

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

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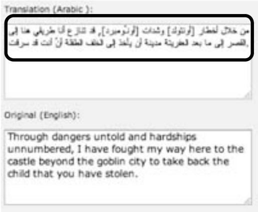

Translation (Arabic):

من خلال أخطار [أونتولد] وشدات [أونومبرد]، قد تنازع أنا طريقي هنا إلى القصر إلى ما بعد العفريتة 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

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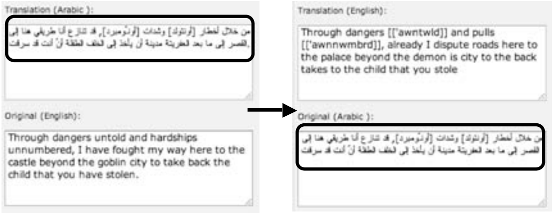

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Original (English):

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):

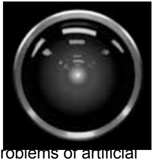
Through dangers [['awntwld]] and pulls [['awnnwmbrd]], already I dispute roads here to the palace beyond the demon is city to the back takes to the child that you stole

Original (Arabic):

من خلال أخطار [أونتولد] وشدات [أونومبرد]، قد تنازع أنا طريقي هنا إلى القصر إلى ما بعد العفريتة 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.

Reality in 2008: Still not 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.

About Human Knowledge: Language & Variation

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]

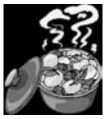
* "I suppose whether the girl saved her little brother from the goblins." [ungrammatical]

Types of Variation

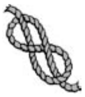
Vocabulary
English "think" verbs: think, know, wonder, suppose, assume, …
Navajo "carry" verbs: depends on object being carried

aah (carry a solid round-ish object)

kaah (carry an open container with contents)



lé (carry a flexible object)

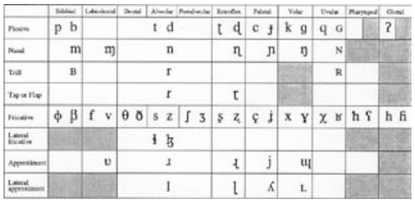


Types of Variation

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	ɴ		
Trill	ʙ			r					ʀ		
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	ʟ			

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 **yiy**iiltsá
boy girl saw
"The boy saw the girl"

Ashkii at'ééd **bi**ilstá
boy girl saw
"The girl saw the boy"

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Word order (syntax)
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boy girl saw
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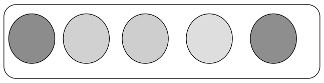
This one prefix changes the entire meaning of the sentence

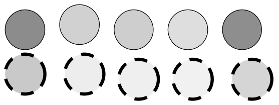
Thinking About Syntactic Variation



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.



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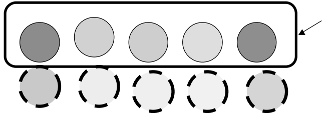

5 different parameters of variation

Similarities & Differences: Parameters

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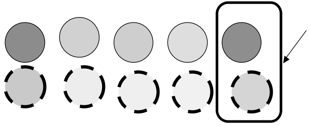
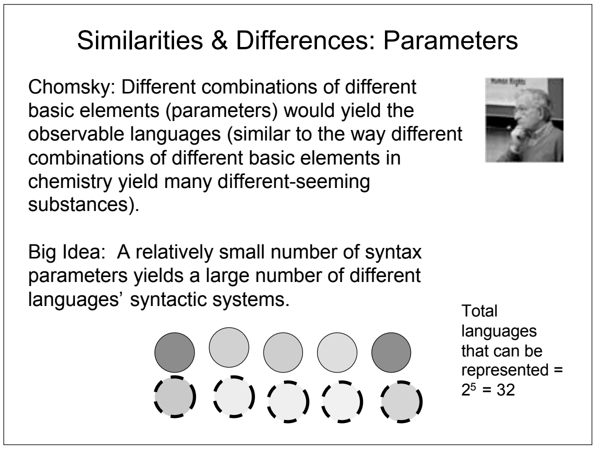


2 different parameter values of one parameter

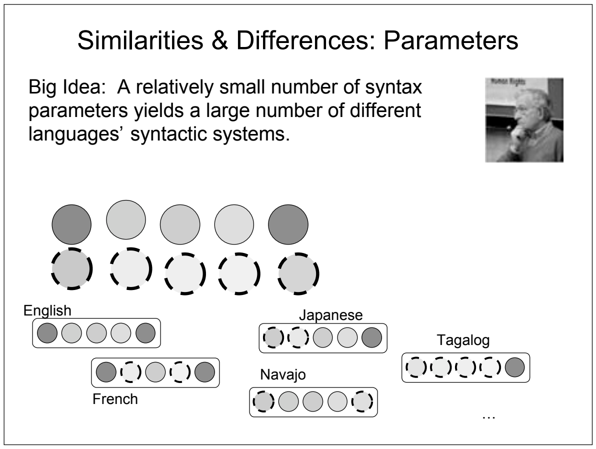


Similarities & Differences: Parameters

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.

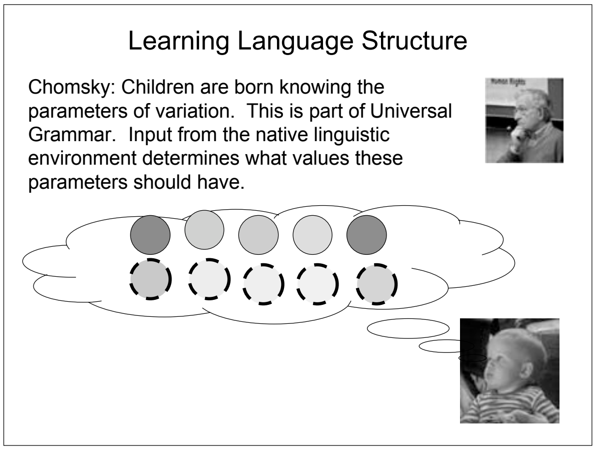
Total languages that can be represented = $2^5 = 32$



Similarities & Differences: Parameters

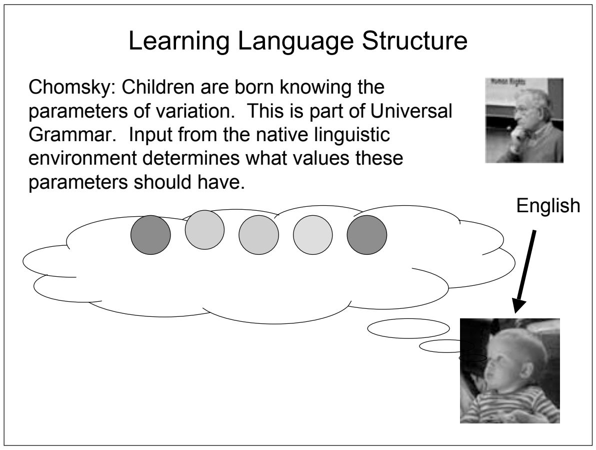
Big Idea: A relatively small number of syntax parameters yields a large number of different languages' syntactic systems.

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.



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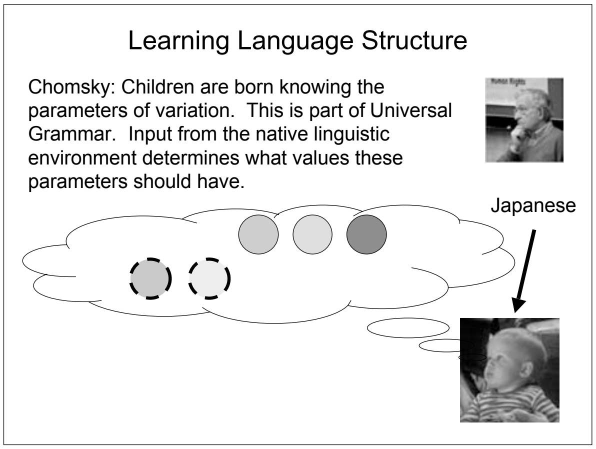

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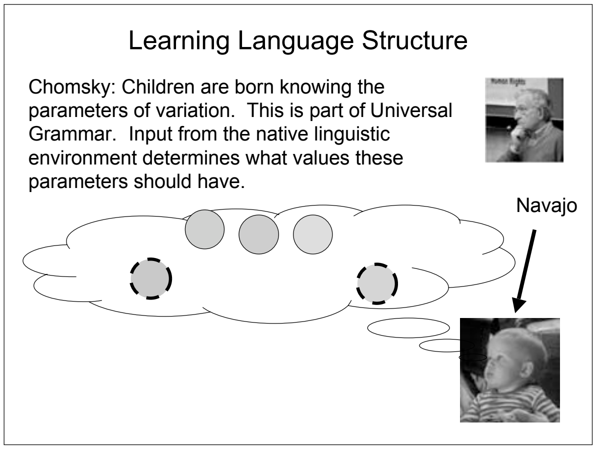

Learning Language Structure

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Generalizations About Language Structure

Greenberg’s Word Order Generalizations

Navajo	Japanese

Greenberg’s Word Order Generalizations

Navajo	Japanese
Basic word order: Subject Object Verb	Basic word order: Subject Object Verb
Ashkii at’ééd yiyiiltsá *boy girl saw*	Jareth-ga Hoggle-o butta *Jareth Hoggle hit*
“The boy saw the girl”	“Jareth hit Hoggle”

Greenberg’s Word Order Generalizations

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

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.

More Language Comparisons

French	Italian
Subject Verb	Subject Verb
Jareth arrivera	Jareth verrá
Jareth will-come	*Jareth will-come*
“Jareth will come.”	“Jareth will come.”
grammatical	grammatical

More Language Comparisons

French	Italian
*Verb Subject	Verb Subject
*Arrivera Jareth	Verrá Jareth
**Will-arrive Jareth*	*Will-arrive Jareth*
“Jareth will arrive”	“Jareth will arrive”
ungrammatical	grammatical

More Language Comparisons

French	Italian
*Verb *Arrivera *He-will-come*	Verb Verrá *He-will-come*
“He will come”	“He will come”
ungrammatical	grammatical

More Language Comparisons

French	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.

More Language Comparisons

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

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

More Language Comparisons

Embedded Subject-Question Formation
(easy to miss)

French Italian

Tu veux que Marie épouse Jay.
You want that Marie marries Jay.
“You want Marie to marry Jay.”

*Qui veux-tu que ___ épouse Jay?
Que veux-tu qui ___ épouse Jay?
Who want-you that marries Jay?
“Who do you want to marry Jay?”

Requires a special “that” form: qui.

More Language Comparisons

Embedded Subject-Question Formation
(easy to miss)

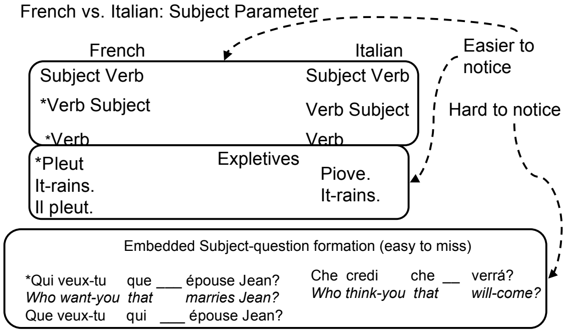
French	Italian
	Credi che Jareth verrá. *You think that Jareth will-come.* “You think that Jareth will come.”
	Che credi che __ verrá? *Who think-you that will-come?* “Who do you think will come?”
	Does not require a special “that” form: use the same one as normally is used - *che*.

More Language Comparisons

French	Italian
Subject Verb	Subject Verb
*Verb Subject	Verb Subject
*Verb	Verb
Not okay to leave out expletive subject “it”.	Okay to leave out expletive subject “it”.
Requires special action for embedded subject questions.	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	Italian
Subject Verb	Subject Verb
*Verb Subject	Verb Subject
*Verb	Verb

Easier to notice

Hard to notice

Expletives

*Pleut It-rains. Il pleut.	Piove. It-rains.

Embedded Subject-question formation (easy to miss)

*Qui veux-tu que ___ épouse Jean?
Who want-you that marries Jean?
Que veux-tu qui ___ épouse Jean?

Che credi che __ verrá?
Who think-you that will-come?

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

French vs. Italian: Subject Parameter

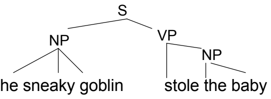
Big idea: If all these structural patterns are generated from the same linguistic parameter (e.g. a “subject” parameter), then children can learn the hard-to-notice patterns (like the patterns of embedded subject questions) by being exposed to the easy-to-notice patterns (like the optional use of subjects 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 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	g a b l ɪ n
syllables	g a b l ɪ n
words	goblin
phrases	Noun Phrase (NP) The sneaky goblin; Verb Phrase (VP) stole the baby
sentences	

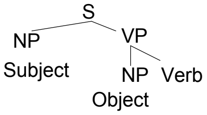

S
NP
VP
NP
The sneaky goblin
stole the baby

Universal Grammar: Principles & Parameters

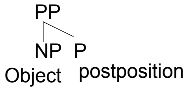
Parameters: Constrained variation across languages. Children must learn which option their native language uses.

Japanese/Navajo

Basic word order:
Subject Object Verb


S
NP
VP
Subject
NP
Verb
Object

Postpositions:
Noun Phrase Postposition


PP
NP
P
Object
postposition

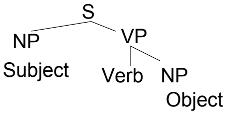
Possessor before Possessed
Possessor Possession

Universal Grammar: Principles & Parameters

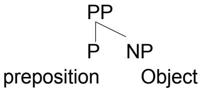
Parameters: Constrained variation across languages. Children must learn which option their native language uses.

Edo/English

Basic word order:
Subject Verb Object


S
NP
VP
Subject
Verb
NP
Object

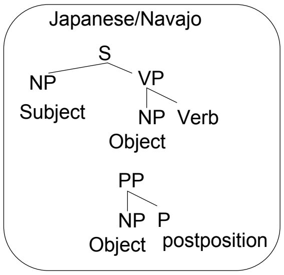
Prepositions:
Preposition Noun Phrase

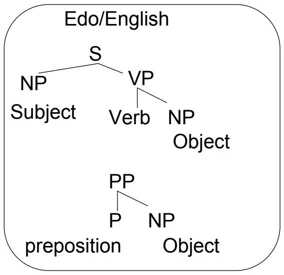

PP
P
NP
preposition
Object

Possessed before Possessor
Possession Possessor

Universal Grammar: Principles & 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 parameters 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

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?