

Ling 240

Language Acquisition
and
Arguments for Universal Grammar

Language Acquisition

- How do children acquire their native language?

Linguistic knowledge

- lexicon
- phonology
 - categories (phonemes)
 - phonological rules
- morphology (derivational, inflectional, compounding)
- syntax
 - phrase structure rules
 - transformations

Tasks for children

- discriminate human voices from other noises
- abstract away differences in pitch (male, female diffs), volume, speed
- identify phonemes of target language
- learn to produce speech sounds (control airflow, timing of vocal cords, articulators)
- decode continuous speech signal into discrete words

Tasks for children (continued)

- combine sounds to make words
- combine morphemes to make words
- combine words to make phrases and sentences

What we will learn today...

- Children's language acquisition is guided by...
 - Learning principles
 - Universal Grammar (Principles & Parameters)
- ...and NOT by
 - Imitation/copying/parent's teaching/corrections (recall discussions in the 1st week)

Example: subj-aux inversion

Was John eating?

Hypotheses

- 1 Move the word that starts with /w/
 - 2 Move the 2nd word in the sentence
 - 3 Move the word that has tense marking
 - 4 Move the 1st auxiliary
 - 5 Move the highest auxiliary
- etc

- Is there adequate data in the input to allow the child to choose the correct hypothesis?

Universal Grammar

- innate principles (and parameters) that guide learning

- infinite number of hypotheses

UG helps learners narrow down the hypothesis space

Example: subj-aux inversion

Was John eating?

Hypotheses

~~1 Move the word that starts with /w/~~

~~2 Move the 2nd word in the sentence~~

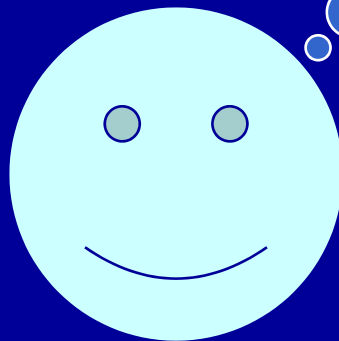
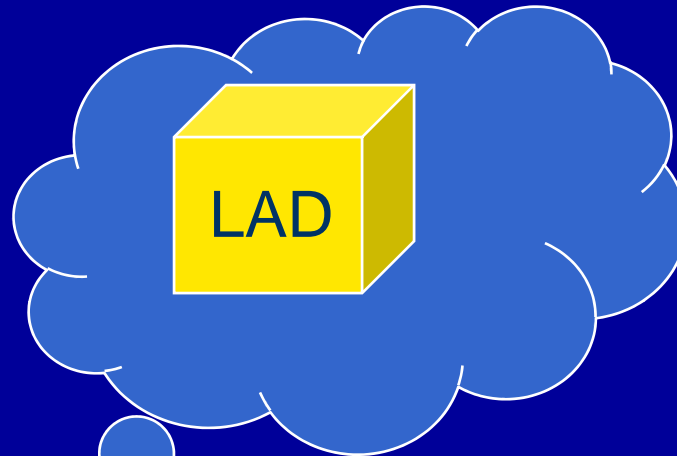
3 Move the word that has tense marking

~~4 Move the 1st auxiliary~~

5 Move the highest auxiliary

etc

Primary
Linguistic
Data (PLD)



Linguistic
Input



Initial State



Grammar

Stages of Acquisition

Pre-linguistic Stages

Age	Production	Perception/Comprehension
Birth – 12 weeks	Crying, reflexive vocalizations	
4-5 mo.		Can distinguish own language (but cf. Nazzi et al 1998)
6-8 mo.	Babbling	Notices distinct phonemes from other languages (cf. deaf children)

Linguistic Stages

10-18 mos

one-word stage

50% describe **objects**

dog (not *animal* or *poodle*)

50%

request for action: *up, open*

modifiers: *allgone, hot, more*

routines: *hi, bye-bye*

Linguistic Stages

10-18 mos one-word stage

Phonology:

- no longer “Universal Listeners”
- Syllables: CV

Syntax:

- know word order (English SVO)
(e.g., Hirsh-Pasek & Golinkoff)

Linguistic Stages

18 mo-2 yr

2 word stage

all dry

all messy

all wet

Daddy sit

I go

see kitty

siren bye-bye

Mommy shoe

boot off

more milk

more bubbles

no bed

Linguistic Stages

2-5 years

- Vocabulary spurt
- longer utterances
- greater grammatical complexity

Linguistic Stages

Sequence of Negation formation:

1. *no drink milk; no baby sleep*
2. *Baby no sleep; Me no drink milk*
3. *Baby won't sleep; Me not hungry*
4. *I'm not hungry*

Linguistic Stages

- Children all go through the same basic stages (though timing may vary)

Learning word meanings

“Gavagai!”



Learning Word Meanings

Gavagai problem: How do children find out what the speaker intended with a novel noun?

Learning Word Meanings

Fido vs. *dog*

dog vs. *animal*

dog vs. *poodle*

dog vs. *fur, paws, 4-legged, barking,*
etc.

Learning Word Meanings

- **Whole object assumption**: Novel words do not refer to parts, but the whole object
- **Basic level assumption**: It refers to the basic level (i.e., dog), not the superordinate category like *animal* or more specific categories like *poodle* or its name *Fido*

Learning Word Meanings

Syntactic cues

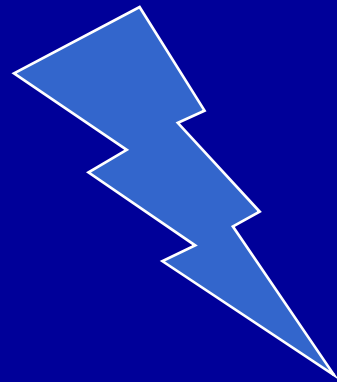
This is a DAX

This is DAX

Learning Word Meanings: syntactic cues

This is a zav.

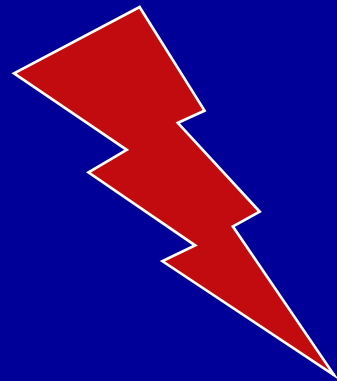
This is a zav one.



Learning Word Meanings: syntactic cues

Give me the zav.

Give me the zav one.



children generalize a word's meaning
on the basis of

- **color** if word is used in **adj** context
- **shape** if word is used in **N** context

Using syntax to learn word meaning:
Syntactic bootstrapping (Gleitman)

Conclusions

- children are guided by learning principles (which are presumably innate)
- children can use knowledge from other domains (syntactic knowledge to help with word learning)

Conclusions

- Children do not just imitate
- Knowledge beyond production capabilities

RULE learning

Mental grammar

- innate component + learned component
- Rule system – how do children learn rules?

Children as rule maker

- Children regularize the language input a lot

Pluralization of nouns (Berko, 1958)

- N + -s = plural N

This is a wug. Now there is another wug.
There are two of them. There are two...

WUGS!

A lot of 4 to 5 year-olds can pass the test



THIS IS A WUG

Children as rule maker

- Children regularize the language input a lot
- This is seen in **overgeneralization** phenomena

U-shaped learning in past tense

- Stage 1: walked, played, came, went
- Stage 2: walked, played, comed, goed, holded
- Stage 3: walked, played, came, went, held

- memorization → **overgeneralization** → learn which verbs are irregular
- Cf. imitation?

child grammar, linguistic principles
and Poverty of Stimulus

Acquisition of rules: a theoretical model

- **A child** who is exposed to **Primary Linguistic Data (PLD)** [=input] of a particular language acquires a **Mental Grammar** of the language.

Acquisition of rules: a theoretical model



+

PLD of
English

=

Mental Grammar
of English



+

PLD of
Spanish

=

Mental Grammar
of Spanish



+

PLD of
Japanese

=

Mental Grammar
of Japanese

...

Acquisition of rules: a theoretical model

$$X + \text{PLD}_{\text{LG}} = \text{MG}_{\text{LG}}$$

$X =$ the child's contribution to the
acquisition of MG_{LG}

**The task: to specify each element in the
formula: X , PLD , and MG .**

A rule in Mental Grammar of English: Subject-Aux Inversion

- (1) *John is happy.*
- (2) *Mary was reading the book.*
- (3) *We are going to talk about this later.*
- (4) *I should finish my homework before tomorrow.*
- (5) *The woman with long hair can speak German.*

What those sentences have in common: Auxiliary verbs

- *be*-verbs: *is, was, are...*
- Modals: *can, should, must, may...*
- Perfective *have* (*Have you read this?*)
- One property that is shared by these items: they are moved in questions.

Yes-No question formation in English

- **Subject-Aux inversion rule:** Move an auxiliary to the front
- Note that this rule is not universal.

John-wa shiawase-desu

“John is happy”

John-wa shiawase-desu-*ka*?

“Is John happy?”

What happens when there are more than one aux?

(6) *Mary has been singing.*

(6)' Has Mary been singing?

(6)'' *Been Mary has singing?

- You have to move the correct one, not one random auxiliary in the sentence

Which one is “the auxiliary” when there are more than one aux?

(7) *Mary is saying that she will leave.*

(7)' Is Mary saying that she will leave?

(7)'' *Will Mary is saying that she leave?

The SAI rule

- Our current hypothesis: Move an auxiliary to the front.
- Our revised hypothesis: Move **the first** auxiliary to the front.
- Any problem with this?

But...

(8) *The child who was watching TV is crying.*

(8)' *Was the child who watching TV is crying?

(8)'' Is the child who was watching TV crying?

- “Move the first” hypothesis failed!

How do we pick up the correct
aux to move?

The child who was watching TV is crying.

Structure?

What is the subject of the sentence?

The notion of “height” in tree structures

- The height of X is determined by the number of nodes that dominate X .

The SAI rule

- Our current hypothesis: Move the first auxiliary to the front. (**failed**)
- Our revised hypothesis: Move **the highest** auxiliary to the front.

Structure-dependence

- Determining **the first** auxiliary does not require structural analysis. (count from left to right)
→ Structure-independent
- Determining **the highest** auxiliary requires structural analysis.
→ Structure-dependent

Structure-dependent rules

- Move **the first** auxiliary to the front.
→ Structure-independent rule
- Move **the highest** auxiliary to the front.
→ Structure-dependent rule

Summary: Adult Mental Grammar of English

- English SAI rule: Move the highest aux.
- **Mental Grammar only allows the structure-dependent version of the rule.**
- **But, what about children's SAI? What does PLD look like?**

PLD of English on SAI

The acquisition of SAI

- What kind of linguistic data is available to children acquiring SAI?

The CHILDES database

- A huge database of spontaneous speech by young children (age 2 – 6) in various languages
- Transcriptions of parent-child linguistic interactions
- What kinds of questions do children hear from adults?

The crucial data

- The distinction between **the first** vs. **the highest** of SAI

Is the boy who was watching TV crying?

- Must involve (more than) two auxiliaries
- The highest one \neq the first one
- The highest, not the first, is moved.

Legate and Yang (2002)

- Child: Adam (2;7 -)
- Total parental utterances: 46,499
- Number of questions: 20,651
- The crucial sentences: 0

So...

- The PLD of English does not involve the crucial data to distinguish the first vs. the highest
- Therefore, both hypotheses are completely compatible with the PLD.
- Therefore, the PLD does not tell children that “move the first” is wrong.

Summary

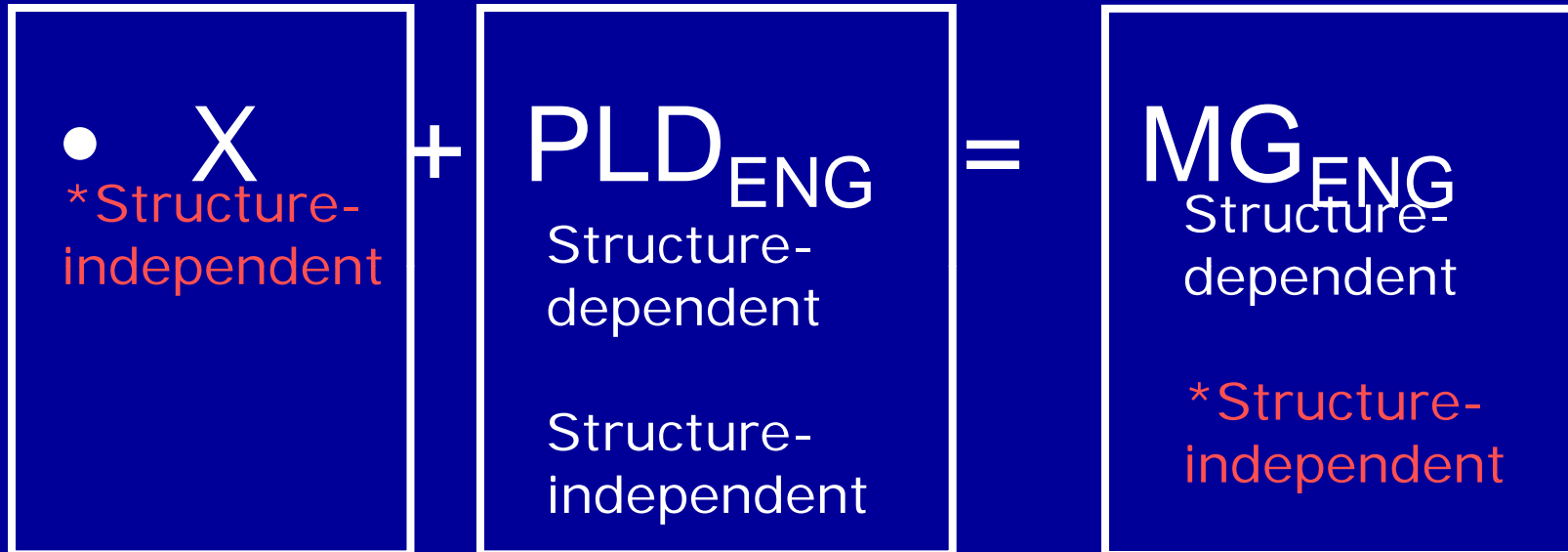
- English PLD does not involve the crucial data to distinguish “move the first” vs. “move the highest”
- Both structure-independent and structure-dependent versions of SAI are compatible with PLD.

the learner's contribution

So far...

- Adult SAI rule: structure-dependent (“move the highest”)
- PLD: compatible with both structure-dependent and independent rules
- Question: How do we avoid the structure-independent rule?

The formula



The learner must **know** that structure-independent rules are not allowed.

The poverty of stimulus argument

- PLD is compatible with both structure-dependent and structure-independent versions of SAI
- Still, adult Mental Grammar only allows the structure-dependent version (“Move the highest”)
- **(Adherence to) structure-dependence must be a part of innate linguistic knowledge.**

The poverty of stimulus argument

- Pointing out a gap between PLD and adult MG
- Arguing that the gap must be filled by X
 - innate knowledge that children bring to language acquisition

Crain and Nakayama 1987

Do children ever consider “move the first” rule?

- Null-hypothesis: children do **not** have innate grammatical knowledge that makes them ignore structure-independent rules.
- Prediction: children should consider the “move the first” rule, because the rule is simple and perfectly compatible with their experience.

Crain and Nakayama 1987

- “Elicited production” experiment
- Participants: English-speaking children (N=30, Age: 3;2 – 5;11)
- Group 1: 3;2 – 4;7 (Mean 4;3)
- Group 2: 4;7 – 5;11 (Mean 5;11)

Experimenter

Tommy

Jabba the Hu



Hey Tommy, look at this! Look at this picture!

Experimenter

Tommy

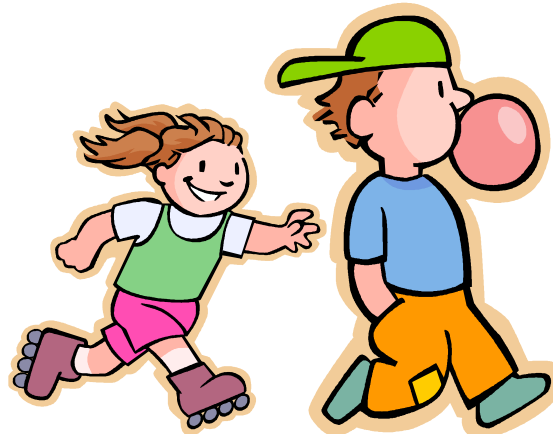
Jabba the Hu



Hey Tommy, look at this! Look at this picture!

Experimenter

Tommy



Jabba the Hu



What do you see Tommy?

Experimenter

Tommy



Jabba the Hutt



Experimenter

A boy and a girl...

Tommy



Jabba the Hu



Yes, a boy and a girl!

Experimenter

Tommy



Jabba the Hu



Tommy, do you think the girl is tall?

Experimenter

Tommy



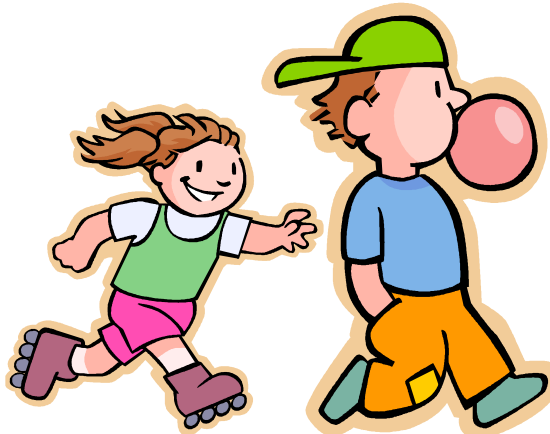
Jabba the Hu



Experimenter

Noooo! She is not tall!

Tommy



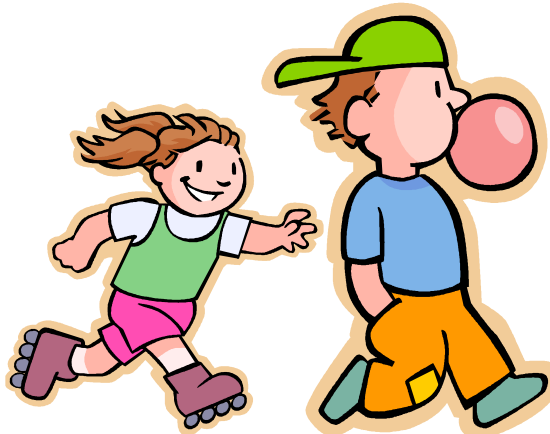
Jabba the Hu



Yeah I agree...but I wonder what Jabba would say...

Experimenter

Tommy



Jabba the Hu



Hey Tommy, why don't you **ask Jabba if the girl is tall?** Ask Jabba if **the girl is tall!**

Experimenter

Tommy



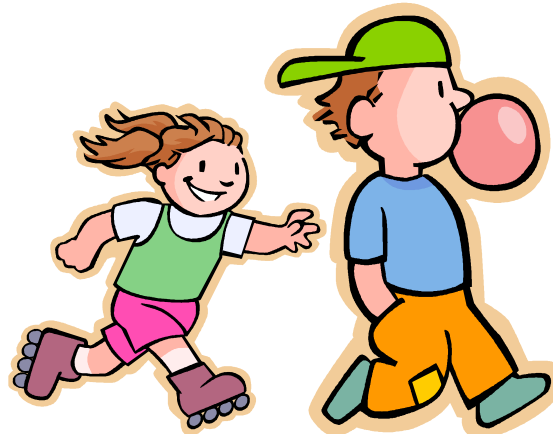
Jabba the Hu



Experimenter

Is the girl tall?

Tommy



Jabba the Hu



Experimenter

Tommy



No...

Jabba the Hu

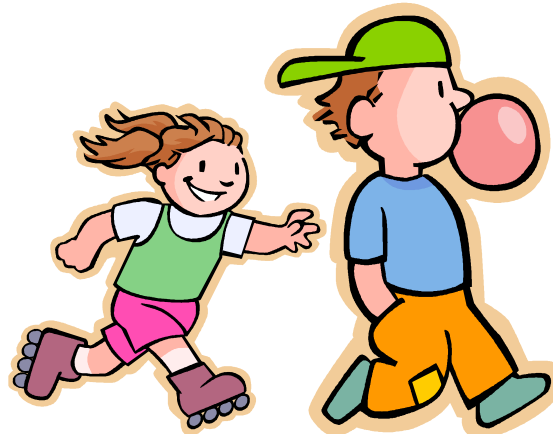


He was right! Tommy, give him a strawberry!

Experimenter



Tommy



Jabba the Hu



Elicitation

- The experimenter never uses questions with SAI

Do you think the girl is tall?

Ask Jabba if the girl is tall!

Materials

- Pretest sentences
 - a. The girl is tall
 - b. The man is tired
 - c. The pig next to the tree is red

Materials

- Test sentences
 - a. The dog that is sleeping is on the blue bench.
 - b. The ball that the girl is sitting on is big.
 - c. The boy who is watching Mickey Mouse is happy.
 - d. The boy who is unhappy is watching Mickey Mouse.
 - e. The boy who is being kissed by his mother is happy.
 - f. The boy who was holding the plate is crying.

“Ungrammatical” questions

- We are interested in whether children consider the “move the first” rule...
- **Is the boy who ___ watching MM is happy?* → structure-independent, or “TYPE III” error

“Ungrammatical” questions

- “Good” results

Children never made any ungrammatical questions at all.

- ***Even stronger results***

Children made various ungrammatical questions, but they never made TYPE III errors.

Results I: did they make ungrammatical questions?

- YES.

		Grammatical	Ungrammatical
Group I	81	31 (38%)	50 (62%)
Group II	87	70 (80%)	17 (20%)
Total	168	101 (60%)	67 (40%)

Note: Group 1 = mean age 4.3, Group 2 = mean age 5;3

What kind of ungrammatical questions did they make?

- Type I / “prefix” error

**Is the boy who is being kissed by his mother is happy?*

What kind of ungrammatical questions did they make?

- Type II / “restarting” error

**Is the boy that is watching MM, is he happy?*

Are there any Type III / “structure-independent” errors?

- **Is the boy who ___ watching MM is happy?*

	Type I	Type II	Type III
Group I	30(60%)	10 (20%)	0
Group II	9 (53%)	5 (29%)	0

Children never made Type III errors.

- That would suggest they never consider structure-independent movement rules: “move the first”.

What is the source of other errors?

- Type II: performance errors, adults do the same thing

What is the source of other errors?

- Type I errors
 - **Is the boy who is being kissed by his mother is happy?*
- Possibility #1: Just adding *is* to the original sentence (Japanese-style question formation)

What is the source of other errors?

- Type I errors

**Is the boy who is being kissed by his mother is happy?*

- Possibility #2: Copying *is* rather than moving it

“Copying” rule?

- Structure-independent copying rule
“Copy **the first** aux”
- Structure-dependent copying rule
“Copy **the highest** aux”
- Most of the test sentences involve two identical auxiliaries, so we cannot determine which one was copied...

So far...

- We have confirmed that children never consider structure-independent **movement** rules.
- However, there is still a possibility of structure-independent **copying** rule...

Revised test sentences

- a. *The boy who **is** happy **can** see Mickey Mouse.*
- b. *The boy who **is** unhappy **should** fix his TV set.*
- c. *The boy who **can** see Mickey Mouse **is** happy.*
- d. *The boy who **should** be working **is** asleep.*

Participants

- The child who made Type I errors in the previous experiment.

Possible sources

- “Copy **the first** aux” (S1)
- “Prefix *is*” (S2)
- “Copy **the highest** aux (S3)

Possible errors

*The boy who **is** happy **can** see MM.*

*S1: **Is** The boy who **is** happy **can** see MM?*

*S2: **Is** The boy who **is** happy **can** see MM?*

*S3: **Can** The boy who **is** happy **can** see MM?*

Possible errors

*The boy who **can** see MM **is** happy.*

S1: ***Can** the boy who **can** see MM **is** happy.*

S2: ***Is** the boy who **can** see MM **is** happy.*

S3: ***Is** the boy who **can** see MM **is** happy.*

Did they make structure-independent copying errors?

- NO.
- Total number of copying errors – 11, but no clear S1 errors
- No Type III (structure independent) errors, again.

So now...

- We have confirmed that children never consider structure-independent rules.

Do children ever consider “move the first” rule?

- Null-hypothesis: children do **not** have innate grammatical knowledge that makes them ignore structure-independent information.
- Prediction: children should consider the “move the first” rule, because the rule is simple and potentially compatible with their experience.

Innate linguistic knowledge, or UG

- Structure-dependence is not a rule; it is a **constraint on rules**.
- UG restricts the range of possible rules that children consider in the course of language acquisition (rather than directly providing rules themselves)

Next...

- Other arguments for UG
 - Critical period
 - Creole
 - Home sign
 - Genetic impairment
 - Teaching apes a human language

Take a break!

Arguments for Innate Specialization for Language

1. critical period
2. dissociation of intelligence & language acquisition
3. poverty of the stimulus
4. language acquisition by chimps?

Argument 1: Critical Period

- the idea that innately determined behavior is dependent on external trigger in environment during a specific period of development
 - binocular vision
 - imprinting of goslings
 - song of the chaffinch

Critical Period Hypothesis applied to language

- critical period = a time period in development when the human brain is prepared to construct a mental grammar

Critical Period

Difficulty testing

- finding good cases
- language is complicated!

Critical Period

Cases

- Genie
- Chelsea
- deaf children born to hearing parents
(Newport & Supalla)

Critical Period

results?

- What aspects of grammar can be acquired after the critical period?
- What aspects of grammar seem not to be acquired after the critical period?

Argument 2: Dissociation between general intelligence & language acquisition

- Genie
- SLI (specific language impairment)
- William's syndrome

Genie

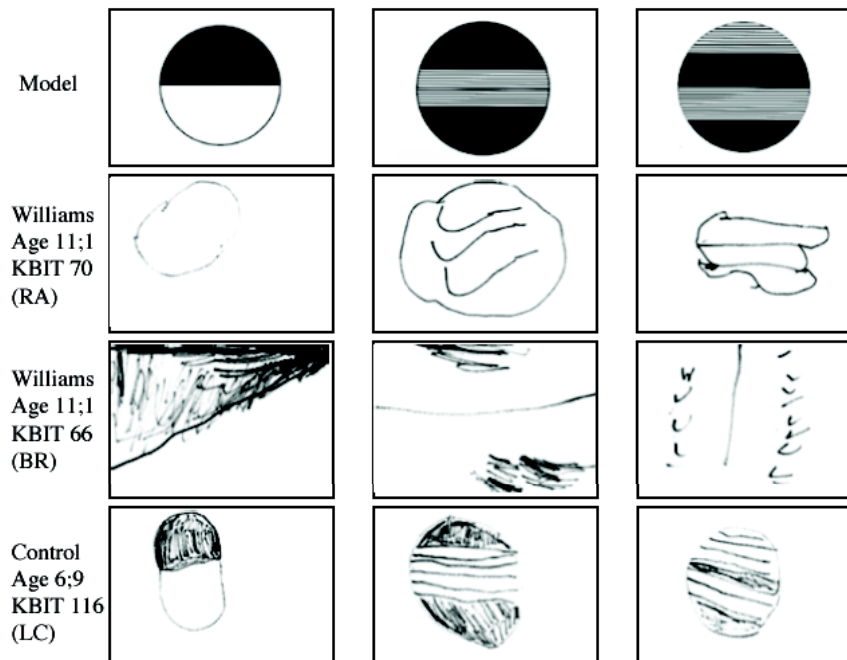
- Genie was more advanced cognitively than babies
- (at least) some claim that she was not mentally retarded
- And yet, difficulties with language

Specific Language Impairment (SLI)

- SLI runs in particular families (genetic)
- Cognitively normal
- Some abnormal properties in their language (fine basic word order, but problems with morpho-syntax)

William's syndrome

- Good language
- poor overall cognitive profile
 - low general IQ (50-60)
 - poor math
 - poor spatial abilities



Argument 3: poverty of the stimulus

LAD + input (PLD) = grammar

Beyond the input: poverty of the stimulus arguments

cases of impoverished input

- creolization
- home sign
- Nicaraguan sign language

children construct rules (grammar)
beyond what is present in input

Pidgin & Creole

- What's a pidgin and creole?



Pidgin

- A reduced “language” (communication system)
- Results from extended contact between groups of people with different language background
- Need to communicate – but generally just for specific purposes (e.g., trade)

Creolization

step 1: pidgin

- syntactically impoverished
- lacks function words (auxiliary verbs, inflections)
- no subordinate clauses
- variable word order

Hawaiian Pidgin

1. too-much money, me think catch though
“I think he earns a lot of money though”
2. the poor people all potato eat
“The poor people only ate potatoes”
3. work hard this people
“These people work hard”

Creolization

Step 2: Creolization

- generation of children learn pidgin as a **native language** (input)
- create a more complex grammar
- including innovations not present in the parent languages

Hawaii Creole English (HCE)

4. They wen go up there early in the morning e go plant.

They went up there early in the morning in order to plant.

Properties of Creole

- consistent word order (SVO in HCE)
- systematic grammatical constraints
- recursive structures (relative clauses)
- innovations
 - indefinite article (specificity): *wan/one* or \emptyset
- still within Universal Grammar

Home Sign

- Goldin-Meadow & Mylander 1990
- 10 deaf children born to hearing parents
- not exposed to sign language
- not making progress with oral speech

Home Sign

- development of gestural, symbolic system of communication
- parallels normal linguistic development (up to a point)

Home Sign

limited system

- mainly stayed at 2-word stage
- no recursion
- no abstract connectives (*before, because, etc.*)

Home Sign

What developed:

- vocabulary (lexicon)
- consistent word order
- verbal inflections (spatial as in ASL)

Home Sign

Characterization of the input (mothers' utterances)

- smaller vocab (1/3 of child's)
- fewer strings of gestures
- not reliable word order
- more complex utterances later than children

Home Sign

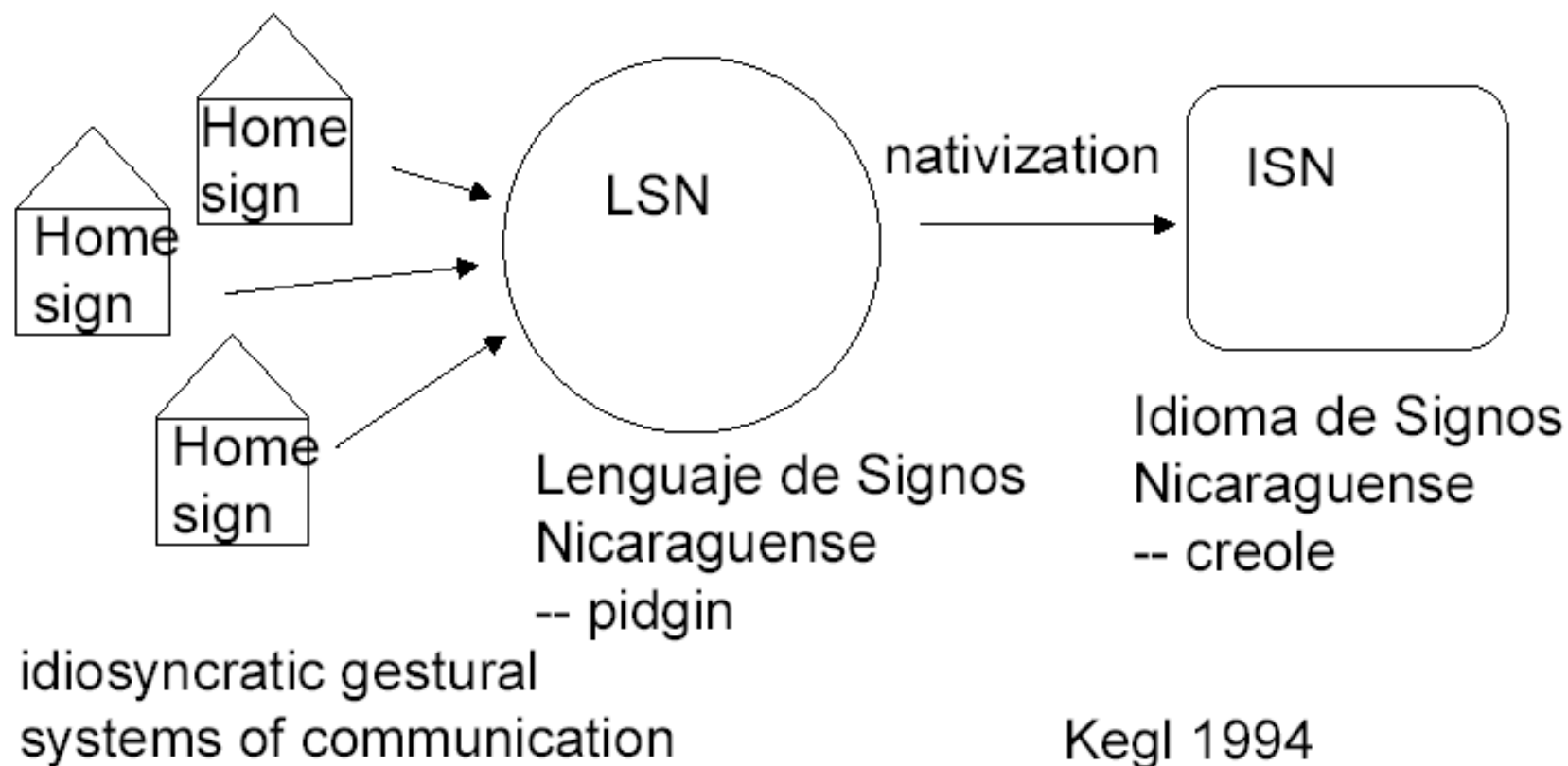
Conclusion

- children had more elaborate and consistent grammar than parents
- **children construct mental grammar** (from underdetermined input)
 - caveat: why didn't their language have recursion/transformation though?

Nicaraguan Sign Language



NSL development



Nicaraguan Sign Language

- creolization with no parallel language input
- all children of hearing parents, no signing adults
- not taught a signed language in school (teachers only taught spanish lipreading and fingerspelling)
- rudimentary system develops from children playing, interacting on school grounds

- Homesign
 - Gestures => structured symbolic communication system
- Pidginization
- Creolization
 - pidgin (no syntax) => full-fledged language

Why can't a full-fledged language develop in one generation?

Hypothesis

- the time required to develop a language (“from scratch”) exceeds the critical period

Spatial Modulations in NSL

- Senghas & Coppola
- spatial modulations develop as a means of marking agreement



Participants

- Cohort 1: entered school pre-1983
- Cohort 2: entered school post-1983
- Within each cohort, divided by age of exposure
 - early: before 6 years old
 - middle: 6-10 years old
 - late: after 10 years old

Results

- Early and middle-exposure participants in 2nd cohort use spatial modulations to signal verb agreement

Results

- Evidence for **critical period**
- Evidence that **children create patterns** rather than just reproducing what they find in the input
- Evidence for **innate knowledge**

Summary: Poverty of the Stimulus

- every child constructs a grammar (a set of rules) based on insufficient evidence
- More comes out than went in!
- trace back to UG

Summary

Hypotheses:

1. $\emptyset + \text{input} \Rightarrow \text{grammar}$ NO
2. LAD + $\emptyset \Rightarrow \text{grammar}$ NO
3. LAD + input $\Rightarrow \text{grammar}$ YES

Open Questions

- How do features like recursion develop in the origin and evolution of language?

Open Questions

- What is the critical period?
- Why can children learn language better than adults?
- due to innate knowledge of language structure? OR
- due to heightened natural capacity to notice patterns in the environment?

Tomorrow

- HW5 due!
- Overview of the class and discussion