Environmental and Biological Contributions to Language Acquisition

Biological Effects on Language Acquisition

Stages in Language Acquisition

Evidence of a Maturational Time Table

Critical Periods in Ethology (Marler)

Critical Periods in Language Acquisition
Goldin-Meadow and Mylander

10 home signers 1-4 years of age
Profound hearing loss
No exposure to ASL, very little English
Language videotaped and analyzed

Sequences of Gestures

By 2 years: children combine gestures in 2-3 sign sentences.
Sequences are systematic

Natural language predicates (properties or actions) take a particular number of arguments
- Sleep 1: actor
- Eat 2: actor, patient (in all languages.....)

Home Sign predicates have same # of arguments
- You eat, cookie eat, cookie eat you
- I sleep

Sequences are systematic

Natural languages may use word order to convey grammatical role
- John eats cookies (John = actor, Cookies = patient)

- Home Sign systems use order as well
  - Patient Action (cookie give)
  - Actor Action (cat run)
Isolated deaf children

Timing of language development:

First words/signs 1 year
Rudimentary sentences 2 years
Elaborations 2;5-3 years

Who is creating the language?
The mother or the child?

Goldin-Meadow & Mylander, 1998
Who is creating the language? The mother or the child?

Goldin-Meadow & Mylander, 1998

Creolization in Progress: Nicaraguan Sign Language

Until 70’s Nicaragua had no schools for the deaf and no signed language
‘77-’83: oralist school created
By ’86 signed pidgin emerges
New children added to community at variety of ages

Photos: Judy Kegl
Creolization in Progress: Nicaraguan Sign Language

Where does the structure of the language come from?
  – Little contact with other sign systems

Do younger children create the language or older more experienced kids?
  – Age matters: younger learners are more fluent
  – Input matters: those who heard less mature language are less fluent

Senghas & Coppola, 2002

General Conclusions

Children can acquire language in wide range of environments
When the input is chaotic, they structure it
When language is absent they create it

Why?

Humans have a ‘linguistic nature’ that rescues learners from inadequacies in environment

Language is a by-product of the developing human brain
The role of biology in language acquisition

The stages of language acquisition
Pre-linguistic communication

Before children begin speaking they develop many communicative skills:

• Turn taking: sensitivity starting around 3 months
• Joint attention: ability to follow another’s eye-gaze
• Gesture and vocalize to request objects (~ 8 months)
• Babbling

Pre-linguistic communication

Language comprehension begins:

• Comprehension of words precedes production
• Kids with tiny vocabularies often already understand sentences
The single-word speaker (12-24 months)

- Word-learning: initially slow, steadily accelerates
- Initially children make errors in mapping a word to its meaning:
  - underextensions: dog = my dog Fido
  - overextensions: daddy = all men
  - mismatches: back = stroller

The single-word speaker (12-24m)

Jasper at 16 months: Beginning of 1 word stage
- Dad: What else is in the bag?
- Jasper: ba!
- Dad: Here’s a little ball and a rattle.
- Dad: You can use it as a drumstick
- Jasper: eh! ……ba
The single-word speaker (12-24 months)

- Holophrases:
  - single words used to indicate entire proposition
- Early words tend to be concrete nouns
  - For small moveable objects: ball, cup, sock
  - For people & animals: mama, dog, cat
  - + some social words & words for events: thanks, hi, more, up (pick me up)

Telegraphic Speech (18 – 30 m)

- Child uses 2-3 word sentences, leaving out words
- In English:
  - correct word order
  - leaves out function words and morphemes (-ed, the, was, of, with)
- In languages with consistent morphological marker (e.g. case)
  - children begin using these devices early
  - may only use a verb in one form
Eve (18m): Telegraphic or 2 word stage

- Eve: Mommy telephone (whining)
- Mother: well, go and get your telephone.....
- Mother: who are you calling, Eve?
- Eve: my telephone.
- ......Eve: block broke.
- ......Eve: Mommy read.

Telegraphic Speech (18 – 30 m)

Children DO hear function words and know something about where they belong given:

- “Throw the ball to me” or
- “Throw was ball out me”
more likely to comply to the first…
Further Grammatical Development (2 – 4 yrs)

• The appearance of grammatical morphemes
• Over-regularizations:
  – child applies a regular rule to an irregular form
  – strong evidence for rule.
  – Z 30m: “Skeleton sayed roar at Dinosaur and Dinosaur sayed roar at Skeleton ….And they fighted together and they kill”

Further Grammatical Development (2 – 4 yrs)

More complex sentences begin to appear
• Questions, negations, passives, multiple clauses…..
• Example: 3 stages of wh-question formation
  1. formed with declarative sentence and question intonation: “Daddy go?”
  2. Question word placed at front “What it is?”
  3. Subject-auxiliary inversion “What is it?”
Zane at 30 months

Question formation: no auxiliary movement
- “Mom our friends are coming?”
- “What those are”

Appearance of relative clauses and complex sentences:
- “We yelled yesterday at a guy who was……A guy who was pushing us, we yelled at him”
- “I like all the animals that have skeletons”

Near perfect syntax by 4

Julien: “This Troll has magic powers. Do you know anybody else who has magic powers?”

Ulysses: “The only two people I know who have magic powers are God up there and the Power Rangers on the cartoon channel” (4 yrs)
These stages are universal

Why are there universal stages?

• Stages occur because of cognitive maturation?
  – Mental systems?
  – Brain structures?
• Stages driven by changes in social environment?
• Stages driven by differences in child’s motivation?
Lenneberg’s Hallmarks of maturationally controlled emergence of behavior

1. Regular sequence of milestones correlated with age and developments in other domains
2. Environment remains stable over time
3. Behavior emerges (in part) before it is useful
4. Early stages not signs of goal-directed practice

Lenneberg’s Milestones

<table>
<thead>
<tr>
<th>Age</th>
<th>Motor development</th>
<th>Language Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 wks</td>
<td>supports head when lying</td>
<td>smiles, cooing (vowel-like sounds)</td>
</tr>
<tr>
<td>20 wks</td>
<td>sits with props</td>
<td>consonants appear &quot;nnn&quot;</td>
</tr>
<tr>
<td>6 m</td>
<td>bends, reaching</td>
<td>babbling: single syllables &quot;da&quot;</td>
</tr>
<tr>
<td>8 m</td>
<td>stands while holding on, fingers used to grasp</td>
<td>reduplicative babbling &quot;bababa&quot; prosody signals emotion</td>
</tr>
<tr>
<td>10 m</td>
<td>creeps efficiently, stands</td>
<td>ineffective imitation of sounds</td>
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<td>walks while holding hands</td>
<td>repeats sound sequences, words appear &quot;mama&quot;</td>
</tr>
<tr>
<td>18 m</td>
<td>sits in chair, gait developed</td>
<td>has 3-50 words, complex intonation, 1 word utterances</td>
</tr>
<tr>
<td>24 m</td>
<td>walks down stairs, runs but falls</td>
<td>two word phrases</td>
</tr>
<tr>
<td>30 m</td>
<td>jumps with two feet, stacks 6 cubes</td>
<td>fast increase in vocabulary, two-five word utterances</td>
</tr>
<tr>
<td>3 yrs</td>
<td>runs smoothly, navigates curves</td>
<td>1,000 word vocabulary, intelligible to strangers</td>
</tr>
<tr>
<td>4 yrs</td>
<td>catch ball, walks line</td>
<td>Language established, deviations more stylistic than grammatical</td>
</tr>
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### Lenneberg’s Milestones

- Correlation retained even if development is delayed (e.g., Downs Syndrome)
- No causal connection between motor skill and language skill
  - Motor disorders don’t affect language (hypotonia)
  - Language delays exist without motor delays (late talkers)
Lenneberg’s Hallmarks of maturationally controlled emergence of behavior

1. Regular sequence of milestones correlated with age and developments in other domains
2. Environment remains stable over time
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4. Early stages not signs of goal-directed practice

Little Variability in Linguistic Milestones

A chart illustrating the age of emergence for language milestones, showing that the percentage of children with specific abilities follows an S-shaped function with little variability. The data is collected from the Boston area in the 1960s.
Little environmental influence on language milestones

- Variations in SES, birth order, “maternal ability” have little influence
- Children of deaf parents go through normal stages of early vocal development (cooing, babbling)
- Language milestones correlated with motor development across cultures

Lenneberg’s Hallmarks of maturationally controlled emergence of behavior

1. Regular sequence of milestones correlated with age and developments in other domains
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4. Early stages not signs of goal-directed practice
Is babbling a form of practice?

Early stages not motivated by utility
- Children vocalize 6 months before they produce a word
- Children of deaf parents babble

Early practice not necessary
- Mute children often comprehend language
- Or begin speaking without cooing or babbling (tracheotomies, psychoses)

Evaluating the Maturation Hypothesis

• Suggests that language development controlled by maturational timetable.
• Correlational evidence problematic in developmental studies
  • Shoe size & vocabulary
• Children may go through these stages because it is the only logical way to learn (e.g. foreigners)
In sum

- Reviewed evidence suggesting that language learning is the natural product of the developing human mind.
- If maturation is the limiting factor, learning should look different if it takes place later in life.
- Presentation of full language environment after the usual maturational period should \( \rightarrow \) abnormal acquisition.

Critical Periods
The notion of a ‘critical period’

Song Learning as an Analogy for Language Learning (Marler)

- Sparrow songs are learned
  - Regional dialects
  - Learn songs similar to the ones heard
- Song learning is innately guided
  - Sparrows prefer to model song from own species
  - Change other songs to match species specific pattern
- Song production is creative
Stages in Song Learning

- Silent Period: song heard but not produced
- Subsong: few species specific features, similar for deaf and hearing birds, noisy
- Plastic song: more varied, many song types
- Crystalized song: selected from song in plastic stage, practiced

Instincts to Learn

Mechanisms by which learning is innately guided

- Selection of stimuli for further processing
  - Releasing mechanisms: behavior produced in response to particular stimuli
  - Attentional biases: preference to process or imitate particular stimuli (song sparrow syllable)
- Innate templates (swamp sparrow repetition)
  - Bias in interpreting stimuli
  - Default expectations
  - Ways of organizing information Crystalized song: selected from song in plastic stage, practiced
Critical Periods in Song Sparrow

Normal Song
- clear syllable structure

Exposed to song btw 35 - 56 days (otherwise isolated)
- clear syllable structure

Critical Periods in Song Sparrow

Normal Song

Exposed to song btw 50 and 71 days.
- Some deterioration
Critical Periods in Song Sparrow

Normal Song

Very early exposure (3 - 7 days)
  – Similar to subsong

Critical Periods in Song Sparrow

Normal Song

Very late exposure (after 300 days)
  – Similar to subsong
A critical period for language learning?

- The case of ‘Isabelle’
  - Hidden in attic by deranged mother
  - No exposure to language
  - Found at age 6
  - Normal Language by age 7
A critical period for language learning?

• The case of ‘Genie’
  - Isolated from age 20 months no exposure to language
  - Found at age 13
  - Language stayed in “pidgin” form

A critical period for language learning?

• The case of ‘Chelsea’
  • Born deaf and mistakenly diagnosed as retarded.
  • Never exposed to spoken or sign language
  • Correctly diagnosed at age 31, Hearing restored
  • Intensive language training
  • No progress beyond rudimentary 2 word sentences
Is there a critical period for language acquisition?

- These cases suggest a critical period
- Exposure before ~7 results in acquisition
- Exposure after ~13 does not
- Problems with this evidence? (TBF)

Johnson & Newport

Q: does acquisition of a second language differ as a consequence of differences in the degree of brain maturation?

- Speakers of East Asian languages tested on their knowledge of English
- All lived in US for past 5 years
- Similar social backgrounds in the US
Johnson & Newport

Evidence for Critical Period:
1. Performance not impaired prior to CP
2. Declining ability with decrease in exposure during CP
3. NO relationship between age of exposure and performance after critical period

Newport 1990

Q: Does acquisition of a first language differ as a consequence of learner age?
Subjects: speakers of ASL
Age of first exposure ranged from birth to 20
All subjects had been using ASL for 30 yrs
Late exposure to first language

What changes at the end of the critical period?

Possibilities:
1. Change in motivations or emotional responses? (duck imprinting)
2. Change in neural circuits caused by experiences? (cat vision)
3. Access to an innate knowledge base?
4. General cognitive processing abilities? Less is More Hypothesis: children’s poor memory helps them learn
Conclusions

• Language must be learned
• Language Development is universal despite enormous environmental variation
  – Universal stages
  – Universal success
• Language acquisition appears to be supported by powerful innate biases and mechanisms
• Are these biases specific to language or part of general human intelligence?