

Psych 56L/ Ling 51:
Acquisition of Language

Lecture 3
Biological Bases of Language I

Announcements

Review questions for biological bases of languages available

Be working on HW1 (due 1/23/14) – remember that collaboration is highly encouraged

Language as a human universal



Language as a human instinct



Fish pretty much always swim.



Birds pretty much always fly.

Humans pretty much always....talk.



More than culture

Language is more than simply a cultural habit that one generation copies from previous ones.

If there is no language model to learn from, humans will spontaneously *create* language.

pidgins & creoles

homesign systems

the case of Nicaraguan Sign Language



Pidgins

Pidgin: language created by adults from different language backgrounds who need to communicate with each other

Example:

Hawaiian Pidgin English: created by immigrant workers from Japan, Korea, and the Philippines who worked for English speakers

Ifu laik meiki, mo beta make time, mani no kaen hapai.

If like make, more better die time, money no can carry.

"If you want to build (a temple), you should do it before you die - you can't take it with you!"

(More than 100 pidgin languages currently in use)

Creoles

Pidgins tend to be structurally simple (often just nouns and verbs).

However, sometimes children are born into a community where a pidgin is the only language. If they acquire that pidgin as their native language, they create a *creole*.

Creoles are grammatically more complex, containing structures that are not in the pidgin language the children had as a model such as consistent word order, tense marking, and multi-clause sentences. Creoles often share the same features.

http://en.wikipedia.org/wiki/Syntactic_similarities_of_creoles#Syntactic_similarities

Put simply: children add something that wasn't already there!

PIDGIN	HAWAIIAN CREOLE ENGLISH
Building—high place—wall part—time—now—time—and then—now temperature every time give you.	Get one [There is an] electric sign high up on da wall of da building show you what time an' temperature get [it is] right now.
Now days. ah. house. ah. inside. washi clothes machine get. no? Before time. ah. no more. see? And then pipe no more. water pipe no more.	Those days bin get [there were] no more washing machine. no more pipe water like get [there is] inside house nowadays. ah?
No. the men. ah—pau [finished] work—they go. make garden. Plant this. ah. cabbage. like that. Plant potato. like that. And then—all that one—all right. sit down. Make lilly bit story.	When work pau [is finished] da guys they stay go make [are going to make] garden for plant potato an' cabbage an' after little while they go sit down talk story-["shoot the breeze"].
Good. this one. Kaukau [food] any kind this one. Pilipin island no good. No more money.	Hawaii more better than. Philippines. over here get [there is] plenty kaukau [food], over there no can. bra [brother]. you no more money for buy kaukau [food]. 'a sw'hy [that's why].

PIDGIN AND CREOLE versions of identical sentences illustrate the structural differences between pidgin and Creole in Hawaii. Pidgin, which is spoken only by immigrants, varies widely from speaker to speaker. Although one can probably say anything in pidgin that can be said in English or Creole, the structure of pidgin is extremely rudimentary. Pidgin sentences are little more than strings of nouns, verbs and adjectives, often arranged to place old, shared information first and new information later in the sentence. Creole arose in Hawaii only among the children of immigrants, and it is much richer in grammatical structure than pidgin. Moreover, the rules of Creole grammar are uniform from speaker to speaker, and they resemble the structural rules of other creoles. English versions of words and phrases are given in brackets.

Derek Bickerton (*Scientific American*, July 1983)

Pidgins & Creoles

<http://www.youtube.com/watch?v=O7X9AAeDCr4>

A detailed look at the development of a pidgin in Hawaii
(start around 0:57)

<http://www.youtube.com/watch?v= VFXoqfoi6I>

A detailed look at the development of a pidgin in Suriname

What creoles tell us

- (1) The existence of language in a community does *not* depend on someone importing a language for a community to learn. (Vocabulary may be borrowed, structural knowledge seems not to be.)
- (2) When children acquire language, they sometimes add *something extra*, which is sometimes thought to be universal to human languages and part of children's innate endowment for language (e.g., Universal Grammar).
- (3) Creoles tend to share the same features - which suggests human minds may tend to construct languages the same way.

Homesign systems

Homesign: A basic communication system created within a family that involves at least one linguistically, but not socially isolated, deaf individual. These deaf individuals use gestures to communicate with the people around them, *devising a method for communicating through gestures that becomes systematic*, and for the deaf individual, it is their primary means of communication.

(Brentari & Coppola 2012)

Homesign systems



Low complexity finger groups



Medium complexity finger groups



High complexity finger groups

A language bias shared by adult signers and homesigners:

They use higher complexity finger groups in handshapes representing properties of the object (ex: *tasty*) and lower complexity finger groups in handshapes representing how objects are handled (ex: *eat*)
(Brentari & Coppola 2012)

Homesign systems

Note: The **gestures from caretakers of home signers do not form the basis** of child home sign systems (Goldin Meadow & Mylander 1983). Homesigners seem to innovate on their own.

- (1) Homesigners distinguish nouns and verbs, even if the signs of their caretakers do not (Goldin Meadow & Mylander 1990).
- (2) Homesigners do not use the word order of their caretakers: Homesigning children in Taiwan and the US use an order like “jar twist you” instead of “you twist (the) jar”. (Goldin Meadow & Mylander 1998, Goldin Meadow & Zheng 2002)
- (3) Homesigners distinguish between nouns (*bird*) and demonstratives (*that bird*), even when the signs of their caretakers do not. (Hunsicker & Goldin Meadow 2012)

What homesign tells us

- (1) Homesigners are not merely copying the gestures of the hearing caretakers around them. Instead, they are **creating their own systematic uses** of gestures.
- (2) There seem to be **some biases in the way these systematic gestural systems develop**, suggesting that the human mind naturally imposes some order on the linguistic system it uses.



Creating a language: Nicaraguan Sign Language (NSL)

In 1978, the Nicaraguan government opened the nation’s first public schools for the deaf. The deaf children who entered had no common sign language, but did have their own individual **homesign** systems.

Once the children were in contact with each other, a new common sign language emerged: Nicaraguan Sign Language.



http://www.pbs.org/wgbh/evolution/library/07/2/l_072_04.html

Creating a language: Nicaraguan Sign Language (NSL)

Ann Senghas (Senghas & Coppola 2001) studied the language of children who arrived to the school at a young age vs. children who arrived when they were older (after age 10).

Language of younger children: **structurally complex (more like creole)**

Language of older children: **structurally simpler (more like pidgin)**

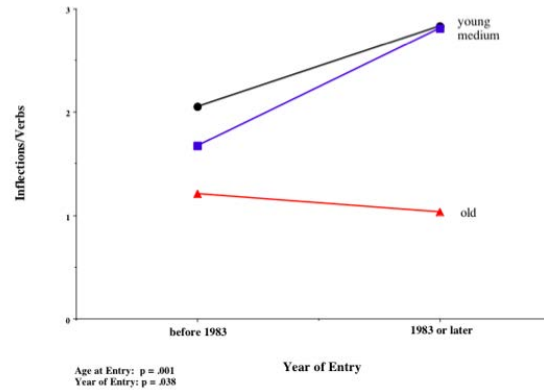
Creating a language: Nicaraguan Sign Language (NSL)

Use of spatial modification: if two signs are made in the same spatial location, it indicates that one sign modifies the other (ex: “tall” in same location as “king” = “tall king”)

Language of younger children: more spatial modification (the younger they were, the more they used it)

Language of older children: less spatial modification

Inflections per Verb



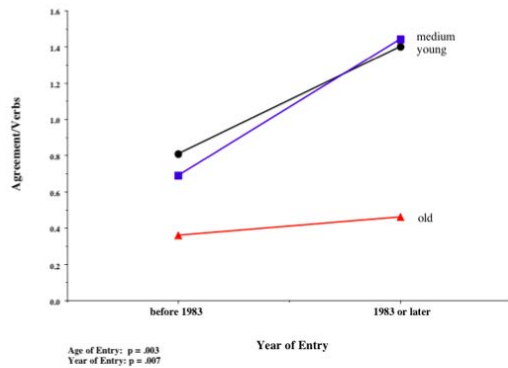
Inflection:

He likes me.

(as opposed to “he like me”)

Figure 2. The number of inflections per verb is greater overall for signers who entered the community in 1983 or later, and for signers who were exposed to the language at a young or medium age. The young and medium Age at Entry signers are particularly affected by a later Year of Entry.

Agreement per Verb



Agreement:

He is smiling.

(as opposed to “he are smiling”)

Figure 3. The number of inflections showing agreement per verb is greater overall for signers who entered the community in 1983 or later, and for signers who were exposed to the language at a young or medium age. The young and medium Age at Entry signers are particularly affected by a later Year of Entry.

Creating a language: Nicaraguan Sign Language (NSL)

Implication: (young) children are the driving force of language creation here. They are the innovators and the ones who retain the more complex structures that result from these innovations.



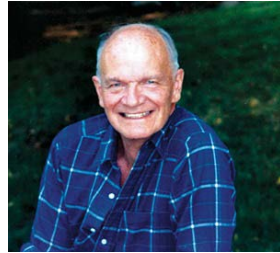
Language Bioprogram Hypothesis

Proposed by Derek Bickerton: the capacity for language creation seen in creolization, homesign, and the development of NSL is the same capacity that underlies language acquisition.

Humans have an innate core knowledge about the structural properties human languages have.

(domain-specific knowledge)

In accord with the generativist approach to language acquisition.



Language Bioprogram Hypothesis

Proposed by Derek Bickerton: the capacity for language creation seen in creolization and the development of NSL is the same capacity that underlies language acquisition.

But that “knowledge” may not be language-specific! It could be statistical learning or pattern analysis abilities.

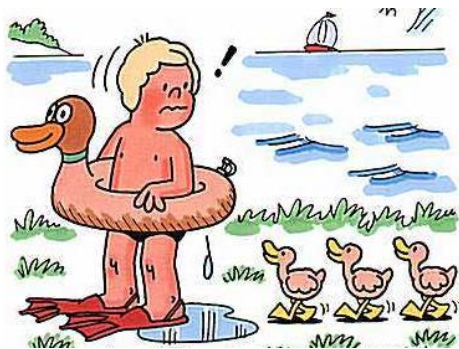
(domain-general abilities)

Support for differences between children & adult responses, given inconsistent input: Hudson Kam & Newport (2005), Hudson Kam & Newport (2009)



Elizabeth Bates

The critical period hypothesis



Critical & sensitive periods

“critical period for language” = biologically determined period during which language acquisition **must** occur in order for language to be learned fully and correctly

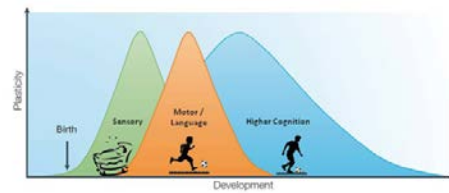
Other biologically determined deadlines:

- **imprinting**: chicks & ducklings follow first thing they see forever (it’s likely their mommy)
- **visual cells in humans**: if cells for both eyes don’t receive visual input during the first year or so of life, they lose the ability to respond to visual input

Critical & sensitive periods

“sensitive period”: biologically determined period during which learning must occur for development to happen correctly, but development can still occur partially after this period

Fig 1: Windows of plasticity in brain development



Adapted from Menotti, T. K. (2005). Critical period plasticity in local cortical circuits. *Nature Reviews Neuroscience*, 8(11), 877–888.

Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?



Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

(1) **Ideal experiment:** deprive children of all linguistic input during the purported critical/sensitive period and see how language development occurs.



Problem: ideal experiment isn't so ideal ethically or logistically

Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

Some historical cases that have unintentionally provided lack of linguistic input to children:

“wild children”: like Victor of Aveyron

Problem: unclear lack of language is solely due to lack of linguistic input (may be other factors)



Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

One success story for lack of linguistic input with a young child: [Isabelle](#)

1930s: 6-year-old Isabelle discovered hidden away in a dark room with a deaf-mute mother as her only contact.

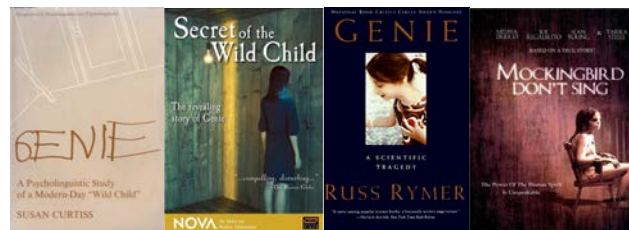
She was taught to speak and by age 8, appeared to be normal.

Potential implication: [Isabelle discovered before critical period was over.](#)

Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

A more thorough study: [Genie](#)



Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

A more thorough study: [Genie](#)

1970s: 13-year-old Genie brought by her mother to social services after escaping mentally ill father; until mother's escape, had no language input (and very horrific living conditions)

By age 17, she had a 5-year-old's vocabulary, and could express meanings by combining words together.

Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

A more thorough study: [Genie](#)

However...syntactic skills lagged far behind - deficient in both production and comprehension.

"Mama wash hair in sink."

"Like go ride yellow school bus."

"At school scratch face."

"Father take piece wood. Hit. Cry."

"I want Curtiss play piano."

"Applesauce buy store"

"Man motorcycle have."

"Father hit Genie cry long time ago."

Dichotic listening tasks showed language was a [right-hemisphere activity](#) for her (while it's a left-hemisphere activity for most adults).

Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

A more thorough study: [Genie](#)

Potential Implication: Genie discovered after critical period was over.

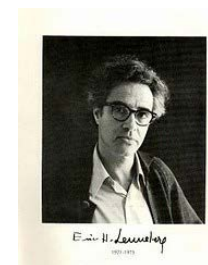
However, Genie may have had other cognitive disabilities...

Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

Lenneberg (1967):

“the only safe conclusions to be drawn from the multitude of reports is life in dark closets, wolves’ dens, forests, or sadistic parents’ backyards is not conducive to good health or normal development”



Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

Another study: [Chelsea](#) (Curtiss 1988)

Family background: A partially deaf woman incorrectly diagnosed as “retarded”. From a loving home.

Discovered at age 31, and fitted with hearing aids

Outcome: Learned a large vocabulary, but syntax and morphology worse than Genie.

Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

Another study: [Chelsea](#) (Curtiss 1988)

Sample speech from Chelsea:

- (1) The small a the hat
- (2) Orange Tim car in
- (3) I Wanda be drive come
- (4) Breakfast eating girl
- (5) They are is car in the Tim

Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

(2) **Late acquisition of sign language (ASL): deaf-of-hearing** children whose parents don't know sign language. Children are eventually exposed to sign language when they encounter other deaf children.

Good: individuals have normal early childhood experience, except for lack of language input

Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

If a critical or sensitive period is true, children who learn earlier should be better than children who learned later - this is what Newport (1990) found. Children who were 4-6 when first exposed to ASL were far superior in their sign language ability when compared to children who were exposed after age 12.



Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

Also important: not just about how long sign language speakers had known the language. **Speakers who had been signing for more than 30 years showed this same difference:** those exposed younger were far superior in their language skills to those exposed when they were older.



Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

(3) **Look at second language learning.**

Why? Children who learn a second language when they are young often become indistinguishable from their native-born peers. In contrast, people who are older have very different outcomes.



Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

Testing age differences in second language acquisition:

- Oyama (1976): testing Italian immigrants learning English
Age of arrival was better predictor of **accent** than how many years the immigrant had been speaking English
- Oyama (1978): **Age of arrival** was better predictor of **comprehension** than number of years speaking the language (not just about motor skill learning ability)

Critical & sensitive periods

How do we test for a critical/sensitive period for language acquisition?

Testing age differences in second language acquisition:

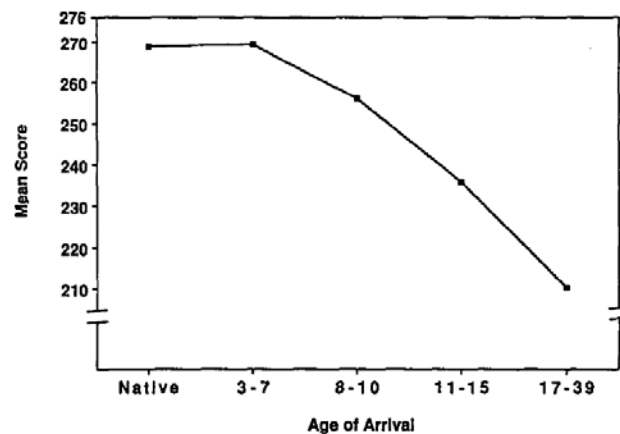
Johnson & Newport (1989): testing grammatical competency of Chinese & Korean natives living in the US

Heard recorded voices speaking sentences, and had to judge whether they were correct or not.

“The farmer bought two pig at the market.”

“Tom is reading book in bathtub.”

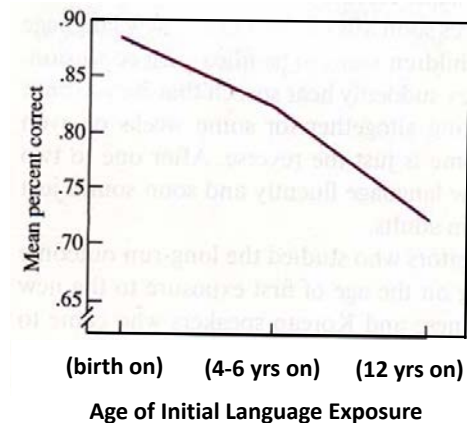
Second-language proficiency dependent on age of initial language exposure (even with same number of years of exposure total)



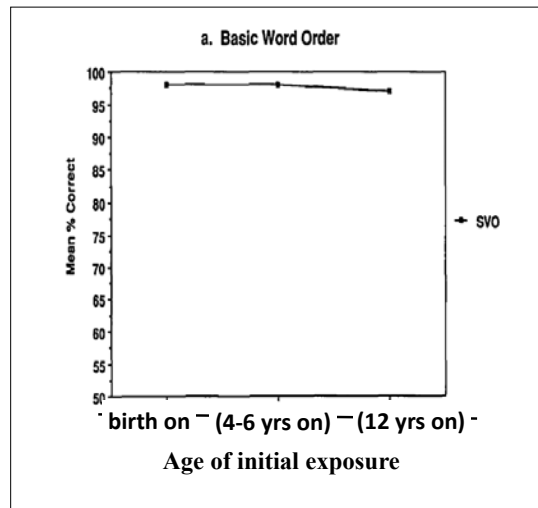
Second-language proficiency dependent on age of initial language exposure

Morphology:
e.g. **verb agreement** in production

Tom **is/*are** reading book
in bathtub



Second-language proficiency dependent on age of initial language exposure – but not all aspects are dependent



Basic word order: **SVO**

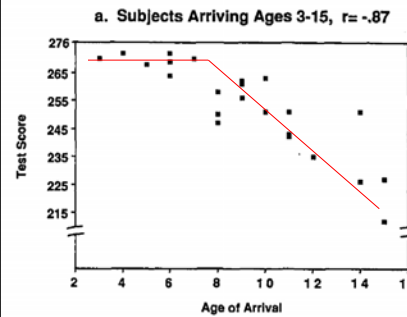
Subject Verb Object

Ex: "Penguins like fish."

As opposed to

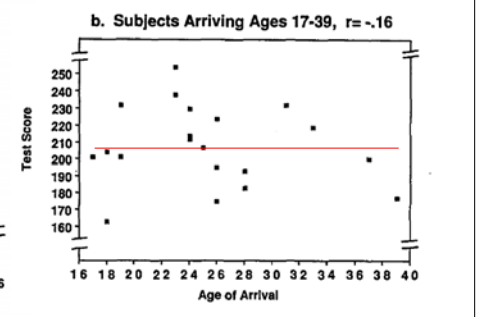
"Fish penguins like"
(Object Subject Verb)

Before and after the critical/sensitive period (sometimes called "maturation")



During Maturation

Decline in ability with maturation.



After Maturation

No relationship between Age of Arrival and Test Score

Some evidence for critical/sensitive period

Johnson & Newport (1989) also found that performance was not correlated with:

- Formal instruction in English
- Amount of initial exposure to English
- Reported motivation to learn English
- Self-consciousness in English
- Identification with American culture

Some evidence for critical/sensitive period

Functional magnetic resonance imaging (fMRI) studies confirm **different neural processing for language** in individuals who learned before age 7-8 vs. individuals who learned after this age (Kim et al. 1997, Dehaene et al. 1997, Wartenburger et al. 2003, Saur et al. 2009)



Some evidence for critical/sensitive period

Event-related potential (ERP) studies confirm differing **left-hemisphere specialization for language** in individuals who learned before age 4 vs. individuals who learned between 4 and 7 vs. individuals who learned after 7 (Weber-Fox & Neville 1996, 1999, Isel 2005)



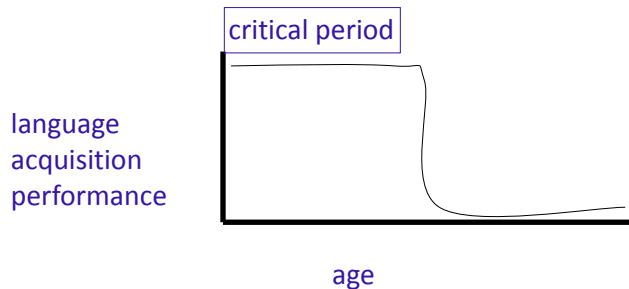
Sum up: Critical/sensitive period

- Language learning is comparatively *effortless* before age 8 or so, extremely effortful after
- Applies to both first and second language learning
- Applies to spoken and signed languages
- Critical/sensitive periods similar to other biologically-programmed abilities in humans and other species

Critical vs. sensitive, revisited

If there is truly a critical period of language acquisition, people learning language after this period should not succeed very well at all (they should be equally bad). In contrast, people within the critical period should do very well (they should be equally native-like).

Expectation: discontinuous function of performance



Critical vs. sensitive, revisited

However, most of the evidence we've seen (including the one below) suggests that there is a **smoother drop-off**. (support for **sensitive period**)

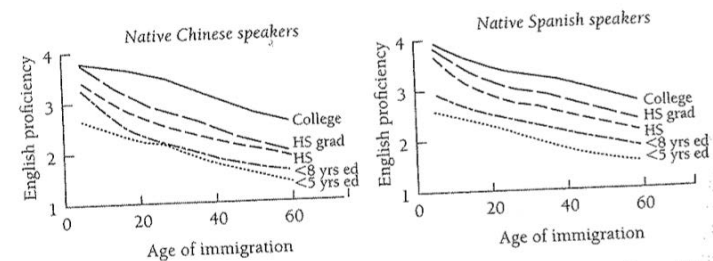


FIGURE 2.6 THE RELATION BETWEEN AGE OF IMMIGRATION AND ENGLISH PROFICIENCY FOR NATIVE CHINESE AND SPANISH SPEAKERS WHO IMMIGRATED TO THE UNITED STATES

Hakuta, Bialystok, & Wiley 2003

Critical vs. sensitive, revisited

“...rather than postulating one critical period for language acquisition, a more plausible hypothesis is that grammatical development is characterized by several *sensitive phases*...a phase can be characterized by an optimal period for the acquisition of the phenomenon in question...characterized by a relatively *short onset*, followed by an extended *optimal period* and a *gradual offset*...”

– Meisel, 2013

Fig 1: Windows of plasticity in brain development



Adapted from Kuhl, 1984, 'A critical period for the acquisition of phonetic structure: Evidence from the use of stop tokens', *Journal of Phonetics* 12, 181-200.

So why are younger children better?

“Less is more” hypothesis: Newport 1991

Children can remember less than adults (and have other cognitive limitations, like less attention). *Perhaps language is actually easier to figure out if the input is limited to smaller chunks.* Adults remember more and can store longer chunks, which makes their analytical task harder.

Studies supporting the idea that a *limitation on the way children process input leads to better learning performance*: Phillips & Pearl 2012, Pearl, Goldwater, & Steyvers 2011, Pearl, Goldwater, & Steyvers 2010, Pearl 2009, Pearl & Lidz 2009, Pearl 2008, Pearl & Weinberg 2007, Dresher 1999, Lightfoot 1999, Lightfoot 1991

So why are younger children better?

Some experimental support for the utility of “Less is more” when learning a foreign language as an adult: Chin & Kersten (2010)

Adults learning French over two one-hour sessions

- full sentences vs. small phrases that incrementally increased length to full sentences (to simulate children’s steadily expanding processing abilities)

Adults learning incrementally outperformed adults learning from full sentences on language proficiency tests of vocabulary and grammar.

Recap

Evidence from pidgins & creoles, homesign, and Nicaraguan Sign Language suggest that language is something that human children can create even in the absence of language input.

The Language Bioprogram Hypothesis suggests that this ability is due to children’s innate domain-specific knowledge about language.

There also appears to be a period during which language is acquired most easily - whether this is a critical period or sensitive period may vary depending on what specific linguistic knowledge we look at.

The “less is more” hypothesis is one idea for why children’s minds might be more suited to language learning than adults’ minds.

Questions?



You should be able to answer up through question 15 of the bio bases review sheet, and up through question 6 on HW1.