Weeks 2-3.
The Critical Period Hypothesis

CAS LX 400
Second Language Acquisition

Child L1A: fast, easy, successful.
Adult L2A: slow, hard, failure-prone.

• Some properties of L1A:
  – Fast
  – Seemingly effortless
  – Uniformly successful in reaching target.

• Some properties of L2A:
  – Slow
  – Hard
  – Typically does not end in native-like ability.

What makes us think there might be a critical period?

• Concerning L1A, there are (traumatic) cases of delayed language exposure which together seem to show that only if recovered before age 10 would normal L1 language development occur. This includes Genie (started at 13;7, learned some but stopped short of native-like attainment in morphology and syntax)

• Another case of severely delayed language access (but without abuse) is Chelsea, misdiagnosed as retarded in early childhood, when in fact she was congenitally deaf—only discovered when Chelsea was 31.

  Chelsea’s utterances have almost no discernable structure at all; her speech was less language-like than Genie’s.

Lenneberg 1967

• Lenneberg 1967 is usually considered to be the written origin of this idea that there is a “critical period” or “sensitive period” for language acquisition.

• He based this on several observations, including the observation that critical periods are biologically common.

What makes us think there might be a critical period?

• Suggests that kids are “built to learn language” in a way that adults are not.

• Perhaps there is a “sensitive period” early in life where one absorbs languages? A sensitive period which ends at some point…

• Perhaps there is a “sensitive period” early in life where one absorbs languages? A sensitive period which ends at some point…
How early is early enough?

- Isabelle (imprisoned with her mute, uneducated mother), starting at 6, rapidly caught up to normal age-levels.
- Jim, hearing child of deaf parents, brought into speech contact around 3;6, rapidly caught up in spoken language, reaching age-norms by 6.

Seems clear enough

- There is some kind of advantage to L1A within the “sensitive period”.
- Is it language specific? Or is there something about overall cognitive development that can explain this?
- Once you get L1 within the sensitive period, is that good enough (does that “get it started”) for L2A even after the sensitive period?

To reiterate…

- Is there a critical period for L1A?
  - Evidence just reviewed suggests probably.
- Does this critical period affect L2A?
  - Is it easier to learn an L2 inside the critical period?
  - It is possible to learn an L2 outside the critical period?
  - Does it just depend on having learned an L1 inside the critical period?

About critical periods

- Just a note: It’s pretty uncontroversial that there is some decline in the ability to learn language that happens with age. Nobody disputes the fact that it’s harder to learn a second language later in life.
- The question is: Is this caused by an irreversible neurological change? (A critical period) Is it impossible to “learn an L2” after the end of the critical period? Or does it just get harder to learn stuff as you get older? Why does it seem to be particularly acute with language learning?

About knowledge

- We can borrow from Krashen a distinction between two types of knowledge:
  - language competence (acquired competence)
  - learned linguistic knowledge
- The first is generally unavailable to conscious reflection. The second is quite often conscious.
  - An L1 example of LLK is Don’t end your sentences with a preposition, which if followed threaten to result in travesties like: This is the sort of pedantry up with which I will not put!
About knowledge

- The critical period hypothesis is about obtaining *acquired competence* (not *learned linguistic knowledge*) and it makes a claim about whether an L2 speaker can obtain a native-like *competence* of an L2.
- People can always gain LLK in an L2 as well, learn rules, apply them, maybe get so practiced at it that it becomes second nature, but this still wouldn’t rise to the level of acquired competence.

L2A and age of initial exposure

- Adults proceed through early stages of morphological and syntactic development faster than children (time and exposure constant).
- Older children acquire faster than younger children (morphology and syntax; time and exposure constant)
- Child starters outperform adult starters in the end.
- So, age improves rate, at least initially, but negatively affects ultimate level of attainment.

Phonology—6

- Studies of phonological acquisition suggest that *6 years old* is a critical one for attainment of native-like phonology.
- Generally tested by having native speaker judges listening (to accent, presumably) and guessing which were native speakers and which weren’t.

Morphology, syntax, semantics—15

- A few studies (including Johnson & Newport 1989) show that L2 speakers with an initial exposure prior to 15 did significantly better than L2 speakers with an initial exposure after 15 in the domain of syntax and morphology.

Comprehension—10

- A small set of results (Oyama 1978, Scovel 1981) suggest that ability to comprehend “masked” speech and recognize foreign accents has a discontinuity at around age 10.

Several “critical periods”

- So it seems that there is an age-sensitivity, but it is not even *language* specific, it is *subpart-of-language* specific.
  - Phonology—6
  - Morphology, syntax, semantics—15
  - Comprehension—10
  - …?
Why isn’t it strange that there should be (a) critical period(s)?

- There are critical periods attested all over the biological world.
- The visual system is a favorite example. In experiments done on macaque monkeys, it was determined that there is a critical period for development of binocular vision cells in the visual cortex (tested by monocular deprivation).
- Recovery after CNS damage: disappointingly limited in the adult brain, but can be nearly 100% in the immature nervous system.

Why isn’t it strange that there should be (a) critical period(s)?

- Vision studies replicated in cats.
- In fact, vision studies “replicated” in humans as well; there seems to be a visual critical period at around age 6, after which providing previously delayed visual stimuli is of no use. (Congenital opacities of the cornea; surgery performed on juveniles or adults does not restore sight).
- Imprinting in birds: just after birth, they “become attached” to a prominent moving object in their environment (typically, the mother). This attachment persists. But it can only be done sometimes in the first few hours, for some species.

Why isn’t it strange that there should be (a) critical period(s)?

…Critical periods of development generally do not have sharp time boundaries. Different layers within one region of the brain may have different critical periods of development, so that even after the critical period for one layer has passed, rearrangement of the layer may still be possible because the entire region has not yet fully developed. For example, 8 weeks after birth layer 4c in the visual cortex of the monkey is no longer affected by monocular deprivation, whereas the upper and lower layers continue to be susceptible for almost the entire first year. (Kandel, Schwartz, Jessell 3d ed. 1991, p. 957)

What might cause a critical period?

- People like to believe that anything is possible and so they tend not to like to believe in the critical period if they can help it. But what else might cause this age-related effect on language learning?
- One possibility: social/cognitive factors that covary with age (an “intervening variable”); e.g., attitude, motivation, empathy, self-esteem, …
- Yet, this doesn’t seem to get at the uniformity of the phenomenon across situations. And why phonology at 6, morphology at 15?

What might cause a critical period?

- Difference in the input? Unlikely to cause this big of an effect, and also unlikely to be as consistent as the facts require.
- Cognitive development provides other learning mechanisms which overwhelm our LAD mechanisms? Plus, is this detectibly different? Is it even conceptually different?
What might cause a critical period?

- Brain development. One of the most popular views is that the critical period is a drop in the plasticity of the brain.
- An early hypothesis was that this is associated with lateralization of language processes.
- Interesting, but the timing is off. Lateralization seems to be complete by around age 5, long before the syntax critical period. Maybe implicated in some way in the phonology critical period?

What might cause a critical period?

- Brain development. Myelinization of axons precludes further connections (limits plasticity). Myelinization happens more slowly—in fact, it might miss the critical period on the other end, still going on after 15. Plus, we’d still like to know why the particular sequence we see, even if myelinization is the answer.

What might cause a critical period?

- Bottom line: We don’t really know.
- Neural development seems like a promising place to look, but there are very few things actually known about the connection between language and neurons, or even about neural development (beyond description).

Johnson and Newport (1991)

- Aiming to test the critical period hypothesis by looking at correlations between eventual performance and age of initial exposure to the target language.
- In particular, they were trying to focus on whether purportedly universal properties of language exhibited in L2 show an age effect.

Subjacency

- Johnson & Newport used grammaticality judgments to try to get at the language learners’ interlanguage competence, testing subtle contrasts that native speakers make.
- Their primary test looked at Subjacency violations, which are most easily seen as a property of possible wh-questions in a language.

Wh-questions

- Consider a wh-question:
  - What did you buy?
- This corresponds to a statement like:
  - You bought coffee.
- When you want to ask a wh-question, you do several things.
  - Replace the target word with a wh-word
  - Put the wh-word in the front of the question
  - If there is an auxiliary (is, are) or a modal (will, should, could, might, …), put that just after the wh-word, before the subject. Otherwise, put do there and use the bare form of the verb.
**Wh-questions**

- So, for example:
  - I will buy a book.
  - I said that John bought a pizza.
- Replace with *wh*-word:
  - I will buy what
  - I said that John bought what
- Put the *wh*-word in the front.
  - What I will buy
  - What I said that John bought
- Put *will* (or insert *did*) after the *wh*-word.
  - What will I buy?
  - What did I say that John bought?

**Wh-questions**

- The relationship between the original position of the *wh*-word (before putting it at the front of the sentence) and the place where the *wh*-word ends up (at the front of the sentence) has to meet certain conditions for a *wh*-question to be grammatical.
  - What will I buy —?
  - What did I say that John bought —?

**Wh-questions**

- It is possible for a *wh*-word to be related to its original position (its *trace*) over several sentences—there is no limitation on the absolute distance between the *wh*-word and the trace.
  - What did I say [that John bought —]?
  - What did I believe [John said [that Mary bought —]]?

**Wh-questions**

- However, there are certain kinds of phrases that cannot contain the trace. If you try to relate a *wh*-word at the beginning of the sentence to a trace inside one of these *islands*, the result is ungrammatical (or bad-sounding) sentence.
  - *What did you ask whether John will buy — tomorrow?*
  - *Who did you see the book John gave — on the table?*
  - *What did you laugh after John brought — home?*
  - *What did John eat — and a muffin?*

**Islands**

- Islands include embedded questions, “complex noun phrases”, adverbial phrases, and conjoined phrases.
- Embedded questions:
  - I asked whether John will buy a book tomorrow.
  - (I asked: Will John buy a book tomorrow?)
  - *What did you ask [whether John will buy — tomorrow]?*

**Islands**

- Islands include embedded questions, “complex noun phrases”, adverbial phrases, and conjoined phrases.
- “Complex noun phrases”:
  - I saw [the book John gave Mary] on the table.
  - (I saw it on the table).
  - *Who did you see [the book John gave —] on the table?*
Islands

• Islands include embedded questions, “complex noun phrases”, adverbial phrases, and conjoined phrases.
• Adverbial phrases:
  – You laughed [after John brought coffee home].
  – (When did you laugh?).
  – *What did you laugh [after John brought — home]?  

Subjacency

• What makes a *wh*-question ungrammatical when the *wh*-word is separated from its trace by an island like this is a principle called Subjacency.
• Johnson & Newport were testing second language learners’ abilities to discern grammatical sentences from sentences which are ungrammatical due to Subjacency violations.

Language variation

• One of the things which is interesting about Subjacency is that languages seem to differ in their sensitivity to this principle.
• Languages also differ in the way they form *wh*-questions. In English and many other languages, the *wh*-word comes at the beginning of the question. In Japanese, Korean, Chinese, Indonesian, and many other languages, the *wh*-word is not put at the beginning of the question, but just “left where it was” (“*wh*-in-situ languages”).

Language variation

• Interestingly, *wh*-in-situ languages tend also to be languages where you *can* ask a *wh*-question where the *wh*-word is inside of an island. So, in Japanese, it is perfectly possible to ask (in Japanese):
  – I saw [the book John gave who] on the table?
  – I laughed [after John brought what home]?

Language variation

• This suggested that Subjacency is not a constraint on *questions* but a constraint on movement (or, the path between a *wh*-word and its “trace”).
• Since Japanese doesn’t move *wh*-words (you could say there is no trace at all, or maybe that the trace and the *wh*-word are in the same place), people in the 80’s concluded that Subjacency was essentially “inactive” in Japanese. It was never called upon, and this counts as a parametric difference between the two languages.
**Language variation**

- Besides being “active” vs. “inactive”, languages can also differ in what counts as an island. This is sometimes referred to as a difference in *bounding nodes*, and is also a parametric difference between languages.

- For example, in Italian, you can ask a question like this (with the trace inside an embedded question):
  - To whom does John wonder
    [which stories I have told — — ?]

- …But you still can’t ask a question about something inside a complex noun phrase (where the trace would be inside a CNP).

**Subjacency**

- The parametric difference between English and Italian is referred to as a difference in *bounding nodes*. The details are too complex to concern ourselves with here, but the general idea is that the set of islands (which Subjacency prohibits a trace within) differs between English and Italian.

  - Subjacency is a principle which is considered to be part of UG; it is not something language-specific, it is not something learned or learnable, it is part of the shape of a language.
  - Subjacency constrains movement, though, so a language without movement (e.g. *wh*-movement) will not have a use for Subjacency.
  - Note that this leaves two options open:
    - Such a language obeys Subjacency vacuously.
    - Such a language does not “have” Subjacency.

- Many of the studies that have been done on the extent to which an IL grammar obeys Subjacency assume the second view.
- The conception of acquisition is that LAD constructs a language-particularly grammar by choosing from “options made available by UG.”
- That is, UG provides Subjacency in its set of options. As LAD constructs L1, it may call upon Subjacency or not. An LAD constructing English calls upon it, an LAD constructing Japanese does not.

- As linguistic theory has developed, this has become less and less the mainstream view. Instead, the first option given earlier has become the accepted view: that Subjacency exists as a constraint in every language regardless of whether the language moves its *wh*-words—if the language doesn’t move its *wh*-words, it satisfies Subjacency vacuously.

- Something to file away in the back of your mind for later.
Subject-Auxiliary Inversion

- Johnson & Newport look at second language learners’ control of Subjacency in comparison to second language learners’ control of Subject-Auxiliary Inversion.
- SAI is considered by them to be an “English-specific” rule (not a universal rule, allowed by UG but in a sense not required by UG).

Subject-Auxiliary Inversion

- SAI is the rule which moves an auxiliary or modal verb to the left of the subject in a question:
  - What did John buy?
  - Who will Mary meet?
  - When is Bill going home?
  - Why would you ask that question?

Subject-Auxiliary Inversion

- So, what Johnson & Newport were assuming was essentially something like:
- When learning a language:
  - If the language has (wh-)movement, LAD is required to pick out the Subjacency rule and add it to the grammar of the language being built.
  - A language may or may not opt to formulate a rule like SAI and add it to the language being built (language-particular, not provided by UG, although in a form allowed by UG).

Johnson & Newport (1991)

- J&N wanted to compare the ability of native speakers of Chinese (a wh-in-situ language) to learn/use Subjacency (a universal principle, provided by UG) and subject-auxiliary inversion (an English-specific rule, supposed to be part of English over and above UG).
- The idea is that if universal principles are provided by UG and there is a critical period, young learners (within the critical period) might have “access” to it whereas older learners might not (given that the L1 did not make use of Subjacency).

J&N91 (Study 2)

- Johnson & Newport looked at how second language learners fared with respect to Subjacency (“UG”) and Subject-Aux Inversion (“English-specific”), and what effect “initial age of immersion” had. They were looking for evidence of a critical period for language learning (in the form of “learning” the syntactic principle of Subjacency).

J&N91 (Study 2)

- What’s the effect of initial age of immersion?
  - 21 speakers Chinese->English with initial ages between 4-16.
  - 21 more with initial ages between 17-25.
J&N91 (Study 2)

• They conclude: Their results are incompatible with the view that nothing’s different between late and early L2 acquisition.

• There seems to be a more rapid drop-off of ability to use the putative universally available principle of Subjacency in one’s L2 if initial immersion is after 14 years old.

What do you lose after the critical period?

• If you lose some ability to learn language after the critical period, what is different?

• A common and tempting interpretation of the critical period effects is that a second language learner’s efforts is no longer facilitated by “UG” after the critical period is over, so people have to learn languages in some way which is different from how kids learn their native language.

Those who disagree…

• Despite all of this, there are still those who maintain that there isn’t a critical period.
• The primary evidence brought in favor of this is that we can find isolated, rare instances of people who have learned a second language in their adult years (after a critical period should be over) who pass for native speakers on various kinds of tests.
• What are we to make of this kind of evidence?

Those who disagree…

• White & Genesee (1996) looked at Francophone learners of English who managed to perform on subtle grammaticality tests at a level indistinguishable from native speakers, despite having learned as adults.
• However, given the absolute rarity of such cases, we might be better off concluding not that there is no critical period, but just that in rare cases it can be overcome.
So where are we?

- There is lots of evidence from neuroscience that some aspects of brain development are subject to critical periods.
- The evidence seems to show that people who start learning a second language relatively late are much less likely to approximate native speaker competence.
- The evidence may not quite manage to show that late learners cannot reach near-native levels.
- So is this inconsistent with a biological explanation?
- Are the “near-natives” just really good with LLK?

So where are we?

- Many studies on many aspects of the critical period hypothesis have been undertaken, and although not every result agrees with every other result, we can distill out a few things which seem to be generalizations.
  - (Generalizations taken from Harley and Wang 1997)

So where are we?

- The onset of language takes place at early infancy, if not already at birth.
  - At least by 6 months, infants are able to discriminate linguistic sounds (phonetic inventories, open syllables) from one another and from non-linguistic sounds.

So where are we?

- Delayed first language acquisition is incomplete when the onset of language is after age 4; the later the age of onset, the less complete acquisition is likely to be.
  - Newport (1990) studied congenitally deaf adults with different initial ages of exposure to ASL and found that even those whose initial age of exposure was as early as four were outperformed by those whose initial age of exposure was prior.

So where are we?

- Late first language acquisition is less successful in the long run than equally late second language acquisition.
  - Many studies combined show this sort of effect; it appears to be vital to learn a native language early, whereas the “window” doesn’t seem to completely close on highly-successful second language acquisition until quite a bit later.
So where are we?

• More mature learners generally make faster initial progress in acquiring morphosyntactic and lexical aspects of second language.
  – The general idea here is that more mature learners have more advanced general cognitive processes and problem-solving ability that allows them to better deal with the task of learning the morphology and syntax. Perhaps this is indicative of a role for LLK? *In the long run*, though, more mature learners are generally *less* successful.

So where are we?

• An increasing age of onset for second language acquisition is correlated with declining ultimate attainment in pronunciation and morphosyntax across age groups, this pattern beginning typically with an onset age of 6 to 7 in childhood and continuing into adulthood. In adult learners, the association between onset age and declining outcomes is most strongly manifested in the oral aspects of second language proficiency.
  – Learning a second language without an accent is very difficult after quite an early age.

So where are we?

• Second language studies have not provided convincing support for a critical period terminus at puberty. Some adult learners are capable of near-native, if not native-like, performance in a second language, whereas some children are less successful than others.
  – Puberty is another biologically scheduled process that is tempting to compare with a “critical period” for language acquisition. However, puberty is not itself contemporaneous with any observable linguistic milestone—it appears to be also maturational, but not directly linked to linguistic capacities.
  – Whatever critical period there is, it seems to be somewhat “overcomable” either with effort or perhaps in terms of individual differences…?

So where are we?

• Monolingual-like attainment in each of a bilingual’s two languages is probably a myth (at any age).
  – This contentious-sounding statement is really aiming to cover the fact that studies have indicated that a bilingual’s knowledge is different from a monolingual speaker’s knowledge in various ways (although most studies seem to be more about speed of access and phonology, not syntax). The idea is that perhaps the appropriate measure of “success” should be approximating a bilingual knowledge rather than a monolingual native speaker’s knowledge, which is sensible enough.

So where are we?

• Maintaining two languages at a high level in a minority context may be particularly difficult for young children.
  – Not a lot of support for this was provided, but there is plenty of anecdotal evidence of people who “once knew a language as a child” but have since come to a point where they don’t believe they know it at all anymore (“language attrition”). Anecdotal evidence also indicates that such people “pick up” the language they “lost” very quickly, suggesting that it hadn’t really been completely “forgotten.” It isn’t clear what importance this fact has, however, other than pointing to a difference between children and adults.

So…

• In the next few classes, we will consider some arguments about the role of “UG” in second language acquisition, and part of the reason there is a debate is that there is some evidence for a critical period for language learning.

• Given that, the question is: What disappears after the critical period? Is it UG? Or does UG play a role in L2A? Or does only *part* of UG play a role?