Q&A: Critical periods in first language acquisition

Newman et al

- If the RH AG is less susceptible to modification after the critical period ends, does it become less and less so with age, or does it stay at the same low level of susceptibility? Basically, is there a difference between a 20-year-old and a 30-year-old in this regard?
  - After the critical period the susceptibility could still be changing, but not changing too fast. So, the difference between a 5 year old and 15 year old is much bigger than between a 25 year old and a 35 year old.

- Will people who receive cochlear implants well past the critical period benefit at all from it in terms of language acquisition? Speech production? Interpretations of sounds in general?
  - There was a case in which a deaf child “Chelsea” was misdiagnosed as mentally retarded, and did not receive any language input or cochlear implant until age 30, while otherwise raised in a normal family environment. She got the implant after 30, and was able to develop minimal speech skills, but did not develop any sort of stable word order or any syntax. I'm not sure about her phonological development, but it would be fair to assume that her mastery of phonology was not perfect either. But she could hear, with the implant.

- Native ASL signers who are hearing and speak English show activation in both hemispheres. Is the activation separate for each language (i.e. LH for English and RH for ASL?)
  - In the particular study, both hemispheres activate when the hearing signer is processing sign language video.

- What effect (if any) would ambidextrous subjects have had on the study?

- So is it the kinesthetic aspect of ASL that causes it to be processed differently by native speaking bilinguals than English?
  - It is clear that the areas of the brain having to do with motion detection are used here, and so yes, it is the visual-kinetic nature of ASL that causes the difference.

- When people are doing things with their hands such as writing, is the right hemisphere also activated?
  - Yes, in different ways.

- English speakers show left-lateralization but native ASL speakers show more right hemisphere use. If ASL is a language just like any other, wouldn't one expect the areas of the brain used to be the same or similar? What accounts for this difference?
  - The areas are actually similar – there is left hemisphere activation during ASL processing, just not as much as for English, and of course, there is strong activation in the right hemisphere for ASL and not English.
  - This is due to the motor-visual nature of ASL, so it's only natural that motor-visual areas are activated for it (which are in the RH), and also that areas next to those are recruited for language processing (to minimize back-and-forth between far-away parts of the brain), just like auditory cortex is activated in the processing of English, and areas next to it are recruited to processing.
  - In left-handed people the parts of the brain doing language are a bit different, too – and that includes spoken language. In people who've had a part of their brain damaged or disabled at birth or later in life (e.g., via stroke), rewiring often occurs so that different parts of the brain start doing language (in these cases, a person may experience aphasia (partial or total speech loss) and then recover from it once the brain rewire itself.

- Is there any actual performance deficit in ASL signing associated with the difference in hemisphere activation between native signers and late signers? - yes

- Facial movements also play a large part in ASL. Do facial movements activate RH STS as well? - they activate RH STS and more.
How is studying bilingual bimodal people different from comparing monolingual people in each mode, or maybe bilinguals in a single mode? Could they still have tried to answer the same questions?  
- There are brain differences between the two modes. So, the questions pursued in this study had to do with figuring out which of these differences are there because of the nature of ASL vs English, and which ones are there because the person has or lacks hearing. This kind of separation could not be done without studying bilingual bimodal people.

Bavalier and Neville

- TMS is not specific, so it's hard to pinpoint which area of the brain is responsible. How, then, can the scientists confidently rely on the info they obtain through this process?
  - It's not possible to pinpoint the exact area, but it is possible to determine the general area of the brain using TMS
- What exactly is meant by “plastic”/“plasticity”? - ability of the brain to change (physically) under the influence of input from the environment
- If reorganization of the brain doesn't improve the sense that colonizes the unused part of the brain, what's the point of doing it?
  - To ensure optimal usage of all the areas of the brain, so that there are no totally unused parts
  - Reorganization doesn't necessarily improve the other sense(s), but it might in some cases
- How does this apply to language? Just the idea of a “critical period”?
  - This explores the ways in which a critical period (for language or for other things) works on the neurological level, what exactly is happenning in the brain as it utilises or loses its ability to rewire itself
- I heard people say that when one sense is shut off, the others are heightened (e.g. when someone is blindfolded). Based on this article, is this statement likely an overgeneralization of the effects of extended sensory deprivation such as that discussed in the article?
  - Some of it has to do with attention. When we're not distracted by all this information coming at us visually, our attention to information from the other senses is heightened, causing the effect as if our hearing or smell or touch are improved. That's different from what's happenning in sensory deprivation. A way to compare the two would be to compare the sense of hearing or smell or touch in a blind vs blindfolded person (or animal)
- Can we infer from this article that if a person never learned or had access to a language, the language-related areas of his brain will be used for something else?
  - Not an impossible hypothesis; however, language doesn't have a “cortex” like vision or hearing, so the “unused” area would have to be something like Broca's area perhaps...
- If the input type affects what a particular area of the brain is in charge of, then does continuous foreign language input eventually get the brain to become better at processing it? Or would this hypothetical difference, if does exist, be confounded by the increase proficiency that would also theoretically be present after prolonged exposure?
  - Theoretically, if a person gets language input, it all goes to the same parts of the brain (those parts that do language). Therefore, we shouldn't expect any changes in the ability of the brain to process, nor in which areas of the brain process it.
  - I think we can reword this question: if sensory deprivation can decrease brain's ability to process that particular kind of input, can extra sensory input improve brain's ability to process that input? - the answer is, yes in some cases.
- Some areas of the brain maintain high plasticity. Is that due to some build-in characteristics or to the kind of input (like visual input)? If the former, suppose we reroute the language somehow to one of these plastic-for-a-long-time areas, would that remove the critical period for language in the organism?
- For those people that are born hearing, get some spoken language, and then become deaf – do
they process events in the peripheral visual field with greater accuracy?

Newport
- Second language learners show less lateralization so could that explain the effects that we saw in the Newman et al ASL studies?
  - No, it can't explain those effects for most of the subjects, since Newman and colleagues looked at native speakers of ASL – those who learned both English and ASL were learning both of them as native (so, first) languages, and same for the late learners had no language before the ASL. The only group for which this would make a difference are those who learned English as their first language, and then learned ASL as a second language later in life.
- Does right or left handedness play into lateralization of language?
  - Yes. Right-handed people are more lateralized, with language functions localized in the left hemisphere of the brain, whereas left-handed people are less lateralized.
- Could Genie's abuse have contributed to her difficulty with language? If a child who had not been abused had received first input at 13, would (s)he have the same ability as Genie, or maybe better?
  - We can look at cases of deaf children who receive first sign language instruction (or cochlear implant) at age 13. The results are variable, with some doing better, and some worse. It seems that 13 is just towards the end of the critical period, so some children are still within the window of opportunity at 13, while others are not.
- Newport is obviously a proponent of the idea of a critical/sensitive period, but does she think this is due to only maturational causes?
  - Why do critical periods happen, and how do they work? The general theory is that, indeed, as the brain matures, the high-maintenance pathways needed for the specific type of plasticity in question die out. This way, the organism doesn't have to expend the extra energy/resources needed to maintain these pathways beyond the window of time when the skill in question is acquired by the vast majority of the individuals.
- Do linguists distinguish between “critical” and “sensitive” period?
  - Most linguists who don't study the issue of such a period directly just use the words “critical period” to mean both critical and sensitive. The distinction is important, however, and is made by the scholars who directly investigate this issue.
- If late second language learners show lower performance than early second language learners, then what is the value of having language classes in college?
  - First of all, language classes serve to provide explicit instruction and language input – otherwise, majority of people taking these classes would not be getting any input in the second language, and thus showing zero learning, rather than slower-than-in-childhood learning. After all, we can't all go to Italy to learn Italian, or to China to learn Chinese!
  - Second, the study showed that if you wait for people to get as good at a language as they'll ever be, then those who started late will, in general, be worse than those who started early, with or without classes. But classes make a difference in the shorter term. For those learners who are beyond the critical/sensitive period, classes serve to kick-start learning using our general learning mechanisms. Thus, even for those learners who are getting language input in their environment outside the classroom (like English-as-a-second-language learners in the US), such classes (like ESL) might kick-start the language learning that would otherwise take a much longer time.
- With second language learning later in life, it seems that the knowledge is more translation
based and the two languages are linked more than in bilingual acquisition.

○ Do people learning a second language later in life ever reach a point where they are not at least partially translating?
  ■ – they do, after reaching a certain level of proficiency
○ Can this be the result of the decline in plasticity and activation of language areas?
  ■ – that's the theory, at least – that decline in plasticity after the end of the critical period makes UG inaccessible for late learners, so they must rely on general learning mechanisms for learning a second language

● Newport says that studies that observed highly proficient late bilinguals and early bilinguals found congruent results. What exactly do they mean by “late bilinguals”? Doesn't that contradict the critical period theory?
  ○ “Late bilinguals” - in this mess of confusing terminology – means late second-language learners
  ○ This would contradict second-language learning, except Newport disputes these studies, and also cites studies showing important differences between late and early learners

● Does similarity between L1 and L2 lessen the age effects of a second language critical/sensitive period? I.e, will speakers of a non-Indo-European language have an earlier-ending critical period for learning English than speakers of an Indo-European language?
  ○ It won't affect the neurological changes that we describe as a critical/sensitive period
  ○ But similarities between L1 and L2 make it easier to extrapolate from the grammar of L1 that the person already knows to L2 using general learning mechanisms, thus making the limiting effects of the critical period less visible in the final outcome of their learning

● What happens in terms of ERP results for a child who is raised bilingual?

● Is there a cognitive difference between being raised bilingual from birth vs eing raised with one language but adding a second one near the end of critical period? - yes, as language acquisition abilities slow down during the “waning” part of the critical period