Lecture notes 3.1 **language and brain: age**

INTRODUCTION

Age as a remarkable site fo difference between L2 and L1 acquisition

A. Two key issues
   i. The possibility that a biological schedule may operate (after which the processes and outcomes of L2 acquisition are fundamentally and irreversibly changed)
   ii. The possibility that there may be a ceiling to L2 learning
B. No clear or simple answers
C. Many questions to understand universal age effect on L2 acquisition remain open

1. CRITICAL AND SENSITIVE PERIODS

A. Early proposals
   i. Neurolinguistics studies in L1 acquisition of Penfield and Roberts (1959) and Lenneberg (1967)
   - Evidence: a natural predisposition in the child's brain for learning the first language; children were also adept foreign language learners
   - Causes: loss of plasticity of human brains by year nine of life; or the completing of lateralization by the onset of puberty
   - Critical period for L1 acquisition as a corollary for L2 acquisition

   ii. Evidence for critical period
   - Development of certain human faculties, such as vision
   - Critical period hypothesis: a specific period of time early in life when the brain exhibits a special propensity to attend to certain experiences in the environment and leanr form them

   iii. Two kinds of age: critical and sensitive periods

Critical and sensitive periods in animal learning, based on Knudsen (2004)

An example of a **critical period** is ocular representation in the cortex of kittens. This neurological process develops according to a narrow window of opportunity between 30 and 80 days of life. If kittens are deprived from the experience of viewing during this time window (because one eye is forced to remain closed), they will lose vision, simply because the closed eye and the brain failed to connect, as it were. That is, even though the now uncovered eye is optically normal, it fails to convey the visual information to the axons in the thalamus, which in turn cannot convey it to the neurons in cortical level IV. Another well-known example of a critical, irreversible period is filial imprinting in the forebrain of ducks, which makes them follow the first large moving entity between 9 and 17 hours of hatching and bond with it as the recognized parent. An example of a **sensitive period**, on the other hand, is barn owls' ability to process spatial information auditorily (indispensable for catching mice in the dark!). Young owls develop the ability to create mental maps of their space based on auditory cues at a young age. If either hearing or vision is impaired during this sensitive period, auditory spatial information will not be processed normally later in life. However, problems can be compensated for and reversed, even well past the sensitive period, if the visual or auditory impairment is restored and rich exposure to sound input is provided

   iv. Evidence for both periods
   - Genie (recounted from different perspectives by Curtiss, 1977; Rymer, 1993) and of several feral children (discussed in Candland, 1993)

- Postponed first language acquisition in the deaf population

v. For L2 acquisition, it seems plausible to posit that there are sensitive periods for a number of language areas.

2. JULIE, AN EXCEPTIONALLY SUCCESSFUL LATE LEARNER OF ARABIC

A. Ioup and her colleagues (1994)

i. To investigate the limit of ultimate attainment of Julie: accent; tacit knowledge (morphosyntactic) (how to test? Translation; grammaticality judgment); anaphora

ii. Laura vs Julie

B. Ioup (2005): the preponderance of evidence supports the existence of age-related sensitive periods for L2 acquisition

3. RATE OF L2 ACQUISITION: ARE CHILDREN OR ADULTS BETTER L2 LEARNERS?

A. Early findings in L2 acquisition

i. an advantage for adults over children

ii. contradict assumed critical period effects

iii. Krashen et al (1979): older is better initially, but that younger is better in the long run

iv. Long (1990): the rate advantage for adults dissipates after a little more than a year, because children eventually always catch up and surpass late starters; Aoyama et al. (2008)

B. Finding in foreign language acquisition

i. Mayo and Lecumberri (2003); Munoz (2006): younger starters do not appear to catch up in these foreign learning contexts, where the L2 is only available through instruction

4. ULTIMATE ATTAINMENT: AGE AND L2 MORPHOSYNTAX

A. Two lines of research both focusing on L2 morphosyntax

i. Correlational

Studies comparing knowledge of morphosyntax associated with varying ages of onset for L2 acquisition.

- Main research question: Are age and morphosyntactic attainment systematically related?
- Researchers' interpretation of results: Johnson and Newport interpreted their data in support of a critical/sensitive period. Birdsong and Molis's replication did not support all of the original findings.

- Johnson and Newport (1989); Birdsong and Molis (2001)
- Methodology: grammaticality judgement tasks
- findings: learners who began acquiring L2 before a certain age, around puberty, tend to exhibit intiutions that are close to those of native speakers; those later starters are not likely to be in the antive speaker range

ii. upper limits of successful late L2 learning

Studies scrutinizing knowledge of morphosyntax in L2 speakers who achieve exceptionally high levels of ultimate attainment and are identified as near-native outside the laboratory (typically, cases of L2 acquisition after puberty)

- Main research question: Can some exceptionally successful L2 acquirers be indistinguishable from native speakers in their morphosyntactic knowledge?
- Researchers' interpretation of results: Coppieters: No, near-native speakers' L2 knowledge is different from true monolingual native speakers. Birdsong: Yes, some rare, exceptional near-native speakers cannot be distinguished from native speakers even under tight laboratory scrutiny

- Coppieters (1987) strong evidence for critical period; Birdsong (1992) again critical period
- Methodology: grammaticality judgement tasks; retrospective interviews
- Question: how native is really near-native?

B. Empirical dissonance persistent

5. EVIDENCE ON L2 MORPHOSYNTAX FROM COGNITIVE NEUROSCIENCE

A. How the brain handles language?(relevant to critical periods in L2 acquisition)

i. Neuroimaging techniques: ERP, etc

ii. The converging findings favor a critical period interpretation for L2 morphosyntax.

- Evidence: localization of language functions in the brain is less lateralized in late bilinguals than in early bilinguals and monolinguals(see Dehaene et al., 1997; Pallier et al., 2003); Weber-Fox and Neville (2001)→L1 vs L2 different activation patterns only in syntactic processing (not semantic processing)→the learning of syntactic functions is fundamentally different from the learning of semantic features (e.g. Ullman, 2001)
- syntax involves computational learning mechanisms and is constrained by a biological schedule, and that semantics draws on associative learning mechanisms and is free from critical period constraints
- alternative interpretations of the above findings: (Osterhout et al., 2002): word length difference in function vs content words in these studies; Daniela Perani and Jubin Abutalebi (2005): not the age of onset but the degree of active use of the L2 that can explain degrees of brain activation.

B. Summary

- "Marinova-Todd et al. (2000) pointed out, given what we know about the plasticity of the brain, any age-related differences in brain location and neural activity patterns may be as much a result of the brain's architecture shaping how subsequent linguistic experience is processed and used for L2 learning, as it could be the result of the brain having been shaped by previous experience. Evidence in favour of a critical period explanation will come only when neuroscientists can establish

beyond doubt that the former, and not the latter, is actually the case."

6. L2 PHONOLOGY AND AGE

A. Special status of phonology with regard to critical periods

i. Tom Scovel's (1988, 2000): It is directly physical and demands neuromuscular programming

ii. Conclusion: foreign sounding accents are likely to develop when the L2 is first learned later in life

iii. Flege et al. (1999):

- acquisition of phonology may be more impervious to non-biological influences such as L2 use and education, and therefore more strictly tied to biological schedules, than other areas of the L2.
- phonetic categories or mental representations of speech sounds in the L1 are stabilized by age five to seven. After that point, new phonetic contrasts will be processed through an L1 filter, and hence it is more difficult, although not biologically impossible, to detect and produce L2 categories that are not salient
- foreign accents may arise 'not because one has lost the ability to learn to pronounce, but because one has learned to pronounce the L1 so well' (Flege, 1999, p. 125).

iv. Counterexamples: exceptional post-pubertal learners whose accents are not recognized as forign even under close scrutiny in the laboratory

B. Summary: in L2 phonology as in L2 morphosyntax, it is not impossible (although it is admittedly rare) to attain native-like levels

7. WHAT CAUSES THE AGE EFFECTS? BIOLOGICAL AND OTHER EXPLANATIONS

A. The interpretation of the evidence on age-related effect far from being settled

i. Methodological issues:

ii. Exceptional learners

B. it is possible to conclude that age-related differences exist in how a skill or ability is learned, and to propose explanations that do not invoke preprogrammed biological changes in the brain as an underlying cause.

i. previous and entrenched knowledge of the L1 and L1–L2 interactions, instead of biology general socio-educational and motivational factors in connection to age effects on L2 learning

ii. a consequence of experience and socialization, and not biological or insurmountable in nature

C. Other SLA researchers argue that the posited sensitive period (or periods) is indeed real (e.g. Hylstenstam and Abrahamsson, 2003). thus far they have been unable to produce a clear answer as to what biological, irreversible

changes may cause the brain to use implicit processes when learning language up until a certain age but not later.

D. Sum up: the field is of two minds as to whether critical periods for L2 acquisition exist. Age effects on L2 learning are pervasive and undisputed, but satisfactory explanations, biological or otherwise, for the observed effects are yet to be conclusively produced.

POINT OF SUMMARY

- In terms of L2 learning rate, adults and older children enjoy an initial advantage over young children that may last over up to one year, sometimes up to three years, particularly if they are tested through tasks that demand cognitive maturity and involve metalinguistic skills. After five years, however, early starters catch up and are better than late starters in second language contexts. In foreign language contexts, by contrast, the lagged advantage for an earlier start has not been observed, even after five years.

- In terms of L2 ultimate attainment, most learners who begin acquiring the L2 before a certain age, typically before puberty, will develop levels of morphosyntactic and phonological competence that are very close to those of native speakers of that language. Post-pubertal learners, however, are not likely to perform in the native speaker range, and this holds true regardless of the number of years they have resided in the L2 environment.

- Exceptions to the observed success and failure tendencies associated with age exist. Thus, some adult starters can achieve native-like levels in their L2, or at least extremely high levels that are near-native. Conversely, an early start does not guarantee complete and successful L2 acquisition in all cases, as some children who start learning the L2 at an age as early as four or even two may be found to differ from native speaker performance in subtle ways. In the former case, exceptions appear to be related to unusually high motivation and high quality of instruction, whereas in the latter case they appear to be associated with high L1-use levels (that is, with high L1 activation or L1 dominance).

- Several explanations for the observed age effects have been proposed and are considered plausible by different SLA researchers. Those in favour of a critical period explanation posit that, after a certain age, it is biologically impossible for the human brain to use the same processes that were involved in learning the L1. Instead, other processes, such as reasoning and problem solving, are summoned during post-pubertal L2 learning. Several neurological and neurochemical causes have been considered (including lateralization, plasticity, myelination and pubertal increases in oestrogen or testosterone) but the empirical evidence is still unavailable for any of them. Of the researchers who favour non-biological explanations, some have considered pre-existing knowledge of the L1 and others have emphasized socio-educational and affective-motivational forces.

- Recent research suggests that bilingualism effects (e.g. L1–L2 interactions) and language activation and dominance effects (i.e. relative amounts of L1 versus L2 use) operate across all ages, beginning as early as age two. This evidence suggests that it may be misguided to compare bilingual attainment to monolingual attainment. Thus, in the future, research programmes may need to shift away from the emphasis on a fundamental difference between monolingual child L1 acquisition and monolingual-like adult L2 acquisition and towards investigating changes in the brain and in cognitive processing that are shaped by the experience that results from being exposed to more than one language simultaneously or sequentially and across varying ages.