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5. AGE AND SECOND LANGUAGE ACQUISITION

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The idea that there is an age factor in language development has long been and continues to be a hotly debated topic. This review begins by briefly revisiting some of the early perspectives on this issue; it goes on to sketch some of the relevant findings which emerged in the three decades following the onset in the late 1960s of serious empirical investigation of the age factor in L2 acquisition; and, finally, in the third section of the survey, it hones in on the results of some more recently published age-related research. The article concludes with a short discussion in the light of the foregoing of (a) the degree of absoluteness of the age factor in L2 acquisition; and (b) the notion that there may be not one, but a number, of age-related factors at work.

Early Perspectives

Much early writing on the age factor and L2 acquisition was based on anecdote and assumption. Tomb (1925) writes of the common experience in the days of the British Raj of hearing English children in Bengal fluently conversing with domestic staff in English, Bengali, Santali, and Hindustani, while their parents had barely enough Hindustani to issue orders. Stengel s (1939) Freudian analysis of the role of age in L2 learning is also based on mere impressionism. Penfield s advocacy of early exposure to L2s on purportedly neurophysiological grounds (Penfield & Roberts, 1959) in fact owes more to his own experience of immersing his children in German and French than to his work as a scientist (see Dechert, 1995). Even Lenneberg s contribution in the 1960s (Lenneberg, 1967) was based partly on folk wisdom, notably his claim unaccompanied by evidence that after puberty L2 learning requires labored effort and foreign accents cannot be overcome easily.

Empirical Contributions from the Late 1960s Onwards

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Age-focused research of the last thirty years or so has often been linked to the evaluation of early L2 instruction in schools. Such studies have consistently found a progressive diminution of any advantage conferred by early exposure to an L2 (see, e.g., Burstall, Jamieson, Cohen, & Hargreaves, 1974; Oller & Nagato, 1974; Stankowski Gratton, 1980). Investigations of naturalistic L2 acquisition yield a converse pattern. Subjects with several years naturalistic experience of their L2 whose exposure to the L2 began in early childhood are found, on the whole, to outperform those whose L2 experience began in later years (see, e.g., Asher & García, 1969; Oyama, 1976, 1978; Patkowski, 1980); whereas studies of subjects with more limited naturalistic exposure to the L2 show older beginners outperforming younger ones (see, e.g., Ervin-Tripp, 1974), their advantage diminishing only after about a year (Snow & Hoefnagel-Höhle, 1978).

Krashen, Long, and Scarcella s (1979) review interprets the evidence as follows: while older beginners generally outperform their juniors initially at least in morphology and syntax in terms of overall long-term outcomes, broadly speaking, the earlier exposure to the L2 begins, the better. Because of findings from school contexts (see above), Krashen et al. restrict their claim to naturalistic L2 acquisition. However, one needs to bear in mind the blurring effect of mixing experimental and control groups in the same classes at the secondary level (Stern, 1976), as well as the vast differences in amount of L2 exposure provided by naturalistic and formal contexts, and the implication of such differences for initial advantage and eventual effects (Singleton, 1989, p. 236). The results of studies of L2 *immersion* programs, where amounts of exposure are much greater, favor...early programs over delayed and, in most cases, late programs (Holobow, Genesee, & Lambert, 1991, p. 180).

In studies conducted in the 1980s and 1990s, there has been some attention to cases of older beginners who attain very high levels of L2 proficiency. For example, Birdsong (1992) found that 15 out of 20 Anglophone adult subjects who began acquiring French as adults in France fell within the range of native speaker performance on a grammaticality judgment task; Ioup, Boustagui, Tigi, and Moselle s (1994) detailed study of two subjects who learned Arabic as adults in an Arabic-speaking environment established that both were attaining levels of performance close to native norms across a range of areas; and Bongaerts, Planken, and Schils (1995) demonstrated that Dutch learners of English who began learning English in a formal instructional setting after age 12 were able to attain English pronunciation ratings within the same range as those attained by native-speaker controls. This kind of evidence does not disturb the Krashen et al. view, which allows for departures from the general trend; however, it does have implications for more absolutist claims.

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Such latter claims have focused on the proposition that there is a maturational limit (usually set around puberty) beyond which it is simply impossible to acquire an L2 (or certain aspects thereof) to native levels. Thus, Scovel (1988), restricting his claim to accent, affirms that those who begin exposure to an L2 after age 12 cannot ever pass themselves off as native speakers phonologically (p. 185). Long (1990, p. 274) reads the evidence on accent in precisely the same way, but also claims that the *sine qua non* for the acquisition of L2 morphology and syntax to native levels is experience of the L2 before age 15. The problem with such claims is that quite apart from evidence from the work referred to in the previous paragraph even studies which report mostly superior attainment by younger beginners often acknowledge that a minority of adolescent/adult-beginners perform at the same level as earlier beginners (e.g., Asher & García, 1969; Patkowski, 1980).

A further dimension of age-related L2 research in the 1980s and 1990s has been the emergence of findings apparently indicating that, while the putative decline in language-acquiring capacity may reach its culmination in adolescence, it has its onset around age 6 or 7. For instance, Johnson and Newport (1989) investigating the long-term attainments in English of immigrants to the USA as gauged by grammaticality judgment tests report that, while subjects who arrived before age 7 performed within the range set by native-speaker controls, performance levels declined linearly with age of arrival between age 7 and 15. Similar results are reported by Hyltenstam (1992). Such findings need, however, to be seen in the light of certain methodological criticisms (e.g., Kellerman, 1995).

A third focus of age-related L2 research has been the idea that children and adults may have fundamentally different processing mechanisms at their disposal. Thus, some adherents of the Universal Grammar (UG) school of thought (e.g., Bley-Vroman, 1989; Schachter, 1989) claim that post-pubertal L2 language learning has no access to UG principles and parameters. The empirical basis for this perspective was, let it be said, never conclusive (cf., for example, Flynn, 1987; Martohardjono & Flynn, 1995), and, as Braidi (1999) points out, recent changes in Chomskyan theory now render evaluation of earlier studies extremely difficult, although she also notes that L2 learners do not seem to exhibit grammars that are not sanctioned by UG (p. 67).

Beyond the confines of the Chomskyan magic circle, an interesting study conducted by Liu, Bates, and Li (1992) examines how age of first encounter with the L2 affects the processing of L2 sentences in terms of the use of word order and animacy as cues to interpretation by Chinese learners of English. Their results suggest that, whereas those who began to acquire English after age 20 transferred Chinese processing strategies

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into English, those who began before age 13 deployed the same strategies as monolingual English speakers.

Very Recent Age-Related Research

The pattern of age-related L2 research over the past three or four years has broadly continued that of the previous ten or fifteen. There have been further studies referring to late beginners who attain native-like levels of performance in the L2; there have been further studies looking at very early beginners; and there have been further studies addressing the question of whether post-pubertal L2 learning and use is subserved by different mechanisms from those subserving child language. Another feature of very recent work in this area has been a renewal of the search for explanations of age effects that do not rely on neurolinguistic arguments.

Concerning the achievements of late beginners, the work of Bongaerts and his colleagues has continued apace (Bongaerts, 1999). A further study has been conducted with respect to learning of English as an L2 by Dutch subjects (Bongaerts, van Summeren, Planken, & Schils, 1997), and there have also been studies of the learning of French as an L2 by Dutch subjects (Palmen, Bongaerts, & Schils, 1997), and the late learning of Dutch as an L2 (Bongaerts, Mennen, & Van der Slik, 2000). These studies essentially replicate the findings of Bongaerts et al. s 1995 study showing that some learners whose exposure to an L2 begins after age 12 can nevertheless acquire an L2 accent which is perceived as native by native speakers.

A further study worth mentioning in this connection is Moyer s (1999) investigation of the L2 phonological attainment of 24 Anglophone graduates in German, none of whom had any exposure to German before age 11, employed as teachers of German at university level. In the main, the ratings for these subjects German accents supplied by four native speakers did not overlap with those obtained by native speaker controls. However, one of the subjects *was* mistaken by the raters for a native speaker. This individual began learning German at age 22 and was largely self-taught. What distinguished him from his peers was a particularly deep fascination with the German language and culture and a particularly strong desire to sound German. Here, then, is a further example of a study showing an age effect in relation to ultimate L2 attainment which fails to operate across the board (see also DeKeyser, in press).

Turning now to research focusing on subjects whose L2 exposure began in early childhood, Kim, Relkin, Kyoung-Min, and Hirsch (1997) used magnetic resonance imaging to investigate the spatial representation of L1 and L2 in the cerebral cortex of early and late bilinguals during a

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sentence-generation task. The results revealed little or no age-related separation of activity in Wernicke s area, but differences did emerge with respect to activity in Broca s area. Among the late bilinguals, two distinct but adjacent centers of activation were revealed for L1 and L2, whereas in the early bilinguals, a single area of activation for both languages emerged. This looks like evidence of different kinds of brain organization in early and late bilinguals. Unfortunately, this study does not say anything very precise about the age at which separate representation of L1 and L2 is supposed to become characteristic: the early bilinguals were all exposed to the L2 during infancy, but the late bilinguals mean age of initial exposure to the L2 was 11.2 years, which clearly leaves any question about the maturational point of divergence unanswered. Other studies based on brain-imaging techniques (see, e.g., Weber-Fox & Neville, 1999) have focused on differences in brain responses to semantic and grammatical anomalies in L2 stimuli; such studies indicate that the responses typical of subjects whose exposure to the L2 begins after age 11 differ from those typical of subjects whose exposure begins earlier. Concerning the question of the impact of a very early beginning, Marinova-Todd, Marshall, and Snow (2000, pp. 16 17) note that some of Weber-Fox and Neville s evidence seems to suggest that the determinant for response-types with respect to particular categories of grammatical anomaly is whether exposure begins before or after age four, while the watershed for response-types relative to other anomalies is age eleven.

On a completely different tack, a number of recent studies have indicated that even very young L2 beginners diverge at the level of fine linguistic detail from native speakers. Thus, for example, Hyltenstam and Abrahamsson (2000, p. 161) cite research by Ekberg (1998) into bilingual teenagers in Sweden exposed to Swedish outside the home as small children but whose output in Swedish differed in a number of lexico-grammatical respects from their native-speaker peers. At the phonological level too, it appears from Flege s work (e.g., 1999) that subjects who begin to be exposed to an L2 in an L2 environment as very young children are nevertheless quite likely to end up speaking the L2 with a non-native accent.

These neurolinguistically oriented studies bear on the issue of whether the processing mechanisms subserving language are different in children and adults. There has also been a continuation of research into the question of whether or not UG continues to be available as a support for language learning beyond childhood. There is no strong evidence that post-pubertal L2 learners do not have available to them the capacities which Chomskyans think of as deriving from UG; indeed, much recent research indicates that post-pubertal L2 learners deal in the same way as L1 acquirers with features purportedly having a UG basis (see, e.g., Bruhn de Garavito, 1999; Dekydtspotter, Sprouse, & Thyre, 1998).

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A non-UG-focused study bearing on what underlies L2 learning at earlier and later ages is Harley and Hart s (1997) investigation of the role of different aspects of language aptitude in two groups of Anglophone secondary school students who had entered French immersion programs at different points, in grade 1 and grade 7, respectively. What transpired was that early immersion students L2 outcomes were much more likely to be associated with a memory measure than with a measure of language ability, whereas the opposite was the case for the late immersion students (p. 395). DeKeyser s (in press) replication of the Johnson and Newport (1989) study yielded similar results: the few adult beginners in his study who scored within the range of the child beginners had high levels of verbal analytical ability, an ability which was not a factor in the performance of the child beginners. DeKeyser interprets his results as suggesting that maturational constraint applies only to implicit language learning mechanisms. Harley and Hart, for their part, acknowledge the possible influence of different instructional styles associated with primary versus secondary-level education. A further possibility is that both sets of results are related to general cognitive changes which impact on language learning but not *only* on language learning.

A further feature of recent age-related L2 research has been a revival of interest in explanations of age effects which depart from the classic critical period or sensitive period view, according to which there is a period of neurological language readiness with rigid limits outside of which language acquisition of any kind is difficult. Arguments advanced in favor of the critical period position have referred to neurological changes observable between childhood and adolescence/adulthood, including the kinds of changes that appear to be indicated by the above cited studies by Kim et al. (1997) and by Weber-Fox and Neville (1999). Counter arguments have included: (a) that the relevant causality has not been established; (b) that the evidence does not point to the kind of sharp cut-off point that characterizes critical periods; (c) that the attainment of some late beginners to native-like proficiency runs counter to the proposition of fixed maturational constraints; and (d) that other more plausible explanations for age effects are available.

With regard to causality, some researchers (e.g., Bialystok & Hakuta, 1999; Marinova-Todd et al., 2000) argue that no clear relationship has yet been established between neurological differences and differences in language proficiency. Accordingly, it is legitimate to speculate that children and adults may, for example, localize their learning differently without showing different levels of learning (Marinova-Todd et al., 2000, p. 17). The same kind of point can be made about the issue of myelination and reduced brain plasticity. Marinova-Todd et al. note in this regard (p. 18) that there is still uncertainty about the precise connection between learning and the state of the neural network. Another possibility, raised by

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Bialystok and Hakuta (1999), citing Gazzaniga (1992), is that the direction of causation may be the reverse of the one usually assumed; they note that brain differences are as likely to reflect different kinds of experience as to determine these experiences, and that such induced differences cannot simply be assumed to support different levels of performance. Even if neurological differences between younger and older L2 beginners do relate to differences in proficiency levels, there is always the possibility that the adult learners assessed & were poorly selected and do not represent highly proficent adult bilinguals (Marinova-Todd et al., 2000, pp. 17 18).

The existence or nonexistence of a cut-off point such as would normally be associated with a critical period is extensively discussed by Bialystok and Hakuta. Their reanalysis (Bialystok, 1997; Bialystok & Hakuta 1994) of Johnson and Newport s (1989) data (see above) shows that the tendency for proficiency to decline with age projects well into adulthood and does not mark some defined change in learning potential at around puberty (Bialystok, 1997, p. 122). More recently, Bialystok and Hakuta (1999) analyzed Census data on age of arrival and reported English proficiency for Chinese-speakers and Spanish-speakers who had resided in New York State for at least 10 years; what emerged is, on the one hand, a steady linear decline of reported English proficiency as age of arrival increased but, on the other, no indication of a dramatically sharper rate of decline at any point between infancy and senescence. Recent data on the relationship between L2 accent and age of arrival obtained by Flege and his colleagues (see, e.g., Flege, 1999) show a similarly continuous decline.

A number of studies have already been cited demonstrating that some adult L2 beginners attain similar levels of proficiency to those attained by child beginners. Such evidence does not sit well with the notion of a neurologically based critical period, which, as Bialystok (1997) says, ought to reveal itself in an unambiguous linkage between L2 proficiency levels and age of first exposure consistent across studies (p. 118).

Finally in this section, let us consider some of the alternatives to a neurological account that have been offered to explain the age factor in L2 acquisition. One that has long been and continues to be discussed is strength of motivation. Marinova-Todd et al. (2000) cite Pulvermuller and Schumann s (1994) judgment that motivation, rather than neurology, is the determining factor in SLA success, and point to the fact that some older beginners who achieve native-like proficiency are characterized by very high levels of motivation. They refer to Ioup s subjects (Ioup et al., 1994), but other instances also spring to mind, e.g., the exceptional case mentioned by Moyer (1999).

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A particular dimension of the motivation issue relates to the question of language dominance. Older arrivals in an L2 environment may make behavioral choices which bring them into frequent contact with fellow native speakers of their L1 and limit their contact with the L2; such choices may have to do with the avoidance of isolation in the new environment and/or the desire to maintain a particular linguistic and cultural identity. Fewer choices may be available to younger arrivals because of compulsory schooling. In any case, their linguistic and cultural identity is unlikely to be as fully formed as that of their elders, and so the motivation to maintain it may be much weaker. According to research conducted by Jia and Aaronson (1999), what results from these contrasting circumstances is that, whereas immigrants arriving at ages older than 10 tend to maintain their L1, immigrants arriving before age 10 seem to switch their dominant language from the home language to the language of the host country. The implication of this phenomenon is that some studies purportedly focusing on L2 proficiency may, in fact, be reporting on a language which has effectively become an L1 for the subjects in question (cf. Bialystok, 1997, p. 123).

This last point clearly raises issues concerning amounts and patterns of L2 input and use, another major focus for discussion of alternatives to the critical period hypothesis. Much of the recent work by Flege and his colleagues has demonstrated the importance of environmental factors for L2 pronunciation, with time spent in a country where the target language is in use (Riney & Flege, 1998) and time spent in the company of native speakers (Flege, Frieda, & Nozawa, 1997) emerging as major determinants of quality of L2 accent. Like Jia and Aaronson (1999), Flege sees a trade-off between L2 and L1 proficiency. He takes an interactionist line according to which bilinguals are unable to fully separate the L1 and the L2 phonetic system so that the phonic elements of the L1 subsystem necessarily influence phonic elements in the L2 system, and vice versa (1999, p. 106). According to this view, young children may acquire a good L2 accent at the expense of their L1 accent; or, alternatively, they may develop an authentic accent in their L1 at the cost of not being able to develop a native accent in their L2. Flege's suggestion is that, as L1 phonology continues to be refined, its influence on L2 phonological acquisition continuously increases.

Another dimension of the input explanation is the role of instruction. Bialystok (1997, p. 123) points out that immigrants who arrive as children enter the education system at a point where explicit language instruction is part of the normal régime for all pupils, whereas the kind of education available to immigrants arriving in early adulthood is unlikely to include language training. With regard to the successful late acquisition of an L2 accent, Bongaerts (1999) comments that his subjects had all received intensive perceptual training that focused their attention

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on subtle phonetic contrasts between the speech sounds of the target language and those of their L1 (pp. 154 155), and that this may well have been a factor in their success.

A further proposal is that age-related differences in L2 proficiency are explicable in terms of general cognitive considerations. Thus, Bialystok and Hakuta (1999) suggest that the presence or absence of literacy skills in the L2 may have a bearing on L2 proficiency and note that immigrants who arrive young are likely to have such skills in good measure because of experience at school, while those who arrive at an older age may not. Bialystok and Hakuta also point to a deterioration over the lifespan in such areas as capacity to perform tasks under time pressure, risk-taking, establishing long-term memory codes, and ability to recall details. They comment: if age-related changes in ultimate language proficiency are to be attributable to these cognitive changes . . . then the decline in ultimate proficiency . . . should . . . be gradual and constant (p. 172). The evidence suggests that this is precisely how it is.

Conclusion

Few L2 researchers challenge the proposition that those L2 acquirers whose exposure to the L2 begins early in life for the most part attain higher levels of proficiency than those whose exposure begins in adolescence or adulthood. The questions that continue to divide the field are: (a) is this a broad tendency or an absolutely inviolate law? and (b) how are such age effects to be explained?

In relation to (a), it may be true, as Hyltenstam and Abrahamsson (2000, p. 155) claim, that there is no case on record of a post-pubertal L2 beginner who has been demonstrated to behave in every last linguistic detail like a native speaker. However, it is also true, as Hyltenstam and Abrahamson acknowledge, that the more closely we study very early L2 beginners, the more we realize that, at the level of subtle detail, they too differ from monoglot native speakers. It seems that, as Grosjean (e.g., 1992) and Cook (e.g., 1995) have been arguing for years, what makes the difference is the very fact of knowledge of another language. Accordingly, the appropriate comparison is not between postpubertal L2 beginners and monoglot native speakers, but between postpubertal L2 beginners and those who begin to acquire an L2 in childhood. Given the trend of recent research findings, it would be a very brave individual who would wager a large sum against the proposition that postpubertal L2 beginners who in all respects perform at levels set by early beginners, even very early beginners, can and will be identified.

Concerning (b), it is difficult to resist quoting yet again Oscar Wilde s wise words about the truth being rarely pure and never simple.

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Bialystok (personal communication) takes the view that talking about an age factor is misconceived; we should rather be thinking in terms of a range of age factors. This coincides with my own conclusion of more than a decade ago which I have not discarded: that the various age-related phenomena . . . probably result from the interaction of a multiplicity of causes (Singleton, 1989, p. 266). Such a perspective can encompass the notion that decreasing cerebral plasticity and/or other changes in the brain may play a role, but the notion that L2 age effects are exclusively neurologically based, that they are associated with absolute, well-defined chronological limits, and that they are particular to language looks less and less plausible.

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This overview presents a variety of views on maturational constraints on language acquisition from the perspective of someone whose belief in the critical period was shaken by his own data, followed by some reasons to doubt the critical period hypothesis (notably the above-discussed absence of a sharp cut-off point and the native-like performance of some late beginners).

Harley, B., & Wang, W. (1997). The critical period hypothesis: Where are we now? In A. M. B. de Groot & J. F. Kroll (Eds.), *Tutorials in bilingualism: Psycholinguistic perspectives* (pp. 19 51). London: Lawrence Erlbaum.

This article provides a very wide-ranging review of work on the critical period hypothesis, accepting the hypothesis as a valuable framework for age-related research but emphasizing the complexity and and puzzling nature of relevant findings.

Hyltenstam, K., & Abrahamsson, N. (in press). Maturational constraints in second language acquisition. To appear in C. J. Doughty & M. H. Long (Eds.), *Handbook of second language acquisition*. London: Blackwell.

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This chapter expands on the points made in Hyltenstam and Abrahamsson (2000) and attempts to reconcile the evidence pro and contra the notion of maturational constraints in L2 acquisition by positing an interaction between maturational and sociopsychological factors.

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