2

Age

Children acquiring their first language complete the feat within a biological window of four to six years of age. By contrast, the ages at which different L2 learners may begin learning the new language range wildly. Thus, age emerges as a remarkable site of difference between L2 and L1 acquisition. Perhaps for this reason, understanding the relationship between age and L2 acquisition has been a central goal since the inception of the field of SLA. Two issues are hotly debated. One pertains to the possibility that a biological schedule may operate, after which the processes and outcomes of L2 acquisition are fundamentally and irreversibly changed. This is also known as the Critical Period Hypothesis in L2 learning. The other issue relates to the possibility that there may be a ceiling to L2 learning, in the sense that it may be impossible to develop levels of L2 competence that are isomorphic to the competence all humans possess in their own mother tongue. Although the topic of age has been investigated profusely in SLA, clear or simple answers to vital questions about the relationship between age and L2 learning have not been easy to produce. As you will see in this chapter, the accrued findings remain difficult to reconcile and interpret, and many questions to understand universal age effects on L2 acquisition remain open.

2.1 CRITICAL AND SENSITIVE PERIODS FOR THE ACQUISITION OF HUMAN LANGUAGE

The idea that there may be an optimal, maybe even critical, age period for the acquisition of language entered SLA research through the work in neurolinguistics of Penfield and Roberts (1959) and Lenneberg (1967). Their ideas quickly became influential in a time when the new field called SLA was emerging. These authors contributed neurolinguistic data supporting a natural predisposition in the child's brain for learning the first language, together with anecdotal observations that children were also adept foreign language learners, when compared to adults. The possible causes tentatively identified at the time were the loss of plasticity undergone by human brains by year nine of life (Penfield and Roberts, 1959) or perhaps the completion by the onset of puberty of the process of lateralization, the specialization in all right-handed individuals of the left brain hemisphere for language functions (Lenneberg, 1967). The hypothesis of a critical period for L1 acquisition, and as a corollary for L2 acquisition, seemed natural in the late 1960s and continues to be considered plausible today.

Indeed, critical periods have been established for several phenomena in animal behaviour and in the development of certain human faculties, such as vision. The hypothesis is that there is a specific period of time early in life when the brain exhibits a special propensity to attend to certain experiences in the environment (for example, language) and learn from them. That is, the brain is pre-programmed to be shaped by that experience in dramatic ways, but only if it occurs within a biologically specified time period. To be more precise, two different kinds of age-related periods for learning are typically distinguished: critical and sensitive. Knudsen (2004) offers useful illustrations of both cases from outside the SLA field, which are summarized in Table 2.1. In much of the SLA literature, nevertheless, the terms 'critical period' and 'sensitive period' are discussed as essentially synonymous. This is probably because the available evidence with regard to the acquisition of an additional language is still too preliminary for SLA researchers to be in a position to make finer distinctions between the two notions (see also discussion by Harley and Wang, 1997).

Table 2.1
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

The evidence for a critical or sensitive period for first language acquisition in humans is strong, although it remains far less well understood than the critical period for the development of, for example, ocular representation in our cortex. Some of the evidence comes from research involving sadly famous cases of children who, due to tragic circumstances, were deprived from regular participation in language use and social interaction until about the age of puberty. This was the case of Genie (recounted from different perspectives by Curtiss, 1977; Rymer, 1993) and of several feral children (discussed in Candland, 1993). Under such seriously detrimental circumstances, these adolescents could not learn the mother tongue to the level of their peers, even after they were rescued and efforts were made to 'teach' them language.

Additional evidence comes from studies of so-called postponed first language acquisition in the deaf population. This case, although unfortunate, accounts for about 90 per cent of deaf babies who are born to hearing parents with knowledge of only an oral language. In essence, these babies grow up without experiencing regular exposure to either spoken or sign input for the first six years of life and, therefore, they learn no first language until they are sent to school, precisely at around that age. The findings contributed over the years by Canada-based researcher Rachel Mayberry (2007; Mayberry and Lock, 2003) suggest that these children will usually exhibit incomplete acquisition of their late-learned first language. A study in the United States by otolaryngologists Mario Svirsky and Rachael Holt (2005) augments this evidence. These researchers tracked the vocabulary, grammar and speech perception abilities of 96 deaf babies who had received cochlear implants at ages one through four. These babies' spoken language began developing once awareness of sound was made possible through the implants. However, babies who received the implant after the age of 2 exhibited slower progress and overall lower performance in vocabulary and grammar (but not in speech perception skills), compared to babies who had their hearing restored before the end of the second year of life. The researchers interpreted the evidence cautiously but suggestively as indication that a sensitive period for L1 acquisition exists, and one that is much shorter than once thought (see also Svirsky et al., *2007)*. In light of the new cochlear implant evidence, we can speculate that it may end after the first two years of life, at least for some aspects of acquisition.

For L2 acquisition, as well, it seems plausible to posit that there are sensitive periods for a number of language areas. But what does the record of SLA research tell us?

2.2 JULIE, AN EXCEPTIONALLY SUCCESSFUL LATE L2 LEARNER OF ARABIC

Striking SLA evidence bearing on the sensitive period hypothesis for L2 acquisition comes from a study conducted by Georgette Ioup and her colleagues (Ioup et al., 1994). These researchers investigated the limits of ultimate attainment achieved by Julie, an exceptionally successful L2 user. The study is unique, as you will appreciate, because Ioup et al. employed a rich case study methodology that yielded in-depth knowledge of Julie's L2 learning history as well as a wealth of data probing several areas of her L2 competence.

Julie was an L1 speaker of British English who had moved to Egypt at the age of 21 due to marriage to an Egyptian. She settled in Cairo with her husband, became a teacher of English as a foreign language (EFL) and had two children. Julie had never received formal instruction in the L2 and could not read or write in Arabic. Yet, she was able to learn Egyptian Arabic entirely naturalistically and regularly passed herself off as a native speaker. In fact, her family and friends remembered she was able to do so just after two and a half years of residence in the country. According to Julie, Arabic became the dominant language at home after the third year of residence in Cairo (although she also reports her children grew up to be competent bilinguals). Julie had been living in Egypt for 26 years at the time of the research.

In order to test whether her accent was truly indistinguishable from that of a native speaker, the researchers mixed Julie's recorded explanation of her favourite recipe with recordings of the same oral task by another six native and advanced non-native speakers of Arabic. Seven of 13 judges rated Julie as definitely native, whereas the other six rated her as non-native, and commented that a few small differences in vowel and consonant quality and in intonation had given her away. In another task testing her speech perception abilities, Julie proved herself able to pick out Egyptian from non-Egyptian accents among seven different varieties of Arabic with 100 per cent accuracy. She was a little bit less adept at discriminating a Cairo-sounding Egyptian accent from two other Egyptian regional accents, but so were six of the 11 native-speaking judges.

In order to probe her tacit knowledge of the Arabic language, Julie, 11 L1 Arabic control participants and another very advanced non-native speaker of Arabic were asked to do three other tasks that tested morphosyntactic phenomena. The first task was translating 12 sentences from English into Arabic. Here, once again, Julie made very few mistakes. For example, she translated 'went to the club' as *raahit linnaadi*, without dropping the preposition *l-* (Ioup et al. explain that this is necessary in Arabic to indicate the meaning is not just 'to' but 'into'; p. 82). The second task involved judging the grammaticality of selected Arabic sentences. Julie's judgements diverged from those of the majority of native speakers on only five out of 37 sentences. Apparently, she preferred the unmarked word order choice for questions and rejected variable word order alternatives that are also grammatical in Arabic. In the third task, Julie and the others had to answer the question 'who did X' in response to 18 recorded sentences containing cases of **anaphora**, a syntactic phenomenon so subtle that it is unlikely to be learned through explanations or through conscious analysis of the input. Anaphora refers to the binding of a pronoun to the right preceding noun in a sentence. For example, who does *she* refer to in the following sentence (p. 89)?

(1) **'Nadia saw Mona when she entered the room'**
  a. ***Nadya shaafit mona heyya daxalit il-ooda***
  b. ***Nadya shaafit mona lamma daxalit il-ooda***

Who entered the room – Mona or Nadia? The preferred answer would be 'Nadia' for the English sentence. In Arabic, if the pronoun *heyya* is used, as in (1a), the preferred interpretation is that 'she' refers to Nadia, the more distant referent. Conversely, if *heyya* is omitted, as in (1b), the preferred interpretation for 'she' will be Mona, the closest referent outside the embedded clause 'when she entered the room'. Julie was able to correctly interpret the anaphora pronouns in two-thirds of the 18 items. She performed less well on the remaining six items, which involved relative clauses such as 'Ahmad bought the dress for the girl that you went to the lady that she angered' (*aḥmad ishtara il-fustaan li-l-bint illi inta ruḥt li-s-sit illi heyya'za alit-ha*, p. 90). Not only Julie, but the 11 native speakers

too, found it difficult to answer the question 'who angered whom' after they heard this sentence! However, only Julie went on to answer in a way that would mean she interpreted the overt pronoun *heyya* to refer to the closest referent in the sentence.

In their study, Ioup et al. also included another exceptionally successful late adult learner, Laura, who like Julie was married to an Egyptian and typically passed off as a native speaker. Unlike Julie, however, she held a Master's degree in modern standard Arabic from a US university and was a teacher of standard Arabic at a university in Cairo at the time of the study. Laura performed by and large as well as Julie in all tasks except for the speech perception one. In other words, she was also exceptionally successful. However, Ioup et al. concentrate on Julie and leave Laura in the background of their report, perhaps because Laura was an instructed learner and hence many more factors come into consideration. Julie, by being a purely naturalistic late learner, provides a strong test case for the Critical Period Hypothesis. Or rather, some would say, against it! In the end, it is difficult to evaluate what the small degree of variability in Julie's L2 outstanding performance means, particularly given that there was definitely some variability for native speaker responses across all measures too. Interestingly, Ioup (2005) herself believes the preponderance of evidence supports the existence of age-related sensitive periods for L2 learning.

2.3 ARE CHILDREN OR ADULTS BETTER L2 LEARNERS? QUESTIONS OF RATE

We all tend to think that children pick up languages speedily and effortlessly. Like many apparently undeniable truths (e.g. the earth does look very flat to our plain eyes, after all!), this assertion was questioned once it was submitted to systematic investigation. When in the 1970s several SLA researchers compared children and adults' L2 learning rate in second language environments, the findings unexpectedly were suggestive of an advantage for adults over children. For example, in two oft-cited studies conducted in the Netherlands, Catherine Snow and Marian Hoefnagel-Höhle (1977, 1978) found that adults and adolescents were better than children in terms of what they could learn in a 25-minute instruction session or up to a year of naturalistic exposure to L2 Dutch. Although the advantage of the older learners began diminishing after ten months or so, the findings were surprising because they flatly contradicted assumed critical period effects.

In a seminal article, Stephen Krashen, Michael Long and Robin Scarcella (1979) put a grain of salt on these findings. They concluded that older is better initially, but that younger is better in the long run. They based this conclusion on a review of 23 studies of L2 learning in second language contexts published between 1962 and 1979, comprising the available findings at the time. The 18 studies that involved short-term comparisons (with lengths of L2 exposure in a second language environment between 25 minutes and one year, rarely up to three years) suggested that adult learners and older children learned at a faster pace than younger children. This may have been in part an artefact of instruction or tests that demanded cognitive maturity and involved metalinguistic skills, because adults may be able to use cognitive and metacognitive abilities and strategies to learn many aspects of the L2 initially faster. Findings were available also from five long-term studies, however, of which the most widely cited to date were dissertations conducted at Harvard University and New York University, respectively, by Susan Oyama (1976) and Mark Patkowski (1980). The five long-term studies revealed that when accomplishments in the L2 were compared after at least five years of residence in the L2 environment (often after ten or 20 years, and for some participants up to 61 years), then young starters were clearly better than adult starters. Long (1990) reassessed the evidence on rate and ultimate attainment a decade later and reiterated the same conclusions, arguing that the rate advantage for adults dissipates after a little more than a year, because children eventually always catch up and surpass late starters. More recent findings from a study by Aoyama et al. (2008) also lend support to the same conclusion.

Age findings gleaned in foreign language contexts in the last few years, however, have complicated this picture (see studies in García Mayo and García Lecumberri, 2003; Muñoz, 2006). Particularly in the context of English learned in Cataluña (Muñoz, 2006), when early starters studying English from the age of eight to 16 were compared to late starters studying English from the age of 11 to 17, the late starters actually maintained an advantage that persisted well after five years of instruction (seven and nine years, respectively). That is, younger starters do not appear to catch up in these foreign learning contexts, where the L2 is only available through instruction. This is actually not surprising if we remember that the same time length of five years entails an intensity and quality of exposure to the L2 that can be radically different in foreign versus second language learning contexts. At three hours a week by nine months of school a year, students enrolled in a foreign language in school may experience as little as 540 hours of actual instruction and L2 exposure over five years. By contrast, in the same chronological time window, learners in L2 environments may accrue about 7,000 hours of L2 exposure (if we calculate a conservative four hours a day). (A sobering comparison is that children learning their L1 may receive of the order of 14,000 hours of exposure, also based on a conservative estimate of eight hours a day!) Thus, as Singleton (2003) suggests, in foreign language contexts considerably more than five years would be needed to capture any lasting differences between differing starting ages. Age may exert universal influences on the learning of a second language, but context moderates these universal effects and needs to be considered carefully.

2.4 AGE AND L2 MORPHOSYNTAX: QUESTIONS OF ULTIMATE ATTAINMENT

Contemporary SLA researchers interested in the question of critical or sensitive periods now consider it essential to take a long-term view on ultimate attainment and to evaluate the end state of L2 acquisition (Long, 1990; Hylstenstam and

Abrahamsson, 2003). Two lines of recent research have investigated this question, both focusing on the area of L2 morphosyntax.

The first line is correlational. That is, it uses statistical analyses to determine the degree to which two sets of numbers (age and scores on some L2 test) co-vary or behave in a similar pattern. Building on the pioneering studies by Oyama (1976) and

Table 2.2
L2 morphosyntactic knowledge along the age of onset continuum

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)	46 L1 Chinese and Korean adult speakers of L2 English who were college educated and had been living in the US for at least five years took a 276-item grammaticality judgement task. There was a statistically significant negative correlation of $r = -0.77$ between age of arrival (which ranged from 3 to 39) and grammaticality judgement score. The correlation was larger when only the 3 to 15 age group was examined ($r = -0.87$) and disappeared for the 17 to 39 group. The youngest group (3 to 7 years old when they arrived in the US) scored within the range of the NS control group, the adolescent group (who had arrived between 8 and 16 years of age) showed scores linearly declining with age and the group of adults (who had arrived at between 17 and 39 years of age) scored variably, without age holding any systematic relationship with their grammaticality intuitions. One late arrival (at age 23 upon arrival) scored 92% accurate, as high as native speakers
Birdsong and Molis (2001)	Exact replication of Johnson and Newport: 61 college-educated L1 Spanish speakers of L2 English took Newport and Johnson's grammaticality judgement task. The 29 early acquirers had arrived in the US between age 3 and 16 and had a mean length of residence of 12.2 years in the L2 environment. The 32 late acquirers had arrived at age 17 or older and had a mean length of residence of 10.5 years. There was a statistically significant negative correlation of $r = -0.77$ for the full sample between age of arrival and grammaticality judgement score. The early arrivals exhibited no variation, as they obtained near-perfect scores. There was a statistically significant negative correlation of $r = -0.69$ between age of arrival for the late arrival speakers and grammaticality judgement score. 13 late arrivals obtained 92% or higher scores, 3 above 95%. (The study also examined reported amount of L2 use. Amount of current L2 use was strongly related to judgements)

Patkowski (1980), it looks at L2 learners sampled to represent a wide range of ages of arrival in the L2 environment, as early as 0 years of life and as late as 50. In most of these studies, the target language investigated is English. The key question asked is: Are age and morphosyntactic attainment systematically related? Ultimate attainment is usually measured by comparing L2 learners' responses on grammaticality judgement tasks along differing arrival ages and against a native speaker baseline. The accumulated findings suggest that, by and large, learners who began acquiring the L2 before a certain age, which these studies locate to be around puberty, will tend to exhibit intuitions that are very close to those of native speakers of that language. The late learners' intuitions, by way of contrast, are not likely to be in the native speaker range, and this holds true regardless of the number of years, since they arrived in the L2 environment past puberty. In the details, however, the evidence presents a consistent dissonance. A glimpse of this dissonance can be seen in Table 2.2, which summarizes a study of this kind conducted by Jacqueline Johnson and Elissa Newport that has become a classic, and a replication by David Birdsong and Michelle Molis that failed to support the original findings.

Two results in Table 2.2 are noteworthy. First, in Johnson and Newport (1989) the relationship between age and grammatical intuitions abruptly disappears after around puberty, whereas in Birdsong and Molis (2001) grammaticality scores keep gradually declining across all ages beyond puberty. Second, both studies turned up one or more learners who had begun to learn the L2 as adults but scored within the native speaker range. These two patterns recur in a number of other partial replications of Johnson and Newport. For example, DeKeyser (2000) produced findings that resonate with those of Johnson and Newport (1989) with 57 Hungarian US immigrants but Flege et al. (1999) obtained a pattern of results similar to that of Birdsong and Molis (2001) with 240 Korean permanent residents in the United States.

The second parallel line of work on age differences and L2 morphosyntactic development pertains to studies that are specifically designed to investigate the upper limits of successful late L2 learning. The focus is, like in Ioup et al. (1994), on exceptional learners who seem to have reached native-like ultimate attainment, often with L2s other than English. Even though these cases have traditionally been considered purely exceptional, Birdsong speculates that they may actually account for as much as 5 per cent to 25 per cent of cases of learners who are given 'a fair chance of success' (Birdsong, 1999b, pp. 14–15). The method of choice has been to compare their performance on grammaticality judgement tasks to that of native-speaking controls, sometimes using retrospective interviews to probe learners' explanations of their choices. The question at stake in this kind of study is: How native is really 'near-native'? Table 2.3 summarizes two oft-cited empirical studies of this kind, both with highly successful L2 French learners. R. Coppieters (1987) found strong evidence for the critical period but David Birdsong's (1992) replication of the same study found strong evidence against it. Interestingly, several studies, using a similar line of evidence but slightly different designs, have also replicated this pattern of conflicting findings. For example, Sorace (1993) found evidence favouring a critical period for morphosyntax among 44 L2 Italian learners,

Table 2.3
Differences between near-native and native morphosyntactic knowledge

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)	21 L2 French speakers, all of whom were highly successful and educated French users who had begun learning the L2 after puberty. They did a grammaticality judgement task and were interviewed. Their average grammatical intuitions on the task were three standard deviations away from the average of native speaker controls. Their rationalizations for their judgements during the interview were different from those of native speakers. Subtle syntactic-semantic and morphosemantic differences of knowledge distinguished nativeness from near-nativeness
Birdsong (1992)	Partial replication of Coppieters: 20 L2 French speakers all of whom were highly successful and educated French users who had begun learning the L2 after puberty. Their age of arrival in France was 19 to 48 and their L1 was English. Of these, 15 participants performed on a grammaticality judgement task within the native speaker range. There was a negative correlation of $r = -0.51$ between age of arrival and scores in this late-starter-only sample

but both White and Genesee (1996), with 89 L2 English learners, and Montrul and Slabakova (2003), with 64 L2 Spanish learners, found evidence against it.

The empirical dissonance illustrated in Tables 2.2 and 2.3 is persistent. Simply put, doubts as to whether a critical period for L2 learning really exists will not go away as long as studies continue to show that there is no sharp drop in grammatical intuitions after some supposedly critical age, and as long as cases of exceptionally successful late learners are discovered against the backdrop of the overwhelming tendency for early starters to 'succeed' and for late starters to 'fail'.

2.5 EVIDENCE ON L2 MORPHOSYNTAX FROM COGNITIVE NEUROSCIENCE

Knowledge about how the brain handles language is highly relevant to any discussions of critical periods for L2 learning. For a decade now, the new field of

cognitive neuroscience has contributed interesting evidence on the issue. The data are elicited with neuroimaging techniques such as event-related potentials, which offer excellent temporal resolution and make it possible to measure in milliseconds the activation patterns of neural networks involved in different cognitive operations while the brain is processing language stimuli. The converging findings favour a critical period interpretation for L2 morphosyntax.

Some researchers have shown that localization of language functions in the brain is less lateralized in late bilinguals (more right hemisphere activation is observed) than in early bilinguals and monolinguals. This is the conclusion supported by research conducted in France by neuroscientists Stanislas Dehaene and Christophe Pallier (see Dehaene et al., 1997; Pallier et al., 2003). Likewise, Helen Neville and her lab in the United States have produced evidence that, when engaged in certain kinds of L2 syntactic processing, the bilingual brains of people who began learning their L2 later in life (eight years or older in most of these studies) show clear different activation patterns from those of monolingual and early bilingual brains. Such age-related differences disappear when brain activation is inspected during the processing of L2 semantic stimuli. For example, Weber-Fox and Neville (2001) investigated Chinese–English bilinguals who were first immersed in the L2 environment anywhere between age one and past age 15. Those bilinguals who were exposed first to the L2 after year seven processed closed-class words (i.e. **function words** like *with*, *the*, *some*) differently from the early bilinguals and the monolingual controls, whereas open-class words (i.e. **content words** like *nose*, *stored*, *glad*) yielded no major differences in brain activation patterns across groups. Germany-based researcher Anja Hahne (2001) also found that her Russian–German bilingual participants, all of whom had learned German as their L2 after the age of 10, processed syntactically anomalous sentences of the kind *Das Geschäft wurde am geschlossen* ('The shop was being on closed') statistically significantly different from monolinguals, whereas no differences were found between the two groups with semantically anomalous sentences. Based on such findings, these and other neurocognitive researchers (e.g. Ullman, 2001) have suggested that the learning of syntactic functions (in the L1 or the L2) is fundamentally different from the learning of semantic features. Specifically, they propose that 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.

Other neurocognitive scientists, however, offer different interpretations of the findings. For example, in the United States Lee Osterhout and colleagues (Osterhout et al., 2002) demonstrated that the different neural activation patterns uncovered for function versus content words could be also explained by the differential word length in both kinds of stimuli (content words are typically longer, and this naturally can affect processing). Italian researchers Daniela Perani and Jubin Abutalebi (2005) suggest that it is not the age of onset but the degree of active use of the L2 that matters when explaining degrees of brain activation. They argue that the neural systems serving L2 and L1 grammatical processing are the same, and that higher attained proficiency and higher daily exposure to the L2 are

independently correlated to lower activation patterns. Furthermore, they report on studies that show that, even when attained proficiency is kept constant, the brains of L2 speakers who have less daily exposure to the L2 exhibit higher degrees of activation in the left prefrontal cortex. They claim this parallels the general neurocognitive finding that increased practice leads to lower levels of neural activation, because with more practice the same processing task will consume less resources (see Chapter 5, section 5.2). Along the same lines of reasoning, Osterhout and colleagues (Osterhout et al., 2008) have initiated a research programme that involves measuring the brain activity of zero-level beginning learners while they process L2 stimuli, longitudinally as they progress through their regular college-level foreign language courses. They have found that brain activation patterns can change in degree and location just after experiencing about four months or 80 hours of college instruction. At least for certain L2 forms, the brain's activation patterns become similar to the patterns observed in fluent L1 users.

Thus, the neuroscience findings, although fascinating, should not be interpreted hastily because, at this early stage of our knowledge about brain and language, it is difficult to evaluate what they may mean for the critical period discussion. As 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.

2.6 L2 PHONOLOGY AND AGE

Unlike subtle morphosyntactic knowledge, which may be difficult to evaluate outside the laboratory, foreign accents are so conspicuous that they can often be detected by the untrained ear. Thus, we all tend to think that, if there are sensitive periods for some areas of L2 learning but not others, then phonology must be one of those areas.

This is Tom Scovel's (1988, 2000) position. For Scovel, speech has a special status when it comes to critical periods because 'pronunciation is the only part of language which is directly "physical" and which demands neuromuscular programming' (1988, p. 62). For example, one-third of the human brain's cortex is dedicated to controlling motor skills in the lower face, lips, tongue and throat, all involved in the production of speech. After reviewing a large number of early studies of foreign accent detection in his 1988 seminal book, he concluded that, in study after study, non-native speaking samples were consistently and accurately detected by native-speaker judges. Likewise, the evidence accumulated since 1988 overwhelmingly shows that foreign-sounding accents are likely to develop when the L2 is first learned later in life.

The study of 240 L1 Korean speakers of L2 English by James Flege and colleagues (briefly mentioned in section 2.4) also lends support to Scovel's suggestion that speech is different. Flege et al. (1999) found that the two moderating variables of

self-reported amount of L2 use and amount of education in the L2 were more related to the morphosyntactic results than to the pronunciation results. This pattern of findings suggests that 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. Nevertheless, Flege (e.g. 1987, 1999) proposes an explanation for the observed age-related phonology effects that is remarkably different from Scovel's.

According to Flege, 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 such an L1 filter, and hence it is more difficult, although not biologically impossible, to detect and produce L2 categories that are not salient. Ironically, then, 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). The older people are when they begin learning an L2, the more settled they may be in their L1 perceptions. In other words, instead of viewing neurophysiological maturational constraints as the main explanatory factor for the development of L2 phonology, as Scovel does, or as a result of neurofunctional reorganization during development, as cognitive neuroscientists do, Flege puts the explanatory emphasis on psychoperceptual and phonetic causes related to previous massive experience with the mother tongue.

We have said that there is clear evidence that accents are likely to develop when the L2 is first learned later in life. This notwithstanding, and paralleling the findings for L2 morphosyntax, there is also evidence in L2 phonology of exceptional post-pubertal learners whose accents are not recognized as foreign even under close scrutiny in the laboratory. Julie and Laura (Ioup et al., 1994) were the first cases, but several more have emerged by now. Notably, Theo Bongaerts and his colleagues in the Netherlands have produced a number of such studies involving very advanced, late L2 learners of English and, in subsequent replications, of French and Dutch (see Bongaerts, 1999). These exceptional learners shared two features. They had all received considerable amounts of high-quality L2 instruction and they all self-reported high levels of motivation and concern to sound native-like. Although her results are less dramatic, Alene Moyer (1999) also found that judges did identify as native the accent of one of 24 advanced L2 German users in the United States, all of whom had begun learning the L2 after the age of 12. In sum, in L2 phonology as in L2 morphosyntax, it is not impossible (although it is admittedly rare) to attain native-like levels. Indeed, it is remarkable that the feat has been attested with some exceptionally successful late L2 learners for target languages as different as Arabic, Dutch, English, French and German.

2.7 WHAT CAUSES THE AGE EFFECTS? BIOLOGICAL AND OTHER EXPLANATIONS

As you can surely appreciate by now, the interpretation of the evidence on age-related effects on L2 learning is far from being settled. For one thing, the

interpretation of findings from correlational data on morphosyntax is subject to a number of methodological criticisms, particularly a discussion about whether an abrupt drop-off at around puberty or a gradual decline across ages is being observed in the data (see Table 2.2; see also discussion in Birdsong, 1999a, 2006). In addition, the critical period explanation does not sit well with the fact that one can always find exceptional learners who began learning the L2 after puberty, often in their twenties, and who perform within the range of native-speaker controls in their grammatical intuitions or go undetected as non-native speakers by multiple judges.

Furthermore, 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 pre-programmed biological changes in the brain as an underlying cause. One such explanation lies with previous and entrenched knowledge of the L1 and L1–L2 interactions, instead of biology. In L2 phonology, as we saw, James Flege takes such a position. In this view, 'age is an index of the state of development of the L1 system. The more fully developed the L1 system is when L2 learning commences, the more strongly the L1 will influence the L2' (Piske et al., 2001, p. 196). Other SLA researchers emphasize general socio-educational and motivational factors in connection to age effects on L2 learning. This is the position espoused by Ellen Bialystok and Kenji Hakuta (1999) and by Catherine Snow, Stefka Marinova-Todd and their colleagues (Marinova-Todd et al., 2000), among others. They argue that socio-educational and motivational forces are so radically different in the lives of adolescents and adults, when compared to children's lives, that language attainment differences can be expected, but they are probably a consequence of experience and socialization, and not biological or insurmountable in nature.

Other SLA researchers argue that the posited sensitive period (or periods) is indeed real (e.g. Hylstenstam and Abrahamsson, 2003). In their view, there is a not well-understood but nevertheless biologically determined impossibility, after a certain age, to continue using the implicit learning processes that are best suited for natural language learning during the early years of human life (e.g. DeKeyser, 2003; Ioup, 2005). This kind of explanation is compatible with Robert Bley-Vroman's (1990) well-known Fundamental Difference Hypothesis, which posits that the acquisition process undergone by children and adults is fundamentally different because children posses the innate ability to intuit the L1 grammar, whereas adults have lost this ability and thus need to resort to problem solving and conscious attention to handle L2 learning (see also further discussion in Chapter 7, section 7.9).

While those scholars who favour the critical period position may turn out to be right, 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. As mentioned in section 2.1, lateralization and plasticity are neurobiological processes that have been considered by various researchers. Another process is myelination, or the development during the first 10 or 12 years of life of white-matter substance around the brain's nerve fibres which protects the nerves and enables faster conduction of information across nerve cells (Pulvermüller and Schumann, 1994; Pujol et al., 2006). An additional suggestion is pubertal increases in estrogen or testosterone (Ullman, 2004). To date, however, we lack sufficient evidence for neurological or neurochemical correlates that can support unequivocally a critical periods explanation (see Singleton, 2005, for more extended discussion).

In sum, it would be premature to proclaim that critical periods for L2 learning exist when so much discordant evidence keeps emerging across relatively diverse bodies of research. The preponderance of evidence suggests that late and adult L2 acquisition generally results in lower levels of ultimate attainment and more individual variability than is observed for L1 and very early L2 acquisition. However, 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.

2.8 A BILINGUAL TURN IN SLA THINKING ABOUT AGE?

Matters surrounding age effects on L2 learning have become even more complex in recent SLA discussions, as two threads of evidence have become available to the research community.

The first new thread of evidence pertains to the realization that age effects may be present in additional language acquisition much earlier than previously thought, perhaps by age four. The claim is far from conclusive but appears to be reasonably promising because it converges out of diverse research programmes. Thus, Hyltenstam and Abrahamsson (2003) noted that small but important morphosyntactic differences are detected in the written and spoken performance of extremely young L2 child starters, if researchers take care to recruit participants who began L2 learning at such early ages (e.g. below 6) and if they employ fine-grained elicitation and analysis procedures. Likewise, in L2 phonology Flege et al. (1995) found very young L2 starters who did not attain the native-like levels of pronunciation we all assume of pre-pubertal children learning other languages. In the neighbouring field of bilingual research, similar findings have been emerging for some time. For example, Catalan researcher Núria Sebastián-Gallés and her colleagues (Sebastián-Gallés et al., 2005) investigated lexical representations of early versus simultaneous bilinguals by asking them to tell apart Catalan L2 words and non-words on a lexical decision task. They found that participants who had started to be exposed to Catalan at age 4 or earlier, but not from birth, did less well on this lexical decision task than participants for whom both Catalan and Spanish were available from birth. As you will remember from an earlier discussion in this chapter, the case of postponed first language development among deaf babies after cochlear implants (Svirsky and Holt, 2005) is consistent with the view that there may be extremely early age effects for (first and second) language learning. Most of the SLA findings and associated explanations for age effects in L2 learning have been generated under the assumption of a much later biological window, namely around age 6 for phonology and perhaps

around puberty or up to age 15 for morphosyntax. If age effects do set in as extremely early in life as age two or four, the long-held assumption that an early start guarantees complete and successful L2 acquisition loses much of its power. Moving the onset of age effects into the very first years of life also blurs the traditional distinction between L2 and bilingual learners. Thus, a new range of theoretical and empirical arguments in SLA may have to be considered in the future, and SLA researchers may need to turn to the study of bilingualism when reassessing the evidence.

A second recent realization for which increasing evidence is mounting is that the actual relative amounts of L2 and L1 use at the time of study may be central to the task of gauging age effects. This is the so-called issue of language activation (also called language dominance in bilingual studies) (see Birdsong, 2005; Perani and Abutalebi, 2005). For example, findings offered by Flege and MacKay (2004) suggest that young starters who do not live up to expectations of complete success in L2 pronunciation may present low L2-use profiles and spend much of their time using the L1. The study by Sebastián-Gallés et al. (2005) also revealed a similar effect for amount of L2/L1 use, even in the simultaneous (from birth) bilinguals they studied. Their participants did best in the language they were more actively and consistently using in daily activities at the time of study. When the putative critical age is pushed back to a much earlier point in life, and the age effects turn out to be entangled with language activation and practice effects, it becomes imperative to re-evaluate the extant evidence with a new lens.

Finally, the findings on age-related L2 learning effects are grounded in the widely held assumption in SLA that the obvious benchmarks for evaluating L2 acquisition and L2 competence are L1 acquisition and L1 competence. In light of the real possibility that bilingualism and language activation and dominance effects operate across all ages, beginning as early as age two of life, we may need to revise this assumption in the future. Quite simply, it may be that bilingual attainment, whether in early or late bilinguals, cannot be directly compared to monolingual attainment. At least David Birdsong (2005, 2006) in the United States, Birgit Harley and Wenxia Wang (1997) in Canada, Vivian Cook (1991, 2008) in the United Kingdom and David Singleton (2001, 2003) in Ireland have raised the possibility that such a comparison may be misguided. Cook (2008) explains the dangers of comparing L2 users with monolinguals eloquently:

> There is no reason why one thing cannot be compared to another; it may be useful to discover the similarities and differences between apples and pears. SLA research can use comparison with the native speaker as a tool, partly because so much is already known about monolingual speakers. The danger is regarding it as failure not to meet the standards of natives: apples do not make very good pears. Comparing L2 users with monolingual native speakers can yield a useful list of similarities and differences, but never establish the unique aspects of second language knowledge that are not present in the monolingual.
>
> (p. 19)

What could, then, be taken as a fair point of comparison to gauge attainment in age studies? Citing the work on multicompetence and bilingualism by Cook (1991) and Grosjean (1989), Singleton (2003) suggests that:

> the appropriate comparison in the investigation of age effects in L2 acquisition is not between post-pubertal L2 beginners and monoglot native speakers but between post-pubertal L2 beginners and those who begin to acquire an L2 in childhood.
>
> (p. 10)

It may well be that the existing evidence on L2 critical periods will need to be reinterpreted as pointing at a fundamentally different state of language cognition for monolinguals and bilinguals, and a different state of overall readiness for language activation of the L1 and the L2 depending on current amount of use of each, rather than a fundamental difference between early monolingual and late L2 acquisition. If bilingualism and language activation/dominance effects operate across all ages, then the explanatory onus would subtly move away from biology and on to 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. The putative impossibility to attain nativelikeness after a certain age, if reinterpreted under a bilingual lens by SLA researchers themselves, may turn out to mean that it is impossible for bilinguals to be monolinguals. This would be inconsequential both from a theoretical and a practical viewpoint. After all, saying that L2 learners cannot reach levels that are isomorphic with monolingual competence would be a non-issue in a world in which bilingualism would be considered the default state of the human language faculty.

In the end, these other recent strands of research suggest that a number of environmental (e.g. opportunities for exposure and use of high-quality L2 input and amount and quality of L1 use) and socio-affective factors (e.g. motivation, L2 instruction and overall education) may mutually interact and become important predictors of success at earlier as well as later starting ages. Thus, these additional variables deserve much more research attention in the future. We can also predict, or at least hope, that many more SLA researchers in the future will turn to new methods and designs that enable them to investigate the bilingualism of early and late L2 learners in their own right, not as deficient or deviant replicas of monolinguals.

2.9 HOW IMPORTANT IS AGE IN L2 ACQUISITION, AND (WHY) DOES IT MATTER?

As we have seen in this chapter, over its more than 40 years of existence the field of SLA has contributed a wealth of research on how age universally influences L2 acquisition. Having answers to the questions raised by age effects in L2 acquisition

is important because it would make us go a long way in our quest for understanding the human language faculty as a whole. In addition, the main findings about age and L2 acquisition generated by SLA researchers to date can be used productively to advocate for various populations of L2 learners.

First, knowing that young children may have a slow start when acquiring an L2 can be an important research-based argument against harmful attempts to promote so-called sink-or-swim educational policies that attempt to reduce or even completely withdraw the first and second language support that is to be provided to language minority children by schools. Such policies have been dangerously gaining ground in the United States for some time now (see Crawford, 2000). Similarly, knowing that older children and adults can have an initial L2 learning advantage for rate over early starters, and that this advantage may last for about five years in second language environments and for even longer in foreign language settings, can also help problematize misguided attempts to mandate public schools to begin foreign language instruction in the first years of elementary education without first evaluating whether the local resources and conditions can appropriately sustain such efforts throughout the full length of schooling (see the discussion of these issues in the United States in Lally, 2001). This trend is regrettably expanding, particularly in areas of the world where English is seen as the default foreign language (e.g. Nunan, 2003). The third important age-related finding to remember is that amazingly successful late learners such as Julie and Laura exist, and that perhaps they account for as much as 5 per cent to 25 per cent of best-scenario learning cases (Birdsong, 1999b). This is hopeful for language teachers and educators. Indeed, knowing that many of them are highly motivated students who also enjoyed high-quality instructional experiences (Bongaerts, 1999; Moyer, 1999) is certainly good ammunition for lobbying in favour of increasing investment of material and human resources for the improvement of second and foreign language education.

2.10 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.

2.11 ANNOTATED SUGGESTIONS FOR FURTHER READING

Newcomers to the field of SLA are often overwhelmed by the many arguments and data that appear to equally support and contradict the Critical Period Hypothesis in L2 learning. It is important to maintain an open mind and an attentive eye when you delve into this literature. With a topic as controversial as this one, it is good to first read the brief overviews by Scovel (2000) and Singleton (2001). You can

profitably compare these two articles published in the same journal and in contiguous years by two seminal experts in the area, the former representing the position in favour of a biological schedule explanation for the observed age differences and the latter espousing a more sceptical stance. At a more advanced level, it is good to read and compare the overviews by Hyltenstam and Abrahamsson (2003) and Birdsong (2006), which offer a more contemporary view, again the former definitely in favour of critical periods for L2 learning and the latter more cautious about making final interpretations.

An accessible treatment of possible reasons for scepticism regarding the Critical Period Hypothesis is Marinova-Todd et al. (2000), and I recommend you also read the rebuttal by Hyltenstam and Abrahamsson (2001) and the authors' response (Marinova-Todd et al., 2001). You could then deepen your understanding of the educational ramifications of age effects by reading Nikolov and Mihaljević Djigunović (2006).

If you are interested in gaining expertise in this topic, book-length readings are in order. The collection of papers edited by David Birdsong (1999a) is difficult to read but fascinating because of the balance between positions in favour and against biological explanations for age effects, and because of the range of theoretical and empirical arguments represented. Although specialized in treatment, the book by Julia Herschensohn (2007) offers a uniquely valuable window into the issue of age because it reviews in depth age effects in both L1 and L2 acquisition and it takes an innatist approach but ends up arguing in favour of a critical period for first but not second language acquisition. Tom Scovel's (1988) book is still a classic well worth reading if you are interested in foreign accents. The collections edited by García Mayo and García Lecumberri (2003) and Muñoz (2006) will be exciting reading if your main interest is in L2 learning in foreign language contexts.

I hope your interest in definitions and limits of nativeness in SLA has been spurred by our discussion in section 2.8. If this is the case, Grosjean (1989), Cook (1991, 2008) and Birdsong (2005) are good readings for you.

Finally, for readers who are or will be parents interested in knowing more about raising children with multiple languages, King and Mackey's (2007) book is engaging and directed to a lay audience but well rooted in the best research about the topic.

3

Crosslinguistic influences

All L2 acquirers, by definition, possess complete knowledge of an L1, and often knowledge of other languages, when they begin learning the additional one. Many of them, indeed, will begin acquiring their L2 after many years of being able users of another language. Thus, previous language knowledge is an important source of influence on L2 acquisition, and this holds universally true of all L2 learners. This chapter offers a synthesis of what we currently know about the following question: If knowledge and capabilities for competent language use are already available to L2 learners through the mother tongue and other languages they may know, how do they affect the development of the new language?

Research on this topic is often known by the rubrics of **transfer or crosslinguistic influence**. You may have also heard of 'interference', but this older term has been displaced by the former two in contemporary SLA discourse. This is to pre-empt the unwanted implication that knowledge of the first language hinders L2 development. Much to the contrary, as we will see in this chapter, crosslinguistic influences can have positive as well as negative consequences for L2 learning. In addition, knowledge of the L1 impacts on L2 acquisition subtly and selectively, sometimes resulting in strikingly different negative and positive consequences for different learner L1 backgrounds, at different stages of development or proficiency and for different areas of the L2.

3.1 ON L1–L2 DIFFERENCES AND SIMILARITIES

During the 1950s and early 1960s, it was initially hypothesized that differences between the L1 and the L2 were responsible for the L2 difficulties experienced by specific learner groups who shared a same L1. This assumption inspired a wave of research comparing similarities and differences between given language pairs, in what soon was known as the school of **Contrastive Analysis** (e.g. Stockwell et al., 1965). It was believed that systematic L1–L2 comparisons would eventually allow researchers and teachers to predict when negative transfer will occur and what errors will be produced by particular L1 background groups of L2 learners. During the 1960s and 1970s researchers in the emerging new field of SLA turned to analyses of actual learner language and began conducting studies using the new methodology of **Error Analysis** and later **Performance Analysis** (see Long and Sato, 1984). It soon became clear that neither the linguistic knowledge nor the