6 Is There an Age-Factor for Universal Grammar?

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Introduction

In the past decade, many arguments have been made for a critical period or perhaps multiple critical periods for all aspects of the language acquisition process. In this chapter, we discuss some research findings which strongly suggest that there are at least two areas of language which are not affected by a critical period. Both derive from the biologically endowed faculty for language and are: (i) the innate principles and parameters of Universal Grammar (UG) governing the acquisition of syntax; and (ii) the biologically determined sensory abilities for the development of sound systems.

To assume this position is not to deny the fact that there may be certain differences between adults and children in language learning; however, we argue that these differences do not of themselves reflect the role of the biologically endowed faculty for language which we believe should be of central focus to inquiry into language acquisition in general and into critical periods in particular. We begin in the first section with a brief outline of the role UG principles and parameters play in the acquisition of syntax. We then discuss evidence from certain areas in the acquisition of syntax which do not show critical period effects. In the second section we consider aspects of the acquisition of sound systems — in particular, the substrate for speech cognition — and we present evidence indicating that basic competence in this area remains accessible to the adult learner as well.

The Language Faculty in the Domain of Syntax

In order to make our claims clear, we first have to consider two issues. One has to do with what we assume to be involved in language acquisition
in general; the other with what we mean by a biologically endowed faculty for language.

Clearly, the acquisition of language is not a unidimensional process but a complex system determined by the interaction of several different processes that occur simultaneously. Consider, for example, what the children have to do in order to learn only one aspect of language, namely the lexicon: not only must they learn the pairing of sound and meaning particular to their language, they must also deduce the categorial information for each lexical item, i.e. whether it is a noun, a verb etc. In addition they must learn the grammatical information pertinent to each lexical item, i.e. its subcategorisation features. For example, children learning English must learn that certain verbs, like *enjoy*, take a gerund; that others, like *want*, take the infinitive; and that still others, like *prefer*, can take both the infinitive and the gerund. Clearly this is a complex process, and presumably the children acquire this type of information by paying attention to their linguistic environment. Thus, certain aspects of language are learnable because they can be induced from positive evidence. In addition, however, the child also comes to know aspects of grammar which are 'unlearned', in the sense that they cannot be derived given the nature of the evidence available to the child. These, we argue, include syntactic principles and parameters provided by the biologically endowed faculty for language, or UG.

Let us very briefly consider some of the arguments leading to the innate UG hypothesis, as first formulated in Chomsky (1968). It is well known that a child attains the complex system of language despite a deficiency of language data on at least four levels.

Firstly, the speech that the child hears does not uniformly consist of complete grammatical sentences, but of utterances replete with pauses, false starts and slips of the tongue. Secondly, the language that the child hears is finite; yet the child comes to be capable of both producing and understanding utterances that go far beyond those that were ever heard in childhood. Thirdly, people attain knowledge of the structure of their language for which no evidence is available in the data they are exposed to as children. For example, children are not systematically informed that certain utterances are ungrammatical or that some are paraphrases of other utterances, or that other utterances are ambiguous. And finally, the exposure to the language is not uniform for all children; yet children worldwide acquire their first languages with amazing regularity in spite of the differences in background and intelligence. All of this is attained in a fairly remarkably short period of time, without much effort or conscious
thought, and with only a narrow range of the logically possible errors that could be committed. Such facts demand an explanation. In fact, one is logically led to positing a biological domain-specific organ that can account for these and many other facts about language acquisition. This domain specific-language faculty makes language acquisition possible by reducing the learner's hypothesis space regarding what makes a possible human language.

As an example of the type of knowledge made available by UG, consider the sentence in (1):

(1) He makes John's lunch.

It is clear to any native speaker of English that in this sentence He and John cannot be coreferential. Logically, there is no reason why this should be so. Two observations have been made about this fact: one is that all children learning English as their L1 come to know it without explicit instruction; the other is that this restriction on coreference holds true in all languages. It is to account for the knowledge of facts like these that the language faculty, and in particular UG, is argued to be innate. UG is composed of principles that universally characterise all languages, like the one disallowing coreference in (1) and known in UG Theory as Principle B of the Binding Theory.

Some UG principles have slightly different instantiations across languages. For example, all languages have a principal branching direction; they can vary to the left, as for Japanese, or to the right, as for English. Such differences are accounted for in terms of parameters. In this particular example, for the same principle, namely Branching Direction, Japanese is parameterised as left-branching, and English as right-branching. In order for this system to work, children must be exposed to a particular linguistic environment to determine whether their language is left-branching or right-branching. Some of the evidence we present later in this chapter pertains to this particular parameter.

So far, then, we have mentioned at least three aspects of the language acquisition process which presumably occur simultaneously. These are schematised in Figure 6.1. To construct a particular grammar, for example, that of English, a child must have access to the language faculty with its principles and parameters, a lexicon, and language-specific rules. Important to note in this regard is that to acquire language, two types of data-driven 'learning' are involved. One has to do with the setting of parameters, which necessitates exposure to the relevant data for a particular language in order to determine the parametric values. Technically, this involves deductive learning which derives from the language
faculties. Another type of learning — e.g. of the lexicon and idiosyncratic rules — may in addition involve an inductive procedure, and may therefore be dependent on cognitive faculties rather than the language faculty. What we hope to show in this section is that, while the question of a critical period for the inductive processes of language acquisition remains open, there seems to be no such period for the deductive processes, particularly in the area of syntax.

Evidence from L2 acquisition

The most direct way to test the existence of a critical period for UG principles and parameters is to test whether they are still accessible in adulthood, and more specifically, whether adult second language learners have knowledge of UG principles in the L2. Importantly, we want to test principles which are instantiated differently in the first and second languages respectively. As we have seen, one such situation arises with parameterisation, that is, if the L1 and L2 choose different values for the same parameter. Another situation is that of principles which are triggered only under certain circumstances, which hold for the L2 but not L1 (see Martohardjono & Gair, 1993). This arises in the case of Chinese and Indonesian adults learning English as a second language. Specifically, the
structure under consideration is question-formation. As shown in (2) below, languages differ in the ways they form questions.

(2) Two types of question-formation

English:  
Who do you like?

Chinese:  
Ni xihuan shei?
you like who

In English, the question word appears at the beginning of the sentence, a result ascribed in UG theory to ‘syntactic __-movement’. Many other languages, like Chinese and Japanese, lack this type of movement, and in such languages the question word appears ‘in situ’ as seen in the Chinese example in (2). An examination of languages with syntactic movement has yielded the observation that this type of movement is subject to a universal principle which restricts the domain out of which a __-word may be moved. This is illustrated in Figure 6.2.

A. THE GIRL WHO HAD A STOMACH ACHE ATE A COOKIE

B. WHAT DID THE GIRL [WHO HAD A STOMACH ACHE] EAT ___?

C. *WHAT DID THE GIRL [WHO HAD ___ ] EAT A COOKIE?

Figure 6.2 Restrictions on syntactic movement

Consider first sentence A, which contains two noun phrases. Logically it should be possible to question either of these nouns and for in situ languages this is in fact the case. However, as one sees in sentences B and C, there is a marked difference in acceptability between the two questions when movement is involved. Questioning the word cookie results in an acceptable sentence. In contrast, questioning the expression stomach ache, as in C, results in an unacceptable sentence. This effect has been ascribed to a principle called Subjacency (Chomsky, 1973) which, together with some other principles, forms the more general principle of Constraints on Syntactic Movement. Notice that sentences B and C are structurally similar in that they are permutations of the same sentence A. Both have the form
of a question containing a relative clause. The critical difference between B and C is that in B, the acceptable sentence, the questioned word originates in the main clause, while in C, the unacceptable one, the questioned word originates in the relative clause. It is of course highly unlikely that language learners, whether they be children or adults, are ever explicitly instructed about facts such as these. Yet any native speaker of English can detect this difference and tell you that B is fine, while C is not.

Importantly, in languages without syntactic movement, the equivalent of sentence C is grammatical. This is because Subjacency is only triggered when syntactic movement occurs, and since these languages do not have this type of movement in questions (recall that the question words remain in situ), Subjacency does not apply. The interesting question that arises, then, is the following: How do adult learners who are native speakers of a language without syntactic wh-movement treat sentences like C when learning English? More concretely, do native speakers of Chinese, for example, know that questioning a noun inside a relative clause is ungrammatical in English even though it is allowed in Chinese? Recall that knowledge of this constraint is provided by UG. A Critical Period Hypothesis for UG principles would therefore predict that native speakers of in situ languages learning English beyond a certain age (presumably after puberty) will not recognise the ungrammaticality of sentences like C in English. This is precisely what Martohardjono (1993) set out to investigate. In what follows we will review the relevant part of the results obtained in that study.

Martohardjono (1993) presented a variety of ungrammatical sentences in English, such as C in Figure 6.2, to two groups of adult learners of English who were native speakers of Chinese and Indonesian, two languages which do not have syntactic movement in question-formation, and hence two languages where movement constraints are not instantiated. Only subjects who had started learning English after the age of 15 were included. In addition to the extractions out of relative clauses illustrated in Figure 6.2, two other types of structures were included, for which movement constraints also hold: extractions out of Sentential Subjects and extractions out of Adjunct Clauses. Examples are given in Figure 6.3.

Table 6.1 shows mean percentages of unacceptable sentences which were correctly rejected as ‘ungrammatical’ by the Indonesian and the Chinese groups. It is clear from these figures that both groups showed solid knowledge of the movement constraints for all the structures tested. Martohardjono concluded from this that UG principles which are not
EXTRACTION OUT OF ADJUNCT CLAUSES

A. THE MAN LEFT THE TABLE AFTER THE WAITER SPILLED THE SOUP
B. WHICH MAN LEFT THE TABLE AFTER THE WAITER SPILLED THE SOUP?
C. "WHICH WAITER DID THE MAN LEAVE THE TABLE AFTER _ SPILLED THE SOUP?"

EXTRACTION OUT OF SENTENTIAL SUBJECTS

A. GETTING THIS JOB HELPED THE GRADUATE STUDENT
B. WHICH GRADUATE STUDENT DID GETTING THIS JOB HELP _?
C. "WHICH JOB DID GETTING _ HELP THE GRADUATE STUDENT?"

Figure 6.3 Extraction out of adjunct clauses and sentential subjects

Instantiated in the L1 remain available to adult L2 learners, strongly suggesting that UG is not affected by a critical period.

Additional evidence for the role of the biologically endowed faculty for language comes from certain types of errors adult L2 learners make. To illustrate this we will return to the question of parameter-setting. Recall that in a parameter-setting model of language acquisition the child would set her parameter values for the L1 according to the data available in her linguistic environment. For the Branching Direction parameter, for example, the Japanese child would, upon hearing a few left-branching structures, set the value at Left Branching (LB). Under a Critical Period Hypothesis for principles and parameters, parameter-values that have not been set during L1 acquisition would no longer be available after a certain age. This would mean that adult Japanese speakers learning English would not have access to right-branching structures, only left-branching ones, since this is what is available in Japanese. Recall that English is principally a right-branching language. In addition, as shown in papers in Lust (1987) for L1 acquisition,

Table 6.1 Mean percent rejection of wh-extractions

<table>
<thead>
<tr>
<th>Relative Clause</th>
<th>Adjunct Clause</th>
<th>Sentential Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesian</td>
<td>90%</td>
<td>90%</td>
</tr>
<tr>
<td>Chinese</td>
<td>73%</td>
<td>88%</td>
</tr>
</tbody>
</table>
learners want to calibrate branching direction and anaphora direction. By anaphora direction we mean simply whether a pronoun precedes an antecedent or follows it. So in a right-branching language like English, a first language learner wants a pronoun to follow its antecedent as in the sentence in (5).

(5) When Ernie saw the clown, he laughed.

In left-branching languages a first language learner wants the pronoun to precede the antecedent, as shown in (6).

(6) When he saw the clown, Ernie laughed.

Utilising branching direction as a basis for predictions about second language acquisition, we would expect under a Critical Period Hypothesis that left-branching sentence structures in English should not be particularly problematic for a Japanese speaker to acquire, since what is available to the learner is the L1 which is left-branching. In addition, if this were true, we would predict that the patterns of acquisition that would emerge for the Japanese L2 learners should not resemble that for child first language learners of English who are able to access right-branching structures.

Contrary to these predictions, Flynn (1983, 1987) found that the sentence in (7) below is extremely difficult for adult Japanese speakers learning English.

(7) When the doctor received the results, he called the gentleman.

This sentence involves a pre-posed, left-branching adverbial adjunct clause as well as forward anaphora in which the antecedent the doctor precedes the pronoun he. These sentences do not involve a contrast in surface language facts between the L1 and the L2. They are productively licensed in Japanese — as exemplified in (8).

(8) Taroo wa nyuusi no kekka o kiita toki Ø
    hahaaoya ni denwa sita
    Taroo-topic entrance exam-pos. result-acc. heard when Ø
    mother-dat. telephone did
    ‘When Taroo heard (found out) the results of the entrance exam, (he)
     called his mother.’

In addition, these sentences are left-branching in accord with Japanese as principally a left-branching or head-final language. A second language acquisition model which derives language knowledge from the L1 only, therefore, does not predict the massive error rate made in imitation on these sentences as shown in Table 6.2.
Table 6.2 Mean amount correct imitation

<table>
<thead>
<tr>
<th>Proficiency Level</th>
<th>Low</th>
<th>Mid</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>0.00</td>
<td>0.16</td>
<td>0.95</td>
</tr>
</tbody>
</table>

(highest possible score = 3)

This error rate, we argue, is predicted by a parameter-setting model of L2 learning which is constrained by syntactic principles and parameters of UG. As already seen earlier, the Japanese speaker learning English must assign a new parameter setting for branching direction. If the Japanese L2 acquisition of English is constrained by the same parameters as is child L1 acquisition and if the L2 learner draws the same deductive consequences as the L1 learner, then errors on sentences as in (6) above can be explained since they not only offend parameter resetting for the L2 but they also offend the deductive consequence regarding anaphora direction which follows from the parameter setting. On the other hand, results such as these are left unaccounted for within a critical period formulation for syntactic principles and parameters of UG.

To summarise, we have argued that the evidence from experimental studies testing some syntactic principles of the language faculty supports a model of second language acquisition in which the biologically endowed language faculty is intact and operative, and we have given two examples of how aspects of this can be used to account for certain patterns of L2 acquisition. Thus, a model of second language acquisition which allows access to this faculty can in some sense explain the course of acquisition that critical period models cannot.

The question that now remains to be answered is: What explains the observed differences between native speakers and non-native speakers, both in the treatment of movement constraints and perhaps in proficiency in general? In other words, why do non-native speakers not perform at 100% levels as one might expect from native speakers?

It has been argued that this difference can only be accounted for by assuming a critical period for the language faculty. Such an explanation derives, we argue, from a basic misconception about the role of the language faculty in acquisition. The role of the language faculty, as we mentioned earlier, is to constrain acquisition so as to make it possible in the first place. At the same time, there are many other aspects in the acquisition process which we have called inductive processes and which do not derive from the language faculty. We note here again some phenomena such as lexical learning, and language-specific rules, i.e. things that are properly
considered outside the domain of this faculty. Clearly, however, all aspects of language acquisition must interact in order to result in language proficiency. There is a whole process which leads the learner from having accessibility to a principle of the language faculty to mastering the particular instantiation of that principle in the language (e.g. identifying the sets of structures the principle ranges over — for instance, assimilating the fact that branching direction applies not only in relative clauses but in other complex sentences as well, for instance sentences with adverbial clauses).

The interaction between the various components of the language acquisition process was presented earlier in schematic form in Figure 6.1, where the dashed arrows represent the auxiliary processes needed to map the principles of the language faculty onto the particular demands of the language. Such processes, which are necessarily inductive in nature, could at least partially account for the observed differences between native and non-native speakers.

To briefly outline this proposal, we suggest the following: Because L2 learners already possess an L1 grammar, they hold confirmed beliefs about how each principle and parameter works as well as their domain of application for the construction of the L1 grammar. Application of the principles and parameters in turn involves extensive ancillary knowledge of the lexicon, etc. and idiosyncratic rules of the language (essentially tied to learned language-specific facts). The L2 learner, thus, is forced to shift not only hypotheses concerning principles and parameters but a whole range of interrelated language specific facts. The native speaker, in contrast, has already instantiated all principles and parameters in the context of a specific language. In other words, they have already gone through the process that we are now trying to explain for the adult L2 learner. In addition, the native speaker is not hindered by competing grammatical systems. In adult L2 learning, the instantiation of principles and parameters in the L2 may not be problematic but rather the mapping of the principles and the parameters onto the structures of the new target language. This mapping will take time as it of necessity involves inductive learning (see Lust, 1981).

The Language Faculty in the Domain of Phonology

Let us now turn to a consideration of some evidence from the acquisition of phonology, an area for which claims of a critical period have traditionally been the most persistent. Today it remains a widely held belief, both amongst laymen and L2 professionals, that beyond a certain age, often cited
as puberty, and more recently as early as 5–7, it is impossible to acquire native-like pronunciation in a second or foreign language. Crucially, this inability is claimed to be biologically determined.

In the 1970s and 1980s a series of experimental studies investigated age-related differences in the acquisition of phonology, focusing in particular on L2 pronunciation. While some of these studies showed a positive correlation between age of arrival and degree of foreign accent as perceived by native speaker judges (e.g. Asher & García, 1982; Seliger, Krashen & Ladefoged, 1982; Oyama, 1982a, 1982b; Tahta et al., 1981), others (e.g. Olson & Samuels, 1982; Snow & Hoefnagel-Höhle, 1982; Scovel, 1988) report that adults and adolescents in fact performed better than young children. An explanation that has been offered for these seemingly contradictory results is that these studies measure different phonological abilities (Krashen, Scarcella & Long, 1982). In particular, those studies which show an advantage for younger learners have been termed ‘ultimate attainment studies’, while those studies which showed an advantage for older acquirers age have been termed ‘rate of acquisition’ studies. It has been suggested that, because ultimate attainment studies measure long-term abilities, while rate of acquisition studies measure short-term abilities, the former are more reliable predictors of overall phonological abilities (Long, 1990).

In this section we argue that while the neurological evidence for a critical period for the acquisition of phonology remains speculative (e.g. Walsh & Diller, 1986; Seliger et al., 1982; Obler & Macnamara, 1991), the empirical evidence available to us today points to the fact that general phonological abilities are maintained in adulthood and remain available to mature L2 learners. In particular, we will address our remarks to the biologically determined ability to construct new phonological systems. First, we will make more precise what this ability must consist of and, concomitantly, what the prediction of the loss of this ability entails for L2 acquisition. We will then suggest (contra Long, 1990) that ultimate attainment studies, measuring native-like pronunciation, may in fact not be the best way to measure this ability. Finally, we will consider some evidence from the area of L2 speech perception and production which indicate (i) that the biological ability underlying the construction of sound systems remains intact throughout one’s lifespan, and (ii) that age-related differences are best explained within a multi-tiered speech learning model which assumes differential use of several processing modes.

Early speculation about a critical period for speech rested heavily on the assumption that speech abilities are related to hemispheric specialisation,
and, crucially, that this specialisation is completed around puberty (Lenneberg, 1967). The original evidence for this assumption was the observation that when young children sustain left-hemisphere damage, they are able to recover speech using the right hemisphere, and that such recovery is less likely for adults. More evidence came from dichotic listening tasks, which seemed to indicate that adults exhibit more left-hemisphere dominance for speech than do children, thus again pointing to increased hemispheric specialisation in adulthood. However, in a recent review of brain damage and dichotic listening phenomena, Witelson (1987) concludes that, in fact, hemisphere specialisation exists in very young infants — at least as early as one month of age. She argues that there is no increase in lateralisation with age. Rather, she claims that there may be, in general, a gradual loss in the plasticity in the brain. With increasing age, if one area of the brain is damaged, other parts are less able to take over the functions previously dealt with by the damaged part.

Other hypotheses have suggested multiple critical periods, governing different subdomains of language. Such hypotheses were motivated by what seemed to be a discrepancy between the upper age limit in the acquisition of phonology (around 5 or 6) on the one hand, and that of syntax and the lexicon on the other (around 15 and upwards). Walsh & Diller (1986), for example, suggest that the two domains of language are subserved by different braincell types; phonology, a lower-order linguistic function, is on this view subserved by pyramidal cells, so-named because of their shape, while higher-order domains like morphology and syntax are subserved by stellate cells. Pyramidal cells adhere to a different maturational time schedule from that of stellate cells. Thus, the former cease to develop at the age of 6 or 7, while the latter continue to develop well into young adulthood. Seliger (1982) offers a similar hypothesis, based on differential schedules of localisation and lateralisation of the neurological substrates subserving the different linguistic subdomains. In a more recent review of the literature, Long (1990) suggests that because of its duration and progressive nature, myelination offers an attractive potential explanation for the gradual decline in the ability to achieve native-like pronunciation. In the same article he suggests that ultimate attainment studies, measuring long-term ability to achieve native-like pronunciation, constitute more relevant evidence for the acquisition of phonology than do rate of acquisition studies. He argues that pairing the behavioural evidence from ultimate attainment studies with the hypothetical neurophysiological events proposed by Walsh & Diller (1986) and Seliger et al. (1982) provides a strong argument for a Critical Period Hypothesis in the acquisition of phonology.
While the correlation proposed by Long may indeed prove useful in explaining the increased difficulty in achieving native-like pronunciation with age, we argue that native-like pronunciation is not an adequate measure of phonological competence. In general, linguistic competence determines potential abilities, rather than actualised proficiency. For the acquisition of phonology and in particular the cognition of speech sound, we would expect competence to govern more fundamental aspects such as, for example, the underlying ability to construct new sound systems. To sketch out this idea in some more detail, let us borrow some notions from another area of cognition, namely vision. Research in this cognitive domain has shown that the visual cortex is equipped with neurons which are specialised in the detection of features particular to the visual world, e.g. lines, contours, etc. Walsh & Diller (1986) have suggested that the same might be the case for language, and discuss the potential existence of neural detectors specialised for linguistic features. Following their suggestion, one would expect that in the case of phonology such neural detectors be specialised for the detection of phonetic and acoustic features pertinent to phonemic differentiation, since these constitute the crucial steps in the construction of a phonological system. That is, whatever else phonological competence may include, for speech cognition it would seem that the relevant underlying ability is not to be measured by eventual attainment of native-like pronunciation, but by a more fundamental ability, namely, the ability to detect sounds pertinent to speech and to manipulate or integrate them into a systematic mental representation of the sound system for the language being acquired. That this ability is indeed basic has been shown in early research in sound perception where newborn infants demonstrated an ability to distinguish speech sounds from non-speech sounds, as well as an ability to perceive distinctive features such as +/- voice (ba/pa) (Eimas et al., 1974).

It is of course possible that the neurological substrate underlying this ability adheres to a maturational schedule, and that after maturation, presumably once the phonemic system of the L1 is well in place, its main function (i.e. the ability to detect distinctive features) diminishes or disappears. The next question to ask then, is: What sort of behavioural evidence would indicate that this basic ability changes with age? The required behavioural evidence, we argue, would be a decline over age in the sensory abilities to establish a new sound system, rather than the sensory abilities to fine-tune such a system. Thus, we would expect a loss or decline in phonological competence to result, for example, in the inability to detect and integrate the phonetic and acoustic features necessary to establish new phonemic contrasts. For L2 acquisition a fundamental change
in these sensory abilities would result in a drastic reduction or even loss of a sensitivity to sound contrasts which do not exist in the L1. This would predict that only those contrasts which already exist in the L1 system should be available to the adult L2 learner.

In fact, research has shown that the sensory abilities to establish new contrasts remain intact in both perception and production. Interestingly, the evidence comes partly from the ‘rate of acquisition’ studies mentioned earlier, which showed that older learners (adolescents and adults) in fact have an advantage over younger learners in the short term. For example, Snow & Hoefnagel-Höhle (1982) tested, amongst other things, the production of Dutch /uy/ and /x/, phonemes that do not exist in English, by native speakers of English in both a laboratory and a naturalistic setting. In these studies, adults and older children (12–15) generally did better than younger children. Although results such as these are often ignored in favour of ‘ultimate attainment’ studies (where early L2 learners fare better than late ones), they in fact constitute an important piece of evidence which addresses directly the question of ability to produce or perceive novel sounds.

More recent research in psychoacoustic perception also argues against a decline in these fundamental sensory abilities. Thus, completely new phonemic categories in the L2, or so-called ‘unequivalent sounds’ (because they do not have an equivalent in the L1) are quite easily perceived by non-native speakers. For example, Best, McRoberts & Sithole (1988) report that a completely novel sound, such as the Kikuyu click, is to native speakers of English, is perceived equally well by infants and adults whose L1 is English. Similarly, Werker & Tees (1983) show that novel contrasts, such as th/dh, which is phonemic in Hindi but not in English, is easily detected by both infants and adults whose L1 is English. While younger subjects fare somewhat better, Werker & Tees also show that with training adults can reach criterion in the perception of these contrasts. Data such as these would not be obtainable if the sensory abilities to perceive novel contrasts disappeared with age.

Similar arguments can be adduced for the production of novel sounds. If one were to lose the ability to perceive/produce new sound categories, we would expect those categories to be ‘unlearnable’. However, adults can and do learn not only to perceive but also to produce new sounds. An early study by Neufeld (1977), for example, reports that some native speakers of English reached criterion in the production of Chinese, Japanese and French phrases, to the point of being perceived as native speakers by the listening judges. Similarly, Flynn & Manuel (1991) successfully trained Japanese
subjects to both perceive and produce the English r/l distinction, which is non-phonemic in the L1. We reiterate that this demonstrated ability to achieve native-like proficiency, with training both in production and perception, is clearly incompatible with a loss in competence, either total or partial.

Further evidence that adults retain access to their original sensory abilities can be found in the work of Flege and his colleagues (Flege & Port, 1981; Port & Mitleb, 1980; Nathan, 1987; Flege, 1987) on voice onset time or VOT values. They found that L2 learners produce stops with a VOT value which lies between that of their L1 and the L2. For example, English /t/ has a long-lag VOT while Spanish /t/ has a short-lag VOT. When asked to pronounce English /t/, native speakers of Spanish learning English typically produce it with a VOT value which lies between English and Spanish, i.e. significantly lower than that of native speakers, but also significantly higher than that of the Spanish /t/. While a proficiency-oriented approach might focus on the fact that these learners did not produce native-like VOTs, the more significant points, as noted by Flege, are (1) that they were able to perceive the difference between the VOTs in the L1 and the L2 in the first place, and (2) that they were able to alter their production of these sounds from the way they are realised in the L1. Again, an explanation based on the loss of basic sensory abilities is inadequate here, as clearly these learners were able to identify and approximate phonetic features which differ in the L1 and the L2. Hypotheses have been advanced that there is an upper limit to the production of L2 VOTs. This is however contradicted by studies which show that some L2 learners do not differ from native speakers in their production of stops, or 'overshoot' native-speaker values (Suomi, 1980; Major, 1987; Flege & Eefting, 1986).

The evidence we have cited so far clearly does not support a loss or a change in the abilities to produce and perceive new sound contrasts; that is, in what we have argued to be fundamental aspects of phonological competence. However, as in the case of the acquisition of syntax, the question of course remains: What accounts for the observed difference between early and late learners? Here again, psychoacoustic research can help provide an answer. In a recent review of the literature, Wode (1991) suggests that the explanation lies in the interaction of different processing modes involved in establishing the phonemic system, namely the categorical/phonemic mode, the continuous/phonetic mode and the acoustic mode. In what follows, we will very briefly adumbrate this idea.
Setting up a phonemic system critically involves establishing discrete categories of sound which are meaningful in the ambient language (categorial/phonemic mode). To do this, the language learner uses the continuous/phonetic and acoustic modes. The process consists of using phonetic features to establish phonemic categories and then selectively and progressively shifting attention away from phonetic contrasts which are not meaningful in the language. This occurs from a very early age, as demonstrated in the research by Kuhl (1986). Thus, infants as young as 6 months of age pay more attention to contrasts that are non-phonemic in the ambient language than do older children, but gradually pay less attention to such cues for processing reasons. Crucially, however, the ultimate establishment of phonemic categories continues into adolescence and young adulthood (Flege & Eefting, 1987).

The difficulty in building a new phonological system for the L2 then, lies in reversing the process used to establish the L1 system. Thus, in constructing a new system, the learner has to relearn to focus on phonetic contrasts. For example, sounds which already constitute a phonemic category in the L1, such as /p/t/k/ in English, typically show an age effect. Werker & Tees (1983), for example, show that English speaking adults are much worse than infants in detecting a difference between dental and retroflex t, a contrast which is phonemic in Hindi but not English or velar vs. glottalised k, a contrast which is phonemic in a native American language Thompson. However, the age difference seems to vary with the particular contrasts in question. Notice that this is a very different argument from that made by the Critical Period Hypothesis, which says that the basic abilities to establish a phonemic system are lost or fundamentally altered. Crucially, the studies we mentioned above show that all three modes (phonemic, phonetic and acoustic) are accessible to adults in identifying non-native sounds (Werker & Logan, 1985).

Conclusion

To conclude, in this chapter we have argued on the basis of the acquisition of aspects of syntax and phonology, that the biologically determined faculty for language — i.e. competence — remains accessible to adult learners, and that differences between child and adult learners can be derived from the ancillary processes used to instantiate competence into the particular demands of a language (e.g. the L2). Understanding and articulating the issues in this way allows us to reconcile different aspects of what we observe about adults in language acquisition, specifically, the fact that in spite of showing solid knowledge of principles and parameters in
the area of syntax and retaining critical sensory abilities for constructing phonemic systems, adult second language learners may at times fail to reach native proficiency in either or both areas. A sweeping biological explanation, we submit, fails to answer the more subtle and ultimately more interesting question of what particular aspects of linguistic behavior are affected by age.

Notes

1. For a more in-depth discussion of these issues the reader is referred to Hornstein & Lightfoot (1981).
2. We refer here to the even ‘deeper’ properties of the phonological competence, such as principles and parameters governing the mental representation of rule systems.

References


