

FACTORS INFLUENCING THE ACQUISITION OF SECOND LANGUAGE PHONOLOGICAL COMPETENCE: CHILDREN VERSUS ADULTS

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Abstract

This paper examines factors affecting the acquisition of second language (L2) phonology in light of child-adult differences. Studies have shown that children achieve better L2 pronunciation than adults in naturalistic environments. Several arguments have been proposed concerning children's superiority over adults in L2 phonological acquisition. They are: (1) the neurological argument; (2) the habit formation argument; (3) the socio-affective argument; and (4) the input argument. This paper reviews each argument critically. At present there seems to be less evidence for the neurological argument and more evidence for the habit formation argument, the socio-affective argument, and the input argument. The interaction of the last three factors seems to provide a fairly adequate account of why children are superior to adults and why some adults are better than others in L2 phonological acquisition.

Linguists and lay people alike have debated whether children possess a special talent for acquiring second language L2 phonology.¹ They ask: Are children actually better at acquiring the sounds of an L2 than adults? If so, what factors explain children's superiority over adults in the acquisition of L2 phonology? The purpose of this paper is to examine these issues by referring to the literature on this subject. First, the question of whether or not differences exist between children and adults in their ability to acquire L2 phonology will be discussed. This will be followed by a discussion of factors affecting L2 phonological development.

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Child-Adult Differences

In the past two decades a number of studies have been conducted to examine the issue of whether children are superior to adults in acquiring the sounds of an L2 (Asher & Garcia, 1969; Olson & Samuels, 1973; Seliger, Krashen, & Ladefoged, 1975; Oyama, 1976; Snow & Hoefnagel-Hohle, 1977). (For a compendium of articles on child-adult differences in second language acquisition, see Krashen, Scarcella, & Long, 1982.) Many of them have been concerned with the critical period for language learning (from approximately age two to puberty), during which complete acquisition is possible, and beyond which native-like acquisition becomes increasingly difficult (Lenneberg, 1967). Some researchers claim that the notion of the critical period is applicable mainly to the phonological aspect of L2 acquisition (Scovel, 1969; Walsh & Diller, 1981). This is because native-like syntax seems much more attainable for adult L2 learners than native-like pronunciation (Ioup & Tansomboon, 1987).

The critical period hypothesis, as it relates to the phonological aspect of L2 acquisition, has a strong version and a weak version (Neufeld, 1980). The strong version does not allow for exceptions: No one after the age of puberty can acquire a native-like accent in an L2 (e.g. Scovel, 1969). The weak version allows for exceptions: Although most adults have difficulty acquiring native-like pronunciation, some do achieve it (e.g. Neufeld, 1980; Seliger, 1981).

The following three studies claim to have presented evidence against the argument that children are better acquirers of L2 phonology than adults. Olson and Samuels (1973) examined the pronunciation accuracy in German of three groups of 20 American subjects — elementary, junior high school, and college students with no prior knowledge of German. The groups had 10 drill sessions, each lasting 15 to 25 minutes, over a period of two weeks. Drills were conducted with language tapes in a language laboratory. Students were asked to *mimic* to the best of their ability words and short sentences containing 33 target phonemes. The results of the college and junior high school groups were significantly higher than those of the elementary school children. Olson and Samuels interpreted these results as indicating that adults are actually superior to children in L2 pronunciation. Thus, they claim that the critical period hypothesis is untenable.

A similar study was conducted by Snow and Hoefnagel-Hohle

(1977). The researchers investigated the Dutch pronunciation of 136 child and adult English-speaking subjects. The subjects were placed into 11 age groups ranging from 5-year-olds to 21-30 year-olds. First, subjects heard the native speaker's pronunciation of five different Dutch words containing nine target sounds a total of 20 times. Then, they were asked to repeat after the native speaker's pronunciation. The results showed that in general the older groups were better than the younger groups in pronunciation accuracy. The authors interpreted these findings as evidence against the critical period hypothesis. *Repetition*

Both Olson and Samuel's (1973) and Snow and Hoefnagel-Hohle's (1977) conclusions about the critical period hypothesis are misleading, however. Neither of the results attained in their studies necessarily reflects the subjects' ability to acquire L2 sounds in "naturalistic" settings² in the long term. The tasks used in both studies tested the ability to mimic L2 sounds in an artificial language laboratory situation. This ability seems to be closely related to the subject's concentration and length of memory span. Since children possess shorter attention and memory spans than adults, the former are at a disadvantage over the latter in these tasks. Thus, the most we could say about these two studies is that adults are superior to children in mimicking L2 sounds under language laboratory conditions at the initial phase of their learning.

In addition to their laboratory study, Snow and Hoefnagel-Hohle (1977) conducted a study of children and adults acquiring an L2 in naturalistic settings. They investigated the acquisition of Dutch by 47 English speakers in Holland. The subjects were divided into five age groups ranging from 3- to 5-year-olds to adults. They were tested three times: First within six weeks of their being exposed to a Dutch language environment, the second and third times at four- to five-month intervals. The pronunciation test consisted of 80 words which were elicited by imitation of a native speaker and by means of pictures. The results indicated that at the initial stages of acquisition, adults were superior to children in pronunciation. Based on these results, the researchers concluded that the critical period hypothesis for pronunciation could not be supported.

This conclusion is, however, questionable. Other results reported in this study indicated that although the older subjects had an initial advantage in pronunciation, they were gradually overtaken by the younger subjects. Since the critical period hypothesis concerns the

eventual attainment of native-like proficiency, the findings of this study could be taken as support for, rather than refutation of, the hypothesis.

Thus, none of the above three studies invalidated the critical period hypothesis. Unlike these last three studies, the next three studies were concerned with *long-term, naturalistic L2 acquisition*. Interestingly, they all suggest that children are superior to adults in L2 phonological acquisition.

Asher and Garcia (1969) examined the relationship between the age of arrival in an L2 environment and pronunciation accuracy in 71 Cuban immigrants. Most of them had been in the United States more than five years. The subjects were divided into three groups according to their age of arrival in the United States: (1) 1-6 years old; (2) 7-12 years old; and (3) 13-19 years old. The subjects and 30 native speakers used as controls read four sentences in English into a tape recorder after rehearsing the material. Nineteen American high school students then rated each subject with respect to native-like accent, using a 4-point scale ranging from "native speaker" to "definite foreign accent."

The results showed that the younger the subject was upon arrival the better his pronunciation was likely to be. The first group, whose age of arrival was between 1 and 6, had the best chance of acquiring a near-native accent. The second group, who had arrived between ages 7 and 12, had a 50-50 chance of acquiring a near-native accent. The third group, those who had arrived at the age of 13 or older, had only a small chance of acquiring a near-native accent.

A study conducted by Oyama (1976) confirms Asher and Garcia's conclusion. Her subjects were 60 male, Italian-born immigrants who had been in the United States for a minimum of five years. They were placed in three different groups depending on their age of arrival: (1) 6-10 years old; (2) 11-15 years old; and (3) 16-20 years old. Data were collected in two ways: First by asking the subjects to read a short passage, next by asking them to describe a frightening experience in their lives. The pronunciation of each subject was then rated in terms of a 5-point scale from "no foreign accent" to "heavy accent" by two native speaker judges. The results indicated again that the younger the subject was when entering the United States, the more native-like his pronunciation tended to be.

Further support for the claim "the younger the better" is provided by Seliger, Krashen, and Ladefoged (1975). The researchers conducted a survey of 394 immigrants to the United States and Israel. The subjects

were divided into three groups according to their age of arrival: (1) 9 years and younger; (2) 10-15 years; and (3) 16 years and older. They were asked to evaluate their own pronunciation and to report whether they thought other Americans or other Israelis considered them as native speakers of English or Hebrew. The researchers found that the younger the subjects were upon arrival, the more likely they were to report that others judged their pronunciation to be native-like. Since their data are based on self-report of others' informal evaluations, we have to accept these results with some reservations.

Thus, the three studies which investigated the long-term effect of age of arrival on pronunciation all suggest that children are superior to adults in the long run in naturalistic L2 phonological acquisition.

What do these studies say about the strong version of the critical period hypothesis? Both Asher and Garcia's (1969) and Oyama's (1976) studies give support to the strong version in that no subject who came to the U.S. after puberty was judged to have a native accent. However, the study done by Seliger et al. (1975) does present some evidence against the strong version. Twelve of those in the oldest arrival group (16 and older) reported that they had native-like accents. Again, however, since the data were based on self report, we have to consider these results with some reservations.

Neufeld (1980) also presented evidence suggesting that there are people who have learned a second language as adults and can pass as native speakers of that language. Seven Anglophones who learned French as adults were selected on the basis of an impressionistic judgment that they could pass as native speakers of French in casual conversation with native speakers. For this study, the subjects read a short passage into a tape recorder after having had as many practice sessions as they wanted. The researchers found that five of these subjects were consistently evaluated as native Francophones by French-speaking judges.

As is known from studies on sociolinguistic variation of L2 phonology (Dickerson, 1975; Beebe, 1980), the reading of words or passages usually (though not in all cases) produces more native-like variants than conversation. It is regrettable that Neufeld did not use conversation data for evaluation of pronunciation accuracy in conversation.

Thus, although there may be weaknesses in the nature of the data, the studies conducted by Seliger et al. (1975) and Neufeld (1980) provide

some evidence for the rejection of the strong version of the critical period hypothesis.

To summarize, children have been shown to be superior to adults in naturalistic L2 phonological acquisition over the long run. Although claims have been made that there are adults who acquire native-like accents in an L2, these adults are still considered to be exceptions. What we need to know now is what factors account for children's superiority in L2 phonological acquisition over adults. This issue will be treated in the next section.

Factors Affecting Pronunciation Development

A controversy exists over why children are better acquirers of L2 pronunciation than adults in naturalistic L2 environments and why some adults are better than others in pronunciation accuracy. There are roughly four kinds of arguments to explain the reasons: (1) the neurological argument; (2) the habit formation argument; (3) the socio-affective argument; and (4) the input argument. Each of the arguments will be reviewed and discussed in the following section.

The Neurological Argument

The neurological argument basically states that the brain loses its capacity to acquire the sounds of an L2 due to lateralization (the localization of language functions in the left hemisphere) and the resultant loss of brain plasticity around the age of puberty (Scovel, 1969). Originally the neurological argument, which actually concerned all aspects of language acquisition, was proposed by Penfield and Roberts (1959), and then reinforced by Lenneberg (1967). Their claim for the completion of lateralization around puberty is based on clinical data from the recovery patterns of language function in children and adults after brain damage.

Genesee (1988) points out a number of conceptual weaknesses with the neurological argument. First, the evidence cited by Penfield and Roberts (1959) and Lenneberg (1967) concerns first language (L1) competence and, therefore, does not necessarily apply to L2 competence. Second, their evidence concerns adults with brain damage. Therefore, it does not necessarily follow that adults with normal neurological systems will experience difficulty learning an L2.

Apart from these conceptual weaknesses, however, there is still a good deal of controversy as to when lateralization is completed. By reanalyzing the data used by Lenneberg (1967) and additionally conducting dichotic listening tests, Krashen (1973) claimed that the completion of lateralization occurs by the age of 5. Furthermore, Krashen (1975) cites some researchers who argue that lateralization is basically complete at birth. If one of these claims turns out to be correct, the difficulty adults have with L2 pronunciation cannot be attributed to lateralization of the brain.

Other researchers maintain that the process of lateralization may start very early in life, but is not completed until puberty or even later in life in some people (Levy, 1974; Seliger, 1981). Based on Levy's (1974) clinical data, Seliger (1981) estimates that about 36% of a normal population still retains brain plasticity after puberty. Seliger attempts to explain the so-called exceptions to the critical period hypothesis (those people who learned an L2 as adults and have mastered native-like accent). He claims that although 36% of adults have the biological potential to acquire a native-like accent, only a small percentage of these fulfills such potential due to other inhibiting forces such as cognitive, socio-affective, and environmental factors.

Even if Seliger's (1981) conclusion regarding the termination of lateralization is correct, the relationship between lateralization and accentless speech is still highly speculative. It is not clear why lateralization of language function would mainly affect the phonological aspect of second language acquisition. Since L2 phonological acquisition involves perceptual and psychomotor skills, researchers in this field should study the neurological mechanisms related to these skills specifically.

Walsh and Diller (1981) attempted to provide a neurological explanation for the discrepancy between L2 learners' phonological ability and syntactic or lexical ability. They claim that the reason why foreign accents are difficult to overcome after childhood is that pronunciation is a lower-order process which is "dependent on the early maturing and less adaptive macroneural circuits" (p. 18). In other words, once these innate macroneural circuits, by which newborn infants are capable of detecting certain phonetic features (Elmas, 1974), are imprinted with patterns of pronunciation early in life, they do not change with experience. On the other hand, lexicon and syntax are higher-order processes which are more dependent on the late maturing

neural circuits. This is why adults can learn the grammar and lexicon of an L2 many times faster than children.

Flege (1987) criticizes Walsh and Diller's (1981) argument. He maintains that their hypothesis with regard to the role of the feature detecting neural circuits would be accepted by few researchers of speech perception and is inconsistent with research results concerning the perception of L2 phonetic contrasts by adult L2 learners. In support of his criticism Flege cites studies by MacKain et al. (1981) and Williams (1980) on the perception of L2 phonetic contrasts by L2 learners. Both studies indicate that as a function of exposure to an L2, learners' perceptions of some L2 phonetic contrasts become increasingly more native-like. For example, MacKain et al. found that adult Japanese learners of English with sufficient exposure to conversational native speaker English can discriminate the members of a synthetic /r/ and /l/ continuum just as native speakers of English. Flege concludes that "there does not seem to be evidence for a discontinuity in neural development that could be reasonably regarded as coinciding with a clear change in speech-learning abilities" (p. 165).

To summarize this section, based on existing evidence no definite neurological claim can be made with regard to children's superiority over adults in L2 phonological acquisition.

The Habit Formation Argument

This argument maintains that L1 habits interfere with the acquisition of L2 habits in perception and production (Lado, 1957). Politzer (1970) suggested that the interference from L1 habits is great in adults, small in children because L1 habits are not as strongly established in children as in adults. Physiologically speaking, this may mean that the perceptual and psychomotor mechanisms of children are not constrained by L1 as much as those of adults.

More recently, Flege (1987) proposed a similar hypothesis with regard to the perception of L2 sounds by children and adults:

Children pronounce a L2 better than adults because they tend to process speech in an 'auditory' rather than a 'phonetic' mode more often, or to a greater extent, than adults, and that this enables them to develop more accurate perceptual 'targets' for L2 sounds. An auditory mode of processing makes use of the psychoacoustic capabilities with which all individuals are endowed. A phonetic mode of processing, on

the other hand, imposes on sensory input patterns of perceptual processing that have been shaped by previous linguistic experience. (p. 172)

Although the habit formation theory was rejected as a theory of language acquisition (Chomsky, 1959; Dulay & Burt, 1975), many empirical studies do suggest that L1 transfer plays a major role in adult L2 phonology (e.g., Carroll & Sapon, 1958; Lotz et al., 1960; Scholes, 1968; Miyawaki et al., 1975; Gass, 1984 for perception; Briere, 1966; Johansson, 1973; Flege, 1980; Tarone, 1980; Broselow, 1984; Ioup, 1985 for production. For a compendium of articles on interlanguage phonology, see Ioup & Weinberger, 1987.). Some researchers even suggest that L1 transfer is prevalent only at the phonological level, but not at the syntactic level (e.g., Ioup, 1985).

The habit formation argument as proposed here does not deny the existence of the creative construction mechanism in the acquisition of L2 phonology, however. In fact, there is substantial evidence to show that the learner's interlanguage phonology is evolving toward the target language phonology unless it is 'fossilized' (Dickerson, 1975; Flege, 1980; Gass, 1984). Furthermore, developmental processes have been reported in the acquisition of L2 phonology (for a review of such processes, see Tarone, 1978, and Sekiya, 1984). Therefore, L1 transfer here should be regarded as an important part of the L2 phonological acquisition process. Furthermore, L1 transfer phenomena includes not only mechanical transfer of exact L1 variants, as conceived by the original contrastive analysis proponents such as Lado (1957), but also other indirect cross-linguistic influence (Flege, 1980).

Although there is a great deal of impressionistic opinion that children exhibit less interference than adults in L2 phonology, there has been little empirical research measuring the actual extent to which L1 transfer plays a role in children's acquisition of L2 phonology (see Wode, 1980). So the claim that children exhibit much less L1 influence in the acquisition of L2 phonology than adults awaits further verification.

Unlike the neurological argument, which considers puberty to be a sudden turning point for L2 phonological acquisition, the habit formation argument does not specify any such age, but suggests that the younger one learns an L2 the better. Therefore, the habit formation argument can explain not only why children are better than adults but also why younger children are better than older children in the

acquisition of native-like speech (Asher & Garcia, 1969; Oyama, 1976; Seliger, Krashen, & Ladefoged, 1975).

Furthermore, unlike the neurological argument, the habit formation argument does not imply the ultimate loss of the ability to acquire accurate L2 sounds. Neufeld (1978) demonstrated that with proper training adults are biologically capable of learning new L2 sounds. In this experiment, 20 English-speaking college students were given a special intensive training in the pronunciation of 100 stock phrases of Japanese, Chinese, and Eskimo. The results of this experiment indicated that about 50% of his subjects were judged to have native-like accent. Further research needs to be conducted to see if their native-like pronunciation would carry over into actual communication. However, Neufeld's results demonstrated that many adults have not lost their *biological* capability to perform new articulatory behaviors of L2 sounds, at least under rigorous conditions.

One important point about Neufeld's (1978) technique of pronunciation teaching is that the subjects did a great amount of listening, focusing on rhythm, pitch, and intonation contours of the utterances before they were allowed to imitate them. Neufeld maintains that the learner's speech perception is influenced by his L1 phonology. Once inaccurate acoustic images of L2 pronunciation are formed due to L1 interference and are fixed in the learner's mind, they also affect the articulation of these sounds. Therefore, it is important for the learner to establish accurate sound images of L2 sounds before attempting to produce them. Neufeld's argument is interesting in that children in a naturalistic L2 environment are also observed to do a great amount of attentive listening before they attempt to speak an L2 (Dulay, Burt, & Krashen, 1982).

To summarize, the habit formation argument is plausible in that it can account for child-adult differences in terms of the amount of L1 interference. However, the claim that children experience much less interference from their L1 phonology than adults should be investigated empirically. Furthermore, it has been suggested that with proper training adults can acquire native-like pronunciation.

The Socio-Affective Argument

The socio-affective argument suggests that the learner's socio-affective traits such as attitudes, motivation, cultural identity, and

empathy will influence his achievement in L2 phonological acquisition. Krashen (1982) suggests that socio-affective variables influence progress in second language acquisition in at least two ways. First, learners with positive socio-affective states will attempt to communicate more with speakers of the target language and therefore receive more input than learners without such socio-affective states. (This point will be discussed later in the section on the input argument.) Second, L2 learners with positive socio-affective states will be more open to L2 input. That is, given the same amount of input, learners with positive socio-affective states will acquire more input than learners without such socio-affective states. In the light of this second point the effects of socio-affective variables on the acquisition of L2 phonology will now be discussed.

With the onset of the formal operational stage³ around puberty, children become increasingly conscious of themselves (Elkind, 1970). This also relates to increasing awareness of their cultural/ethnic identity. They will develop a stronger sense of cultural/ethnic allegiance or negative social attitudes towards one language/culture or another⁴ (Schumann, 1975; Brown, 1980). As a result, it will be harder for them to adopt a new cultural/ethnic identity. These changes in the learner's socio-affective states seem to have a great consequence in L2 learning, including L2 phonological acquisition.

There is substantial evidence to suggest that pronunciation is an important aspect of cultural/ethnic identity (Bourhis & Giles, 1977; Beebe, 1977; Beebe & Giles, 1984). If children in an L2 environment experience relative ease adopting a new cultural identity, we should expect them to adopt L2 pronunciation relatively easily too. On the other hand, many adults might have difficulty assimilating new pronunciation behaviors because of a psychological block against adopting a new cultural identity.

However, some adults have integrative motivation to learn a second language, that is motivation to achieve L2 proficiency in order to participate in the target culture or to be a member of the target society (Gardner & Lambert, 1972). These adults may be willing to adopt new cultural norms, and may thus try to improve their L2 pronunciation. Seliger et al.'s study (1975), previously described, presented some evidence to support the claimed relationship between integrative motivation and pronunciation achievement. Among the subjects in the 10 to 15 age group, those with no accent tended to consider themselves

“more American” than those with an accent. These results concur with Gardner and Lambert’s conclusion that learners with integrative motivation develop better oral skills.

Another important observation is that children are under more pressure to conform to the norms of their peers, including norms of pronunciation (Tarone, 1978; Peck, 1978; Brown, 1980; Snow & Hoefnagel-Hohle, 1977). Children even mock the child learner’s accent directly (Peck, 1978). Thus, in order to be accepted into their peer group, child L2 learners try to adopt the same accent as their peer group. On the other hand, adults are not only less susceptible to peer pressure to conform but are often willing to retain their foreign accents in order to maintain their cultural/ethnic identity (Snow & Hoefnagel-Hohle, 1977; Beebe & Giles, 1984).

Adolescents in an L2 environment are also under pressure to conform to the norms of their peers (Oyama, 1976). However, adolescent L2 learners are considered to have a disadvantage over child L2 learners in that having already developed a cultural/ethnic identity, adolescents have more “perceptive filters to readjust” (Brown, 1980, p. 139). From this argument, we should expect children to surpass adolescents, and adolescents to surpass adults in L2 phonological attainment in naturalistic environments. The data reported by Oyama (1976) and Seliger et al. (1975) support this hypothesis.

It should be noted that in a foreign language classroom, where the learners are all non-native speakers of an L2 from the same L1 background, peer pressure may work against L2 pronunciation development. The learners may make little effort to master L2 pronunciation for fear of sounding “foreign” or different from others in the class, thus retaining their L1 accent in their L2 (Stevick, 1976; Hildebrandt & Giles, 1981).

With regard to the relationship between identity and pronunciation, Guiora et al. (1972a, 1972b, 1980) proposed an interesting argument. According to Guiora et al., pronunciation is the most important contribution of “language ego” (the identity a person develops in relation to the language he speaks) to a person’s identity. They suggested that children’s flexible ego boundaries allow them to identify or empathize with the speakers of a new language, and as a result, children in an L2 environment assimilate native-like pronunciation of the language relatively easily. However, this is not usually the case with many adults, who have already established firm ego boundaries.

Nonetheless, some adults are considered to have higher empathy levels than others. Guiora et al. (1972a, 1972b, 1980) suggest that the higher the person's empathy level is, the better chance he has of achieving good L2 pronunciation. Guiora et al. attempted to demonstrate the correlation between empathy and L2 pronunciation ability experimentally. In their first experiment, Guiora et al. (1972a) attempted to increase the empathy levels of subjects through the use of alcohol. They found that the pronunciation of subjects given a small amount of alcohol was significantly better than that of a control group. Brown (1980) criticized this experiment by arguing that muscle relaxation caused by alcohol may be a more important factor in accounting for the superior pronunciation performance of the subjects than the affective effect. To address this criticism, Guiora et al. (1980) replicated the alcohol study using valium instead of alcohol as a means of increasing subjects' empathy levels. The results indicated a relationship between empathy and pronunciation, according to researchers.

Hill (1970) also supports the socio-affective argument based on some anthropological evidence. Challenging Scovel's (1969) neurological argument for the critical period hypothesis, Hill introduces Sorenson's (1967) report that in some non-Western societies, where multi-lingualism is highly valued, adults acquire native-like fluency in second languages. Hill interpreted this report as indicating that lack of empathy with the speakers of other languages on the part of adults is not universal, but culturally-determined.

One serious weakness with Hill's argument is that it is based on second-hand anecdotal evidence. There is no empirical evidence to show that those adult L2 learners whom Sorenson reports to have achieved native-like proficiency actually speak the language with native-like accent. However, if further research shows that this is the case, it would be strong evidence against the neurological argument for the critical period hypothesis and strong support for the socio-affective argument.

To summarize this section, the socio-affective argument is certainly appealing in that it can explain both child-adult differences and individual variation among adults in L2 phonological attainment. At present, however, much of the evidence is impressionistic. More research is needed.

The Input Argument

The input argument is not equivalent to Krashen's (1985) Input Hypothesis. The input argument states that the quantity, the quality, and the conditions of input are important in determining the degree of success in achievement of native-like accent.

It has been mentioned previously that in general, children in an L2 environment are highly motivated to assimilate with their peers, while adults are not. This difference in integrative motivation will naturally relate to the amount of contact with speakers of the target language. This, in turn, will relate to the amount of native speaker input and the intensiveness of the input they will receive. Those with integrative motivation, children or adults, will have more contact with target language speakers; thus they will receive more intensive native speaker input than those without integrative motivation (Gardner & Lambert, 1972; Seliger et al., 1975; Oller, 1977; Beebe & Giles, 1984). Snow and Hoefnagel-Hohle (1978) report that English-speaking children learning Dutch in Holland received more L2 input than adults.

In addition to the amount of native speaker input, how that input is received by L2 learners also seems to affect the nature of L2 phonological development. As mentioned in the discussion of the habit formation argument, many children are reported to go through a "silent period," during which they do a great deal of intensive listening. This period will help them to form accurate acoustic images of L2 segmental and suprasegmental sound features, which is subsequently crucial for their accurate production (Neufeld, 1978). On the other hand, adults, pressured to communicate from the start, often have to produce L2 sounds before they have formed accurate acoustic images. Once inaccurate acoustic images of the L2 sounds become fixed in the learner's mind, they affect production (Neufeld, 1978). Interestingly, the Vaupes River Indians in Brazil, who are reported to acquire a native-like command of an L2 as adults, also engage in attentive listening before they try to produce (Sorenson, 1967).

Related to the silent period argument is the claim that children in a naturalistic L2 environment depend on the 'ear' more than adults for pronunciation. Adults are more likely to depend not only on native speaker input but also on other sources for pronunciation, such as orthography and articulatory explanation of L2 sounds.⁵ These other sources of pronunciation may interfere with the learner's formation of

accurate acoustic images of L2 sounds, and thus their production. Sekiya (forthcoming) provides some data to show children's dependence on the acoustic images of L2 sounds for pronunciation. In a study on the acquisition of English pronunciation by 80 Japanese children in the United States, the researcher reports many instances of the substitution of /f/ for /θ/ among the subjects. This substitution is attributable to the acoustic similarity of /θ/ and /f/ (Delattre, Liberman, & Cooper, 1962), and is often found among children acquiring English as L1 (Edwards & Shriberg, 1983). This kind of substitution is not reported among Japanese adult learners (Kohmoto, 1975).

To summarize this section, children seem to have an advantage over adults in terms of the native speaker input that they receive in an L2 environment. The amount of input, the quality of input, and how children receive input all seem to be favorable for their acquisition of L2 phonology.

Factors Related to Adults' Varying Degrees of Success in L2 Pronunciation Achievement

In the previous sections I have examined factors influencing L2 pronunciation development in terms of child-adult differences. The following studies by Suter (1976) and Purcell and Suter (1980) attempt to account for adults' individual variation in their ability to acquire L2 phonology. Suter (1976) studied the correlations between English pronunciation accuracy scores and 19 variables for 60 non-native speakers of English from four language backgrounds: Persian, Arabic, Japanese, and Thai. The results of Purcell and Suter's (1980) reanalysis of Suter's original data indicated that the following four variables were the most significant predictors of pronunciation accuracy: (1) L1 background; (2) aptitude for oral mimicry; (3) length of residency in the L2 country; and (4) strength of concern for pronunciation accuracy. It should be noted that age of arrival was not included among the four best predictors.

In interpreting these results, several important points are implied. First of all, the finding that age was not such a significant predictor as these four variables may seem contradictory in light of the evidence presented in the first section of this paper. But actually it is not contradictory. This result seems to be attributable to the fact that none of the subjects had arrived in the U.S. before puberty. If prepuberty-

arrival subjects had been included, age would likely have been among the significant predictors.

Second, two possible interpretations of the most important predictor, L1 background, were suggested by Suter (1976): (1) Phonological and phonetic differences between L1 and L2 may have affected the learner's pronunciation accuracy, or (2) cultural or personality traits of each language group may have affected their pronunciation accuracy. The first interpretation is related to the habit formation argument. The second is related to the socio-affective argument, more specifically Hill's (1970) claim that different cultures have different attitudes towards learning other languages, resulting in different degrees of L2 proficiency.

Conclusion

Accumulated evidence supports the popular claim that children are superior to adults in the long run in the acquisition of L2 phonology in naturalistic settings. Several possible explanations for this were examined in this paper. At present, the neurological argument does not have as much empirical support as it was once claimed to have. However, it is possible that there is still some neurological component in children's superiority over adults. The habit formation argument, the socio-affective argument, and the input argument also seem to be plausible as explanations for the children's advantage, and these arguments have more support. They are not necessarily mutually exclusive. In fact, it is likely that these three factors affect the acquisition of L2 phonology in one way or another. The interaction of these factors seems to provide a fairly adequate account of why children are superior to adults and why some adults are better than others in L2 phonological acquisition. Future research should be conducted to provide further empirical support for each argument and to examine to what extent each factor and the interaction of the factors influence the acquisition of L2 phonology.

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L2 Phonological Acquisition

Notes

1. L2 phonology includes not only L2 segmental features but also L2 suprasegmental features.
2. The term "naturalistic" is used to refer to an L2 acquisition environment in which an L2 is used as a medium of communication. It is in contrast with a foreign language classroom environment or an experimental learning environment.
3. The formal operational stage is a Piagetian concept of a stage of children's development. With the onset of the formal operational stage, children can deal with abstract concepts and make hypotheses, inferences, and deductions.
4. Children are reported to begin to acquire certain attitudes toward one language/culture or another as they reach school age (Brown, 1980).
5. This change in the learner's learning strategies may be related to the cognitive change people go through during the stage of formal operations around puberty (see Note 3). Due to this cognitive change, it is now possible for L2 learners to 'learn' the rules of the language *consciously* in addition to 'acquiring' them *subconsciously* in a manner similar to children (Krashen, 1981).

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