

THE ACQUISITION OF ENGLISH CONSONANTS
DURING THE FIRST TWO MONTHS OF
LEARNING ENGLISH AS A SECOND
LANGUAGE BY TWO MANDARIN
SPEAKING CHILDREN

楊 懿 麗

(作者為本校西洋語文學系專任副教授)

摘 要

近年來，兒童語言 (child language) 的研究，不但有助於解釋人類語言學習能力與其他認知能力的關係，並且提供新近語言學的理論的正反證據，促使語言學理論更趨進步。再者，兒童語言的研究，可以推測語言的演變 (參見 Jakobson 1941, 1968)。

至於兒童第二語言學習的研究 (child second language acquisition)，不但在兒童語言研究界闢開了一條新的途徑，更允許學者由另一個角度來探討人類語言學習的能力。就理論上而言，兒童第二語言學習的研究，目的在求證是否人類只俱有學習一種語言的能力？還是俱有學習二種以上語言的能力？是否第二語言的學習與第一語言的學習，循着同樣的途徑 (process)？而就應用方面而言，目的是想求知究竟兒童第二語言的學習現象能提供給外語教育什麼樣的啓示？

本論文研究兩個講中國話的學前兒童 (三歲半，五歲) 學習英語的初期形態。其主要目的在探討英語二十四個字音，在他們學習過程中的習得順序 (acquisition order)，討論潛在的音韻步驟 (phonological processes)，以及影響此習得順序的外在因素。

研究結果發現爆破音 (stops) 及滑音 (glides) 最先習得，而摩擦音 (fricatives) 及流音 (liquids) 最晚習得。此順序與英語兒童學習的順序同，印證了「第二語言之學習如同第一語言之學習」的理論。而在所犯的錯誤之中，只發現少數是受母語的影響。絕大多數之錯誤，亦與英語兒童所犯之錯誤相同，均由於某些潛在的音韻步驟 (phonological processes) 所引起。這些音韻步驟包括刪 (deletion)，增 (insertion)，替 (substitution) 及同化 (assimilation)，但是研究中，亦發現二個兒童喜愛延長 (lengthening) 某些子音，此現象為英語兒童學習過程中少見的現象，似乎是由國語的干擾所引起的。研究中亦發現此二個兒童的學習形態受着年齡及個人興趣等其他因素所影響。

I Introduction

The study of child phonology has been found to be able to shed light on the study of linguistic change (Jakobson 1941, Stampe 1969, Ferguson and Farwell 1975, Hsieh 1972, Wang 1979). After Jakobson's *Kindersprache, Aphasie, und allgemeine Lautgesetze* was translated into English (1968), phonologists have shown a growing interest in child phonology. Studies in this area are many and varied. Some focus on universal ordering, some on phonological processes, and some on rule formation. This interest is soon carried over to the research on child second language acquisition. Researchers of child second phonology acquisition, like those of other aspects of child second language acquisition, are most interested in finding if parallels exist between the acquisition of two language systems, often using data from first language acquisition research for comparison. In order to build a more solid theoretical base, there is a great demand of studies on subjects of different first language backgrounds learning the same second language, English in most of the cases. Especially worthwhile are studies in which the subject's first language is from a different language family from the second language. The present study is one such study, for Chinese and English belong to different language families.

The purpose of this study is to describe the acquisition of English consonants by two Mandarin Chinese speaking children during the first two months of learning English as a second language. Specifically, this paper describes the phonemic system and the order of acquisition, examines the processes, strategies and some factors underlying such patterning.

II Review of Literature

This section will give a brief introduction of major theoretical frameworks of child phonology and a description of recent research results in child second phonology acquisition.

II. 1. Approaches to Child Phonology

Roman Jakobson (1941) claims that phonological development is universal, that sounds that distinctively belong to a language will be acquired later than sounds that are common to all languages, and that the acquisition of certain phonemes presupposes the acquisition of certain other sounds; hence affricates imply spirants and spirants imply stops. The idea of distinctive feature analysis, which is developed in the theory of adult phonology, is applied to the study of child phono-

The Acquisition of English Consonants During the First Two Months of Learning
English as a Second Language by Two Mandarin Speaking Children

logy. The acquisition of certain phonemes presupposes the acquisition of certain features; some features are easier to acquire, e.g., consonantal vs. vocalic, than others, e.g., stridency. After 1968, the translation of Jakobson's work into English stimulated many studies on child phonology on the basis of distinctive feature contrast.¹

Yet Jakobson's distinctive feature contrast can not account for the phonological development of many individual learners. Moskowitz, for example, after investigating the speech of a twenty-six-month-old finds that the child has learned all of the distinctive features relevant to the correct production of /f v s z θ ð /, but only two of these six phonemes are really "learned." Moskowitz concludes,

The situation suggests that THE LEARNING OF DISTINCTIVE FEATURES PER SE IS NOT A PRIMARY GOAL OF MACKIE'S LINGUISTIC PRACTICE AT THAT TIME. Once learned, a feature does not necessarily spread rapidly throughout the system to all relevant segments. (1970:431)

Menn (1971) also finds that the distinctive feature hypothesis is too strong. Her subject, Daniel, did not develop his phonology according to Jakobson's schema. She suggests that Jakobson's feature contrast should be considered as "a scheme of innate abilities" rather than as being able to give predictions as to the order of acquisition (p.246). She is much concerned with individual differences caused, for instance, by specific input data.

Menn and many others are more interested in writing rules to account for the processes employed by the child learner. Their rules are called phonotactic rules. They believe in the distinction between an underlying form and a surface form. They propose that the deviant productions of the child learner are the results of the application of a certain set of phonotactic rules. The following example, taken from Ingram (1974a:54), illustrates two such rules (only one of which actually applies in this very case).

(a) adult pronounced form	[krækɾ]
(b) child's perceived form	[kXæX]
(c) child's underlying form	[kæS]
(d) phonotactic rules	[kæ] (reduplication)
(e) substitution rules	----
(f) child's spoken form	[kækæ]

The example clearly shows that the child's system is very much different from the adult system, and the rules are different from the adult rules. Yet the child's system, however deviant it is from the adult standard system, is a productive one.

Stampe (1969), postulating the theory of natural phonology, argues that the child's system is closely conformable to the adult system. He proposes that the child's productions "result from the application of the innate phonological system to some sort of phonological representation" (1969:446). The innate system involves a full set of unlimited and unordered phonological processes which are to be revised at times by any of the three methods, i.e., suppression, limitation, and ordering. If a child fails to suppress or limit or order a certain process which does not apply in the standard language, he will deviate from the standard. To the extent that the child is able to perform any of the three tasks in order to "revise" the innate system, he is working toward the adult standard form.

Stampe has presented many instances to show that the child learns gradually to perform the three revision tasks. For example, Leopold's subject (Hildegard) first failed to suppress the process of voicing as she said [baba] (for [papa]); then she began to suppress the process, but only partially, when she said [paba]. Finally she was able to produce [papa], showing that the suppression was successfully done (p.447).

While Stampe's theory is able to explain many deviancies, his analysis has also invited criticism. For example, Menn (1980) remarks that there is no reason to believe that a child has gone through several complex processes when he produces [kæi] for "candy." In her own words,

Suppose a certain child produces no intervocalic coronals at all, and says [kæi] in attempting to match the sound of the word "candy." Can we say that the processes of nasal assimilation, degemination, flapping, and flap deletion have applied? Not unless we postulate that the /nd/ cluster exists as an articulatory target (as well as an acoustic target) to the child. But if the child in question never makes intervocalic coronal contact, how can we speak of degemination (shortening of contact), or of flapping (making contact during ballistic tongue movement)? The child simply has failed to make contact: He or she has not learned to get the blade of the tongue up to the anterior part of the palate and down again while continuing to phonate (p.35).

While the theoretical issues of child phonology are far from being settled, some researchers are satisfied with the identification of phonological processes. Many of the processes have been found to be quite universal. The following is a brief description of some most obvious phonological processes exemplified by Ingram (1974a, 1974b, 1976).

1. Reduplication and diminution. These two processes are very common in the earliest utterances of young children. Reduplication is the process in which the

The Acquisition of English Consonants During the First Two Months of Learning
English as a Second Language by Two Mandarin Speaking Children

child repeats the syllable of the word, e.g., *daddy* [dada].² Diminution is the process by which the child automatically adds an /i/ to the end of the word, e.g., *hi* [haidi], *up* [api].

2. Deletion. Deletion occurs in the following situations: (a) final consonants, (b) weak syllables, e.g., *banana* [nana], (c) consonant clusters, e.g., *sleep* [lip], *star* [ta:]. The omission of the final consonant is sometimes compensated by lengthening the preceding vowel or by using a slight glottal stop (Ingram, 1976).

3. Substitution. There are many types of substitution: (a) stopping is the process in which stops are used for fricatives, nasals, and liquids (Ingram, 1976); (b) fronting is the process in which front sounds are used for medial or back sounds (Ingram, 1974b); (c) centralization is the process in which "erroneous attempts at labial, interdental, post-alveolar and velar phones are all very much likely to turn up in alveolar position than in any other" (Olmsted, 1971: 244); (d) frication is the process in which fricatives replace liquids and glides (Ingram, 1976); (e) glides are used for liquids and one liquid is used for the other (Ingram 1976).

4. Assimilation. Assimilation is the process "in which a sound becomes similar to (or is influenced by) another sound in the word" (Ingram, 1976: 34). It can operate both backward (regressive) and forward (progressive). An example of regressive assimilation is found in *dark* [ga:k], and of progressive assimilation is found in *noisy* [nɔni:]

5. Insertion or addition. It is the process in which a sound is inserted. Usually a vowel is inserted between two consonants to make an extra syllable (Ingram 1976).

6. Voicing and devoicing. The two processes operate in opposite ways. Voicing occurs most often with initial stops, while devoicing occurs with final stops, e.g., *pie* [ba], *mud* [mat].

Does the universality of these processes apply also to second language learning? This is one of the research questions of the present study.

While emphasis has mostly been on the search for universality of language acquisition, some researchers begin to feel the need to study individual variations in phonological acquisition. Ferguson (1979), for instance, not rejecting the value of the search for universality in child phonology, feels that findings on individual differences will contribute to a total understanding of the learning of a phonology. He has found that individuals might choose different routes in learning particular sounds, that certain strategies³ result in certain patterns of phonology acquisition, and that children often have different learning styles to tackle their learning task.

To sum up, research of child phonology has achieved very much in the past two decades, giving rise to a vast array of ideas and theories. From distinctive feature

hypothesis to natural phonology, from phonotactic rules to phonological processes, from universal sequence assumption to individual difference consideration, each theory contributes one way or another to unravel the mechanism underlying child phonology. A better picture might emerge some day. Meanwhile, research evidence from child second phonology studies might also prove helpful in settling some theoretical issues.

II. 2. Child Second Phonology

A couple of studies on children learning two languages (one of which is English) at an early age have found that the acquisition of English consonants by these children is rather similar to that by the English monolinguals: stops are acquired first, and fricatives last (Celce-Murcia 1978, Burling 1978, Itoh and Hatch 1978). Phonological interference from the other language is also reported in these studies. Celce-Murcia's daughter "strongly articulated" the /t/ in *potty*, an example of the influence of French phonology (p. 45). Burling attributes the inconsistency in his son's articulation of /f/ and /v/ to the influence of Garo (p. 57). Itoh and Hatch find that the substitution of /h/ for /f/ and /b/ for /v/ are due to interference from Japanese. Leopold (1978), on the other hand, finds "very little" evidence of interference of either language (English or German) on the other (pp. 25-26). All these studies have found cases of simplification such as devoicing, final consonant deletion, consonant-cluster reduction, and glide substitution.

Henning Wode (1978a, 1978b), in studying his four children (ages 4, 6, 8, 9) learning English as a second language, finds that the four children did not acquire English in a Jakobsonian type of developmental sequence, nor in an approach reminiscent of the feature/process hypothesis implicit in Ingram. Instead, he discovers that the children approached L2 phonology through "the grid of L1 phonological system." He proposes a theory of equivalence which states that L1 either facilitates or interferes the acquisition of L2 phonology. He says, "L2 phonological elements are scanned for equivalencies and for non-equivalencies. That is the L2 elements are checked as to how similar they are to the L1 elements at the child's disposal." (p. 114) He has identified many instances of L2 targets being substituted by L1 elements, the results of the equivalence process. The most interesting case is the productions of English /θ ð/ by three of the children who, in the course of their L1 development, had had a lisp. The three children were nevertheless using the German /s z/ for the English /θ ð/. (1978a: 105)

Wode also notices cases that can not be explained by his equivalence theory. The most obvious instance is the acquisition of /r/. Four types of substitutions are

found: the uvular [R], the bilabial [w], the central continuant [ʝ], and the retroflex [ɭ] (1978b: 119). Only the [R] substitution can be judged as L1 interference, and yet it appeared rather sporadically. Wode finds that the four types of substitutions for /ɣ/ occurred in a fixed order in the speech of all four children. What surprises him is that this order, with the exception of the uvular [R] substitution, is also the order found for native speakers of English.

Clearly, L2 phonology research is at its beginning stage. While interference or facilitation of L1 phonology is very likely, in L2 phonology acquisition a specific order of acquisition can also be expected. Whether this order is identical to the order of L1 phonology is still an open question. More studies are needed to prove or disprove it.

III. Methods and Procedures

III. 1. Subjects

The ages of the two children whose speech is being studied are 5;3 and 3;6. The five-year-old is a girl and will be called H, and the three-year-old is a boy and will be called C. They are children of the same parents, but they are of very different character. H is quiet and alert; C is talkative and less attentive. Their acquisition of their mother tongue is quite different. H had a very active babbling stage between 0;6 and 1;0. She said her first word at 0;11, the same time she started to walk. While C did not babble until he started to say one-word utterances at 1;6. His many motor skills were developed late compared to his sister's. Both children were exposed to three dialects of Chinese--Mandarin Chinese, Hakka, and Taiwanese. On the whole, Mandarin and Hakka are dominant. Both children can understand Taiwanese but can speak only a little of it.

The children were not exposed to English before they came to the United States in January 1980. However, they are linguistically conscious. When they were enrolled in a public nursery school on February 7, 1980, the boy said that he did not want to go to school because he could not speak English. But he soon began to like going to school as his sister did. H had, from the very beginning, liked to go to school and to play with English-speaking children in school and in the neighborhood.

III. 2. Procedures

Besides taking notes on an every-day-observation basis, seven recordings were made from March 7 to April 14. Each time the two children were recorded sepa-

rately for the same materials. Despite their individual preferences, they learned almost the same set of materials at the same time. During the recording sessions, the children were prompted to make spontaneous utterances by pictures, spelling books with vivid pictures, real objects, and translation in mother tongue and illustrations of situations. When they failed to say the word by themselves, the present writer would say it once for them to imitate. When the first imitation was not audible, more imitations were encouraged. During the first two sessions, there were more imitations, but in the last three sessions, the children could say most of the words without being prompted. Since research has found that there is no significant difference between the use of spontaneous speech and imitative speech,⁴ both types of utterances will be used for analysis. Besides, there are three reasons for the inclusion of imitative utterances: (1) imitation is an important step and strategy for them at this early stage of language learning- they learned many words during the recording; (2) the ability to imitate well can also be an index to the ability to produce correctly; (3) imitation is a good way to elicit phonemes that the children may try to avoid in spontaneous speech.

The recordings were then transcribed by the present writer.⁵ The IPA (KK) was used. A number of other symbols were also used to mark the distinctive characteristics of their productions. They are as follows:⁶

w	labialized	[f̥]	U	grooved	[s]
~	nasalized	[ã]	:	lengthened	[s:] [a:]
ɹ	palatalized	[t̪]	◦	devoiced	[b̥]
ɻ	retroflexed	[t̪ʳ]	h	aspirated	[tʰ]
•	slight pause	[s•]	f	frication	[rʃ]
L	liquidized	[z]			

IV. The Data

The total inventory consists of 120 lexical items or so. This inventory is presented in the appendix. The words are presented alphabetically. The letter S in parentheses after the word means that the word was uttered spontaneously. If there are more than one phonetic representation, they are arranged in the order they were produced.

V. Results

The English consonants produced by the two subjects are presented in Table 1. Column 1 lists target phonemes; Column 2 and 3 are H's and C's productions of the target phonemes at various positions as shown in the words in Column 4. The last column gives the position of the phoneme in the word. The table gives a clear picture of the phoneme system the children have at the given point. Several preliminary observations can be made.

1. Of the twenty-four English consonants, fifteen have more than one allophone, including the $[\phi]$ phone.

2. For many phonemes, the distribution of their allophones is systematically determined by the position of the phoneme in the word; for instance, stops are clearly aspirated at syllable initial position, but deleted at syllable final position. $[\phi]$ is most likely to occur at syllable or word final positions or in clusters.

3. The devoicing of voiced stops at word-final position is rather scarce. On the contrary, the two subjects tend to lengthen the voicing to result in almost an extra syllable. The devoicing of voiced fricatives is common in both children's speech.

4. The younger child, C, has more deviant productions. But his deviancies are not caused by his first phonology; rather, they are caused by his undeveloped speech organism. His liquids are strongly fricativized, and his fricatives liquidized or grooved. Also, he has more instance of final consonant deletion.

5. The three nasals merge into one ($/\eta/$) at word or syllable final positions by both subjects.

6. The liquid $/r/$ has the greatest number of allophones. At word initial position, it is correctly produced; at post vocalic position, it is deleted; and in clusters, it is often substituted by $/w/$, and sometimes by $/l/$.

7. If taking only the initial position into consideration and using the number of deviancy as measure, the order of acquisition roughly looks like: glides, stops, affricates, nasals, liquids, fricatives.

Table 1. English Consonants Produced by H and C

1	2	3	4	5
P	p ^h	p ^h	piano, please, apple, help, stop, ship	I F
	p	p	spaceship, happy	I
		φ	help, stop	F
b	b	b	bed, bird, black, brother, bus, boat, football, birthday, subway[s^būwey], zebra, baby	I
t	t ^h	t ^h	Texas, TV, eight, jet, right, boat	I F
	t	t	star, stop, street, doctor, rooster	I
	φ	φ	football, night, peanut, rabbit, rocket, carrot(C), boat(C), elephant(C)	F
d	d	d	dog, doctor, don't, good, hand(H), wind(H)	I F
	d		bed, bird	F
		φ	bird, bed, hand, road runner, wind	F
k	k ^h	k ^h	car, cookie, cowboy, clock, corn, truck(H), cake(H), black(H)	I F
	k	k	squirrel, icecream, twinkle	I
	φ	φ	doctor, walk(C), truck(C), black(C), clock (C)	F
g	g	g	good, green, dog, egg(I)	I F
		φ	egg	F
w	w	w	wagon, wind, walk	I
y	y	y	yes, yea	I
h	h	h	hand, helicopter, help	I
f	f	f	five, four, coffee(C), elephant, fish, football, Safeway [sefūwey]	I
		φ	coffee	I
v	b	b	TV, very	I
	φ	φ	five	F
θ	s	s	thank, birthday, thumb (H)	I F
	f	f/t	three, thumb	I
ð	d	d	mother, brother	I
s	s	s	bus, horse(H), next, six, sleeping, star(H), street(H), submarine, subway, swing(H), yes(H), Texas(H)	I F
	φ	φ	spaceship, rooster(C), horse(C), Texas(C) yes(C), star(C), street(C), swing(C)	I F
z	z	z	zebra	I
	z	z	please, cheese, cherries(H)	F
		φ	cherries	F

The Acquisition of English Consonants During the First Two Months of Learning
English as a Second Language by Two Mandarin Speaking Children

Table 1. (continued)

1	2	3	4	5
ʃ	s/ʃ	s	shell, she	I
	ʃ	ʃ	fish, ship	I F
ʒ	z	s	television	I
č	č	č	cheese, cherries	I
ǰ	ǰ	ǰ	juice, John (C)	I
	tʂ		John, jet	I
	dz		Brackenridge	F
		č	Brackenridge	F
m	m	m	moon, mother, sesame, snowmobile	I
	ŋ	ŋ	pumpkin, drum, cream, swim(H)	F
n	n	n	night, nine, next, peanut, bunny, hand, elephant	I F
	ŋ	ŋ	don't, moon(H), crayon, green, John, longhorn, nine(H) pen(H), pumpkin, submarine, train	F
	φ	φ	corn, nine(C), pen(C), moon(C)	F
			swing, sleeping, longhorn, monkey, thank	F
l	l	l	Colorado, elephant, milk, help, shell	I F
	φ	φ	walk, apple, football, motorcycle, sleeping(C), please(C)	I F
	w		flower	
r	r	r	rabbit, roadrunner, rocket	I
	l	l	squirrel(C), cream(H), barrow, Colorado(C)	I
	φ	φ	bird(C), airplane, horse(C), star, butter, mother	F
	w	w	frog, Brackenridge(H), umbrella(H), zebra, brother, cream(C), submarine(C), three, very(C), carrot(C), cherry(C), green	I

Column 1: target phoneme

Column 2: H's production

Column 3: C's production

Column 4: words in which the sound appears

Column 5: positions in the syllable, I (initial), F(final)

* The big letters C or H in parentheses denotes that only C(or H) has such production for the particular phoneme.

VI. Discussion

The acquisition order, given tentatively earlier confirms, to a certain extent, the universal order hypothesis. Compare, for example, the ordered given by Salus and Salus (1974:155).

Years	
3 1/2	b p m w h
4 1/2	d t h g k n y
5 1/2	f
6 1/2	v ʈ z s l
7 1/2	s z θ r

Using age 5 1/2 as the dividing line, fricatives and liquids are acquired later than glides, stops, and nasals. Such a picture is rather pleasing. But a closer look at each of the phonemes will reveal much variation than first felt. This is especially clear in the acquisition of fricatives. The order of acquisition for both subjects in the present study is

f s ʃ z v (θ ʈ ʒ)

And the order for the native speakers of English is

f v ʈ ʒ ʃ s z θ

The similarity between the two orders is that /f/ is the first fricative acquired, and /θ/ among the last to be acquired. But voiced fricatives are acquired much later than voiceless fricatives by the two subjects. Here the influence of the learners' first language is seen to work: voicing is not a distinctive feature for Chinese consonants. Another instance of L1 interference is found in the production of /s/—the sound has been produced with longer duration than adequate, clearly a residue of the Chinese dental sibilant plus a high unrounded back vowel. As to the interdentals /θ/ and /ʈ/, since native speakers of English also acquire them late, it is hard to say whether their being acquired late by the two second language learners is due to first language interference.

From the substitution patterns of sounds, general phonetic tendencies of learners regardless of first language backgrounds and the facilitation/interference of the first language can, once again, be brought to light. Following are results taken from Itoh and Hatch (1978:81) on fricative substitutions.

The Acquisition of English Consonants During the First Two Months of Learning
English as a Second Language by Two Mandarin Speaking Children

American Ss (after Moskowitz)	Takahiro
/f/ [p] [w]	[h]
/v/ [b-] [-f] [-b-]	[b]
/š/ [d] [š]	[š] [č] [f] [j]
/ž/ [d] [š]	[č] [s]
/s/ [b]	
/z/ [š]	
/θ/ [p] [š] [t] [f] [s]	[s] [š] [t] [p] [f]
/ð/ [d]	[d] [z] [j]

And following are H's and C's substitutions of fricatives:

H	C
/f/ [b]	[f]
/v/ [b̥]	[b̥]
/š/ [s-] [ɸ-]	[s-]
/ž/	
/s/	
/z/ [z̥] [z]	[z̥] [z]
/θ/ [s] [f]	[s] [f] [t]
/ð/ [d]	[d]

In spite of the great variety of substitutions, in producing /f/ /v/ and /θ/ /ð/, the Chinese subjects and the Japanese subject show almost the same phonetic tendencies as the first language learners, i.e., /f/ and /v/ strongly labialized, /θ/ replaced by /s/ or /f/ and /ð/ by /d/. Takahiro's /h/ for /f/ has been attributed to the influence of Japanese (p. 81), and H's /š/ at word-initial positions is replaced by the Chinese lamino-palatal fricative /ɸ/. Both H and C substitute /s/ for /š/ at syllable initial position; this is not found in American subjects' nor in Takahiro's speech. Perhaps the most interesting case of substitution is H's and C's use of /z̥/ for /z/. No such substitution has been found in other studies.

The acquisition pattern of fricatives by the two subjects neither supports nor rejects strongly the universal order hypothesis. Though there are instances of interference, they are very few in number, compared to deviancies caused otherwise.

The acquisition of liquids, on the other hand, follows the same order as found for native speakers of English. Both subjects either delete the liquids at postvocalic position or substitute them with /w/ at initial position or substitute one liquid (here /l/) for the other (/r/). Labiolization is especially strong in C's speech; even when /r/ is realized as a liquid, it is often produced with lips narrowly rounded, causing clear

frication of the airstream.

Yet liquids are acquired later than fricatives by native speakers of English according to Salus and Salus, but the two Mandarin speakers seem to handle the problem with more ease. Wode's theory of equivalence finds support here.

The two subjects do not seem to have much trouble learning stops, affricates, and nasals. All six stops are picked up at the same time, an apparent instance of first language facilitation. H seems to have more difficulty mastering the affricate /tʃ/ than C. She is clearly using her Chinese retroflex sibilant (/ʈʂ/) for the English sound. The fact that both subjects merge the three nasals into one (/ŋ/) at final position is probably due to their L1 interference.⁷

The foregoing discussion of the acquisition order and the substitution patterns of English consonants by two Mandarin preschoolers suggests that none of the theories (discussed earlier) alone can account for the acquisition pattern. While there seems to be an order that bears partial similarity to the order for native speakers of English, there are also instances of interference and facilitation, supporting the equivalence theory. Some phonemes can be learned easily because of L1 experience; some are prone to be interfered; and still some are inherently difficult and require that both L1 and L2 learners must undergo the same processes. Implicit here is the idea that the young learners of the present study tend to employ a strategy to render the production task easy to perform even if their L1 does meddle in the task. I am referring to the universal phonological processes discussed in Section II. I will illustrate my point by giving specific examples.

1. Deletion. As mentioned earlier, final consonants are prone to be deleted. This process is most consistent and prevalent in the three-year-old's speech, and occasional in the five-year-old's. All stops, with the exception of /g/, in word or phrase final positions are omitted by C: *truck, help, cake, stop, rabbit, good night, hand, boat*. However, in the following words, the final consonants are not deleted: *good, ship, jet*. Instead, the final stops are sometimes pronounced in such a way as to result either in an extra syllable or a puff of air. The five-year-old has very few cases of final consonant deletion (*rabbit, rocket*), but she frequently drop them in casual speech, e.g., *night, boat, hand, help*. In imitation tasks, H can do quite well not to drop the final stops, but C often fails to perceive and produce them. Yet pretty soon, he learns to produce first /p/ in *help* and *stop*, and then /t/ in *boat* and *night*.

Word length influences their productions. While both children utter the final stops in *ship, boat*, and *good*, they omit the final stops in the following compounds:

ferryboat, spaceship, good night.

Deletion also occurs with consonants other than stops at final positions. Both C and H delete the final element in *five*. C deletes the final cluster in *six*. C also has more instances of final fricative deletion: *cherries, horse, Micky Mouse, Texas, yes*. Strangely enough, both subjects do not delete /š/, /č/, and /ǰ/.

/r/ and /l/ are also frequently deleted at postvocalic positions, e.g., *bird* (C), *star, butter, mother walk, apple, football*. In such cases, the preceding vowel is often lengthened.

When there is a consonant cluster, deletion also occurs. Usually the first element of the cluster is deleted: *box, six, spaceship, rooster, tractor, helicopter, doctor, peanut butter, football, airplane, bugs bunny, road runner*. The glottal stop is frequently substituted for the deleted medial stop (See Appendix for the transcription of these words). C's productions of *star* and *stop* are further evidence of the deletion of the first element in a cluster. The only exception is his *please* and *sleeping* where the second element is dropped.

To sum up, final consonant deletion occurs more in C's speech than in H's; stops and liquids tend to have a greater chance of being deleted than fricatives; voiceless stops are more often omitted than voiced ones; affricates are not deleted. Clustering as well as word length often leads to the deletion of some consonants. Clearly, deletion is the most available way to ease the production task.

2. Lengthening. As mentioned just before, the deletion of some consonants often results in the lengthening of the preceding vowel. Thus vowel lengthening is a measure taken to compensate for the deleted consonant. This process has been identified for first language learners (Ingram 1976). But consonant lengthening, found in the present study, seems to be rather unique. The two subjects are found to lengthen consonants, the most clear case being the fricative /s/ at word final positions (e.g., *bus, juice*). The two words are so pronounced as if they have two syllables each, the second syllable sounding like a Chinese syllable with the high unrounded back vowel. H has more of such lengthening than C, suggesting that more of her L1 phonology is affecting her L2 phonology acquisition. Other instances of consonant lengthening by H and C are *sleeping* (H), *star* (H), *street* (H), *Safeway* (H), *cheese, egg* (H), *flag, good, escalator* (H), *swim* (H), *yes*. Many of these words have clusters which H wants to avoid by lengthening the first element and C by deleting it. Clearly what they are doing is to revise the syllable structure of these words to the most manageable structure, that is, CV structure. H's lengthening of the first consonant in such words often results in a slight pause, making the words much easier to say than they actually are.

3. Substitution. Substitution patterns have been described. Some of the substitutions reflect the processes of stopping (/b/ for /f/ and /v/, /d/ for /ð/), fronting (/s/ for /ʃ/), and centralization (/s/ for /θ/). C has one more case of centralization (*basket* [task^hi]) and one more case of fronting (*rooster* [r^fuper]), both of which are produced by imitation and are cases of substituting stops for stops. Other than these, little evidence can be found for the three processes. Clearly, the two subjects have passed the stage for the three processes.

The substitution of liquids deserves more discussion. As already said, /r/ is frequently substituted by /w/ in clusters: *frog*, *green*, *three*, *zebra*, *brother*; and sometimes by /l/ in medial positions: *squirrel* (C), *barrow*, *Colorado* (C). Sometimes, C uses /w/ for /r/ even at initial positions: *carrot*, *cherry*, *submarine*. /l/ is used for /r/ in H's *cream* and C's *zebra*. However, /l/ is never substituted by /r/, indicating that /l/ is easier to acquire than /r/ for the two subjects. This is not the case with native speakers of English. Yet it is also clear that the Chinese retroflex liquid and retroflex sibilant have not speeded up the two subjects' acquisition of the English /r/.

4. Vowel insertion. Vowel insertion often occurs in clusters when no deletion occurs. The inserted vowel, in this very case, is often the lax back high vowel and sometimes the schwa. Examples are as follows.

/bl/	--- [bʊl]	black	/fr/	--- [fʊr]	frog
/pl/	--- [pʊl] [pəl]	plane, please	/kl/	--- [kəl]	clock
/fl/	--- [fʊl]	flower	/kr/	--- [kʊl]	cream

Insertion of a short vowel occurs to clusters at syllable boundaries too. In *Safeway* and *subway*, a third syllable is created by inserting /ʊ/ after the first consonant in the cluster. While insertion of vowels is less common in first language acquisition (Ingram 1976: 34), it is quite common in the two children's speech. It might be due to the interference of their first phonology which requires a syllable to be structured as CV.

5. Assimilation. In the utterances of the two children, assimilation occurs most often with words that are said in imitation. Following are the few cases of assimilation found in the inventory.

C
happy birthday [hædɪbə:sde]
strawberry [sbəbɛwɪ]
submarine [səmə'mʊɪŋ]
pumpkin [phʌmp'hɪŋ]

H
helicopter [helɪ'taptə] [helɪpa'pə]
snowmobile [snɒnobaɪ]

The Acquisition of English Consonants During the First Two Months of Learning
English as a Second Language by Two Mandarin Speaking Children

twinkle ['tiŋl]

Colorado [kələ'lado]

C's first two and H's first one are examples of regressive assimilation, that is, a later sound influences an earlier sound. H's second production of *helicopter* has a phoneme that causes assimilation deleted. Most instances of assimilation are progressive. Assimilation is not very common.

Thus far, we have illustrated the operation of some phonological processes in the speech of the two second language learners. Clearly, the two subjects have skipped some early processes (e.g., reduplication and diminution), and have created some rather idiosyncratic strategies for producing some consonants in some situations. Although the processes of consonant lengthening and vowel insertion are likely the results of L1 interference, they are nevertheless of similar nature as the other processes which are typical of L1 learners. All the processes are essentially the processes of simplification.

The revision process, postulated by Stampe in his natural phonology, can also be evidenced in the present study. Below are a few examples to illustrate the application or the lack of the application of the process of revision.

1. To the subjects, stops should be released. So when they come to produce final stops (after some time of deleting them), they, applying the process of release which should be suppressed in Standard English, produce the stops in the same way as they are at initial positions. It takes some time for the two subjects to learn to suppress the process and produce unreleased stops correctly.

2. Labialization seems to be a process naturally given. Both children's production of /f/ /v/ /θ/ and /r/ are clearly labialized. The suppression of this process seems to be quite difficult in acquiring these fricatives.

3. Though the two subjects have no difficulty producing voiced stops,⁸ they appear to be unable to suppress the process of devoicing in producing voiced fricatives.

As we examine their development over time, we find that the learners are constantly revising their system (or revising their hypotheses about the target language). For instance, in the very beginning, both children pronounce the letter C as /ç/, attempting to use their first phonology as an easy way out. But as they realize the difference, they avoid saying the letter for some time, and finally are able to produce it correctly. (Could it be that there is an innate system in them that involves a phonological process for the correct production?) Clearly, they have revised their system according to the target standard.

A few facts deserve mentioning because they might be necessary for their learn-

ing process and might account for some individual variations.

Both children often avoid (refuse to repeat or say) producing some words. When they are learning new words, both children scarcely repeat immediately. When the word is hard to produce, they even proclaim that they do not want to say it. H avoids talking about *airplanes* for some time after she has tried to pronounce it a couple of times wrongly. As the children refuse to repeat or say a certain word, they seem to say, "Wait a minute. I am not ready yet. I must figure it out myself first."

Apparently, the learners have their own styles (or strategies) of learning. C is especially fond of questioning as a way to elicit the target language. For example, one day, while looking at a picture of *airplane*, C asks, "What's this?" in Chinese. The present researcher answers him in Chinese. But he asks the same question again and again until finally the present researcher answers him in English. He is then satisfied with the answer, and ends the conversation. Because C knows that he can not produce the word comprehensible enough, he asks for it directly—as a way to prepare himself for the correct production, perhaps.

The most interesting phenomenon is that the children often appear to be immune to overt teaching. Many a time the present researcher teaches them to produce certain words by asking them to watch closely how the words (or the sounds) are produced, but they do not care to watch and rely solely on their ears to learn the words. Overt correction from adults also proves fruitless. The children always say things according to the internal system they have at the given point of time. Again, they prefer to learn in their own way.

Frequencies of occurrence seem to determine partly the correct production of some sounds in certain words. Though /j/ and /ʃ/ have presented some difficulty, both subjects correctly produce them in *juice* and *ship* both of which occur frequently in their every day speech.

The age difference between the two subjects seems to decide the ways they approach the second phonology. The older child often relies on reasoning and her first language; the younger child shows no such tendency.

Difference between their interests also affects the production of certain sounds. C, though knowing that his production of *airplane* is not correct, loves to say the word again and again. And as a matter of fact, he correctly says the word sooner than H. H on the other hand, masters the cluster in *girl* quite early which C has avoided for a long time.

The physiology of sound production does not seem to concern researchers very much. But in actuality, some sounds are easier to produce than others; it takes more

effort to produce a voiced consonant than a voiceless one. B. L. Smith has attributed devoicing to "aerodynamic factors" (1979). Ferguson observes that "the absence of dental and alveolar and labiodental fricatives in babbling is a strong indication that these sounds present articulatory problems to the child" (1978:101). It is not surprising that the two subjects of the present study have not acquired /ʒ/ at all. For one thing, the phoneme requires more articulatory operations than other fricatives. And another reason is that it occurs very rarely.

The phonological processes, the learning strategies and other factors discussed just now all point to the same conclusion: While the learners are employing some phonological processes to render their learning task easy to perform, they are actively revising their L2 phonology in their own systematic and consistent way on the basis of their L1 phonology, input data, and the adult standard. To the extent that these phonological processes and learning strategies (avoidance and questioning) mirror general cognitive structure, they are universal. Thus, the two subjects' learning of English as a second language is very much the same as the learning of a first language. Factors such as age and preference differences do cause some variations between the two learners; however, they do not affect the general picture of acquisition.

VII. Summary and Conclusion

The present study has followed the theoretical frameworks outlined earlier in discussing the acquisition of twenty-four English consonants by two Mandarin speaking preschoolers. The findings about their phoneme system are discussed in four categories: acquisition order, interference, phonological processes, and learning strategies and other factors.

The acquisition orders, either that of major sound classes or that of the sounds within a class, agree partly to the orders found for English L1 learners. Clearly some sounds are always acquired earlier than others by both first and second language learners. While the acquisition of some phonemes (e.g., stops) seems to be facilitated by the learners' L1 phonology, the acquisition of some other phonemes (e.g., liquids) seems to be predetermined by the inherent properties of these sounds, hence a universal order found for all learners. The late acquisition of /ʒ/ may also be attributed to the inherent properties that make the sound hard to produce.

The late acquisition of voiced fricatives and sounds like /z/ and /θ/ is probably due to L1 interference. There are other instances of interference. But compared to other types of deviancies, interference errors are few in number, and they actually

disappear in no time. They can be best justified as easy ways by which the L2 learners manage to speak the second language.

The phonological processes, including those under the influence of L1 phonology, reflect the universal tendency for simplification. There is also evidence for the revision process advocated by Stampe. In fact, the two learners are constantly revising their system so as to move toward the adult standard. In this sense, again the two L2 learners are very much like L1 learners.

Despite overt teaching and correction from adults, the two children learn the second language in their own way, each developing particular strategies according to their existing cognitive structure to approach the second language. Thus, H is found to avoid repetition and speaking and C found to question more. Age difference also results in different learning styles.

Factors like frequencies of occurrence of and individual preference for certain words seem to determine the correct production of certain phonemes in these words.

In short, the present study support both the universal order hypothesis and the equivalence hypothesis. Yet there is also counterevidence for either theory. The only thing we can safely claim is that the two second language learners are *actively* learning the second language *in their own way* suitable to their existing cognitive structure which already has one phonology as data base.

VIII. Postscript

By the end of the second month, the children are making great progress every day. They can spontaneously say all the words which they can only imitate in the beginning. The younger child is aware of the final consonant and can utter it in most of the cases: *truck, help, cake, stop*. And the older child can say *John* well enough to be taken as a native speaker. Both children do not hesitate to produce *airplane*, over which they have been struggling a lot; and the vowel between /p/ and /l/ and other clusters is not as long as it used to be. Clearly, their way of learning is very rewarding, and they have achieved within two months what native learners of English do in two years.

Notes

1. Stampe 1969, Moskowitz 1970, Menn 1971, Waterson 1971, Kornfeld 1971, Smith 1973,

The Acquisition of English Consonants During the First Two Months of Learning English as a Second Language by Two Mandarin Speaking Children

- Ingram 1974a 1974b 1976, Ferguson & Farwell 1975, Ferguson 1978.
2. Examples here and elsewhere are from Ingram 1976, unless otherwise indicated.
 3. Ferguson (1979) defines strategy as "ways in which a child takes an active organizational role in determining the structure of his language." (P. 194).
 4. The findings are reported in Templin (1957), Cazden (1972), Leonard, Schwartz, Folger, and Wilcox (1978).
 5. The present writer knows that ideally more than one transcriber should be used.
 6. These diacritic symbols are adapted from Ingram 1976, p. 93.
 7. In Mandarin Chinese only nasals /m/ /n/ /ŋ/ appear at word final position; in both Hakka and Taiwanese, the three nasals and the three unaspirated stops /p/ /t/ /k/ appear in word final positions. Most syllables end without any consonants.
 8. Although very few cases have been identified as having voiced stops devoiced, the present writer feels the two subjects' productions of voiced stops are not as strongly voiced as these stops should be. But because the present study did not use any spectrogram to help analyze the data, the question of voicing can not be looked at any more closely.

References

- Albright, R. W., and J. B. Albright. "The Phonology of a Two-Year-Old Child." *Word*, 12(1956), 382-390.
- Brown, R., and D. C. Hildum. "Expectancy and Identification of Syllables." *Language*, 32(1956), 411-419.
- Burling, R. "Language Development of a Garo and English-Speaking Child." *Second Language Acquisition*, ed. E. Hatch. Rowley, Mass.: Newbury House, 1978, pp. 54-75.
- Cazden, C. B. *Child Language and Education*. New York: Holt, Rinehart and Winston, 1972.
- Celce-Murcia, M. "The Simultaneous Acquisition of English and French in a Two-Year-Old Child." *Second Language Acquisition*, ed. Hatch, pp. 38-53.
- Corder, S. P. "The Significance of Learners' Errors." *IRAL*, 5(1967), 161-170.
- Dulay, H. C., and M. D. Burt. "Creative Construction in Second Language Learning and Teaching." *Papers in Second Language Acquisition*, Proceedings of the sixth Annual conference on Applied Linguistics, ed. H. D. Brown. Ann Arbor, Michigan: University of Michigan Press, 1975, pp. 65-80.
- Edwards, Mary Louise. "Perception and Production in Child Phonology: the Testing of Four Hypotheses." *Journal of Child Language*, 1 (1974), 205-219.
- Ervin-Tripp, Susan M. *Language Acquisition and Communicative Choice*. Stanford, Calif.: Stanford University Press, 1973.
- Ferguson, C. A. "Fricatives in Child Language Acquisition." *Papers on Linguistics and Child Language*, eds. V. Honsa and M. J. Hardman-de-Bautista. New York: The Hague, 1978, pp. 94-115.
- _____. "Phonology as an Individual Access System: Some Data from Language Acquisition." *Individual Differences in Language Ability and Language Behavior*, eds. C. J. Fillmore, Daniel

- Kempler, & William S-Y. Wang. New York: Academic Press, 1979, pp. 189-201.
- and C. B. Farwell. "Words and Sounds in Early Language Acquisition." *Language*, 51 (1975), 419-439.
- , David B. Peizer, and T. E. Weeks. "Model-and-Replica Phonological Grammar of a Child's First Words." *Lingua*, 31(1973), 35-65.
- Hsieh, Hsin-I. "Lexical Diffusion: Evidence from Child Language Acquisition," *Glossa*, 6(1972), 89-104.
- Huang, Joseph, and Evelyn Hatch. "A Chinese Child's Acquisition of English." *Second Language Acquisition*, ed. Hatch, pp. 118-132.
- Ingram, D. "Phonological Rules in Young Children." *Journal of Child Language*, 1(1974), 49-64.
- (a) ———. "Fronting in Child Phonology." *Journal of Child Language*, 1(1974), 233-241. (b)
- . *Phonological Disability in Children*. London; Arnold, 1976.
- . "The Production of Word Initial Fricatives and Affricates by Normal and Linguistically Deviant Children." *The Acquisition and Breakdown of Language*, eds. A. Garamazza and E. Zurif. Baltimore: John Hopkins University Press, 1977, pp. 63-85.
- , Lynda Christensen, Sharon Veach, and Brendan Webster. "The Acquisition of Word-Initial Fricatives and Affricates in English by Children between 2 and 6 Years." *Child Phonology, I, Production*, eds. G. H. Yeni-Komshian, J. F. Kavanagh, & C. A. Ferguson. New York: Academic Press, 1980, pp. 169-192.
- Itoh, H., and E. Hatch. "Second Language Acquisition: A Case Study." *Second Language Acquisition*, ed. Hatch, pp. 76-88.
- Jakobson, Roman. *Kindersprache, Aphasie und allgemeine Lautgesetze* (1941) tr. as *Child Language, Aphasia, and Phonological Universals*, trans. A. R. Keiler. The Hague: Mouton, 1968.
- and M. Halle. *Fundamentals of Language*. The Hague: Mouton, 1956.
- , C. C. Fand, and M. Halle. *Preliminaries to Speech Analysis*. Technical Report No. 13. Acoustic Lab., MIT, 1952.
- Kornfeld, J. "Theoretical Issues in Child Phonology." *Papers from the Seventh Regional Meeting of the Chicago Linguistic Society*, 1971, pp. 454-468.
- Lenneberg, E. J. *Biological Foundations of Language*. New York: John Wiley and Sons, 1967.
- Leonard, L. B., R. G. Schwartz, M. K. Folger, and M. J. Wilcox. "Some Aspects of Child Phonology in Imitative and Spontaneous Speech." *Journal of Child Language*, 5(1978), 403-415.
- Leopold, W. F. *Speech Development of a Bilingual Child: A Linguist's Record, II, Sound-Learning in the First Two Years*. New York: AMS Press, 1970 [1947].
- . "A Child's Learning of Two Languages," *Second Language Acquisition*, ed. Hatch, 1978, pp. 23-32.
- McNeill, David. *The Acquisition of Language*. New York: Harper and Row, 1970.
- Menn, L. "Phonotactic Rules in Beginning Speech." *Lingua*, 26 (1971), 225-251.
- . "Phonological Theory and Child Phonology." *Child Phonology, I, Production*, eds. G. H. Yeni-Komshian, J. F. Kavanagh & C.A. Ferguson. New York: Academic Press, 1980.
- Menyuk, Paula. *The Acquisition and Development of Language*. Englewood Cliffs, N. J.: Prentice-Hall, 1971.

The Acquisition of English Consonants During the First Two Months of Learning
English as a Second Language by Two Mandarin Speaking Children

- Messers, S. "Implicit Phonology in Children." *Journal of Verbal Learning and Verbal Behavior*, 16(1967), 609-613.
- Moskowitz, A. I. "The Two-Year-Old Stage in the Acquisition of English Phonology." *Language*, 46(1970), 426-441.
- . "The Acquisition of Fricatives: A Study in Phonetics and Phonology." *Journal of Phonetics*, 3(1975), 141-150.
- Oller, D. K. "Simplification as the Goal of Phonological Processes in Child Speech." *Language Learning*, 24:2(1974), 299-303.
- Olmsted, D. L. *Out of the Mouth of Babes*. The Hague: Mouton, 1971.
- Peizer, D., and D. Olmsted. "Modules of Grammar Acquisition." *Language*, 45(1969), 60-96.
- Richards, J. C. "A Non-contrastive Approach to Error Analysis." *English Language Teaching*, 25(1971), 204-219.
- Salus, P. H., and M. W. Salus. "Developmental Neurophysiology and Phonological Acquisition Order." *Language*, 50(1974), 151-160.
- Saporta, S. "Frequency of Consonant Clusters." *Language*, 31 (1955), 25-31.
- Selinker, L. "Interlanguage." *IRAL*, 10(1972), 219-231.
- Smith, B. L. "A Phonetic Analysis of Consonantal Devoicing in Children's Speech." *Journal of Child Language*, 6(1979), 19-28.
- Smith, N. V. *The Acquisition of Phonology: A Case Study*. Cambridge: University Press, 1973.
- Stampe, D. "The Acquisition of Phonetic Representation." *Papers from the Fifth Regional Meeting of the Chicago Linguistic Society*, 1969, pp. 443-454.
- Stevens, Peter, "Spectra of Fricative Noise in Human Speech." *Language and Speech*, 3(1960), 32-49.
- Templin, M. *Certain Language Skills in Children*. Minneapolis: University of Minnesota Press, 1957.
- Wang, W. S-Y. "Competing Changes as a Cause of Residue." *Language* 45(1969), 9-25.
- Wang, William S-Y., and John Crawford. "Frequency Studies of English Consonants." *Language and Speech*, 3(1960), 131-139.
- Waterson, N. "Child Phonology: A Prosodic View." *Journal of Linguistics*, 7(1971), 179-211.
- Weir, Ruth. *Language in the Crib*. The Hague: Mouton, 1962.
- Winitz, H. *Articulatory Acquisition and Behavior*. New York: Appleton-Century-Crofts, 1969.
- Wode, H. "Developmental Sequences in Naturalistic L2 Acquisition." *Second Language Acquisition*, ed. Hatch, pp. 101-117. (z)
- . "The Beginning of Non-school Room L2 Phonological Acquisition: A Survey of Problems and Issues Based on Data from English as L2 with German as L1." *IRAL*, 16 (1978), 109-125. (b)

Appendix: Inventory of H's and C's Productions in the First Two Months

Standard Spelling	H's productions	C's productions
airplane (S)	ɛ: pʊlɛ:ŋ ɛəp ^h əle:ŋ ɛɪp ^h le:ŋ	ɛ:p ^h 'le:ŋ ɛəp ^h ə'leŋ ɛəɪ ^f əp ^h 'leŋ
apple (S)	ɛ:p ^h ɔ:/eyp ^h ɔ:	ɛp ^h ɔ:
automobile (S)	ɔt ^h omobɪl	ɔt ^h omobɪl
barrow	'bɛ:lɔ/'bæro	'bɛ:lɔ
baby (S)	'beɪɪ	'beɪɪ
banana (S)	bə'nana/bɒ'nana	bə'nana:
basket	'bɛsɪkɪt ^h	'task ^h ɪ
bed	bɛd	'bɛdə
bicycle (S)	'baɪsɪkɔ:	'baɪsɪkɔ
bird	bɜrdə/bɜrd	bə:
black	bʊ'læ:k ^h	bʊ'lɛ:
boat (S)	bɔ/bot ^h	bɔ
Brackenridge	'bwɛkɪrɪdz	bwɛkɪɕ
brother	bwa:də	b ^f ʊ'ra:də
bugs bunny (S)	'bʌgbəɪɪ	'bɒ'bəɪɪ
bus (S)	bʌs:/bʌs	bə:s:/bʌs _u
cake	k ^h ɛk ^h	k ^h ɛ:
car (S)	k ^h ɑ:	k ^h ɑ:
carrot	'kæ:rət ^h	k ^h æwə
cheese (S)	ʃɪs:	ʃɪs:
cherries (S)	'ʃɛɪɪs	'ʃɛwɪ
clock	kə'lɑ:k ^h	k ^h ə'lɑ:
coffee (S)	k ^h ɑ:bɪ/k ^h ɑ:fɪ	k ^h afɪ
Colorado (S)	k ^h ɔlɔ'ra:do	k ^h ɔlɔ'lado
cookie (S)	'kʊk ^h ɪ	'k ^h uk ^h ɪ
corn	k ^h ɔ:	k ^h ɔ:
cowboy (S)	k ^h aubɔɪ	k ^h aubɔɪ
crayon	'kwæyɔŋ	'kwæyɔŋ
cream (ice cream) (S)	kʊ'lɪŋ/kʊ'lɪm	kʷɪŋ
doctor (S)	'dɔ'tər	'da'tə
dog (S)	dɔg:	dɔgə/dɔg:
don't walk (S)	'dɔŋ'wɔ:k ^h	'dɔŋ'wɔ:

The Acquisition of English Consonants During the First Two Months of Learning
English as a Second Language by Two Mandarin Speaking Children

Appendix (continued)

drum	drʌŋ	drʌŋ
egg	eg:	ɛʔ
eight (S)	et ^h	et ^h
elephant (S)	ˈeləfənt ^h	ˈeləfən
elevator	ˈɛ.ləvɪtər	ˈeləvɛtə
escalator	ɛ.s:k ^h ələtə	ˈɛs̩.kələ
ferryboat	ˈfɛlɪbɒt ^h /fɛrɪbɒt ^h	ˈfɛrɪbo
five (S)	fai	fai
fish (S)	fɪʃ	fɪʃ
flag	fʊˈlɛ:g:	fʊˈlɛ:g:
flower	ˈfwa:wə	fʊˈlawə
football (S)	ˈfʊˈbɔ:	ˈfʊˈbɔ:
four (S)	fɔ:	fɔ
frog	fwag	fʌwag/fuˈrag
girl (S)	gɜrl	gə
go (S)	go:	gɔ:/go:
good (S)	gʊd:	gʊd:
good night (S)	gʊ.ˈnaɪt ^h /gʊˈnaɪ	gʊ.ˈnaɪ
good morning (S)	gʊ.ˈmɔ:nɪŋ	gʊ.ˈmɔ:nɪŋ
green	gwiŋ	gwiŋ
hand	hændə	hæn
happy birthday (S)	ˈhæpɪˈbɜ:sde	ˈhædɪˈbɜ:de
helicopter	ˈhelɪtaptə ˈhelɪpəˈpə	ˈhelɪkəˈtə
help (S)	hɛlp ^h	hɛl
horse (S)	hɔrs̩	hɔ:
jet (S)	tʃet ^h	ʃet ^h /ʃet ^h
John (S)	tʃaŋ	ʃaŋ
juice (S)	ʃu:s:	ʃu:s
let's go (S)	ˈlɛtsgo	ˈlɛtsgo
longhorn (S)	ˈlɔŋhɔŋ	ˈlɔŋhɔŋ
Micky Mouse (S)	ˈmɪkɪmaʊs	ˈmɪkɪmaʊ
milk (S)	mɪlk ^h	mɪlk ^h
monkey (S)	ˈmʌŋk ^h i	ˈmʌŋk ^h i
moon (S)	mū:ŋ	mū:
mother (S)	ˈmadə	maɖə

Appendix (continued)

motorcycle (S)	'moto'saɪkl	'moto'saɪkl
next stop (S)	nɛs'tap	'nɛstə
nine (S)	naɪŋ/maɪŋ	naĩ
peanut butter (S)	'pɪnʌ' bʌtə	'pɪnʌ' bətə
pen	pʰɛŋ/tɛŋ	pʰɛ:
piano (S)	pʰɪ'æno	pʰɪ'æno/pɪ'nano
please (S)	pʰəlɪz/pʰlɪs	pʰɪz/pʰi:s
pumpkin	'pʰʌŋkʰɪŋ	'pʰʌmpʰɪŋ
rabbi ⁺ (S)	'ræbɪ/'rʰæbɪtʰ	'ræbɪ
	'ræbɪ	
rake	rekʰ	rʰɛg
ringing	'rɪŋɪŋ	'rʰɪwɪŋ
road runner (S)	'ro'ranə	'rorʌnə/'rolʌnə
rocket	'rakʰɪ	rʰakʰɪ
rooster	'rustə	'rʰupə
Safeway (S)	'sef:we	'sefʊwe
seethe	sɪz/si:	sɪs
sesame street (S)	'sɛsəmis:tri	'sɛsəmiɾri
she	ʃi/si	si
shell	ʃɛl	ʃɛl
six (S)	sɪs	sɪ
ship (S)	ʃɪpʰ	ʃɪpʰ
sleeping (S)	's:lɪpʰɪŋ	'sɪpɪŋ
snowmobile (S)	'snɒno baɪl	'snomobaɪ
spaceship	'spɛɪʃɪ	'spɛ:ʃɪ
squirrel	s'kɛrəɔl	'skwɔlə
star (S)	s.ta:	ta:
stop (S)	s.tapʰ/stap	tapʰ/tap
strawberry	'stɔ: 'bɛrɪ	stɔ' bɛrɪ/sbɔ' bɛrɪ
submarine (S)	səmə' rɪŋ	səmə'wɪŋ/səmə' muɪŋ
subway (S)	'sʌbuwe	'sʌbuwe
superman (S)	'sjupeɪmən	'sjupeɪmən
swim (S)	s.wɪŋ/s:wɪm	swĩ
Texas	'tesəs	'tɛ:sa
TV (S)	tɪbi	tɪbi
television	'teləvɪzɪn	'teləvɪsn

The Acquisition of English Consonants During the First Two Months of Learning
English as a Second Language by Two Mandarin Speaking Children

Appendix (continued)

thank you (S)	'sæŋkyu	'sæŋkyu
three (S)	fri/fwi	fri/fwi
thumb	sam	tam
tomato (S)	to'mæto	tə'mæto
tornado (S)	tɔ:'nedo	tɔ:'nedo
tractor	trɛ'tə	'trɛ:tə
train	tre:ŋ	triŋ
	triŋ	trẽŋ
truck (S)	trʌk ^h	trʌʔ
twinkle (S)	'tɪŋkl	'tɪtɪ/'tɪkl
umbrella	əm'bweɪlə	əm'bəɪlə
very (S)	'bɛrɪ	'bɛwɪ
wagon (S)	'wægəŋ	'wægəŋ
walk (S)	wɔ:k ^h	wɔ:k ^h
wind	wɪnd:	wɪŋ
yes (S)	yɛs:	yɛ:
zebra (S)	'zɪbwa	zɪblə
	'lɪbwa	zɪbwa