



National Library  
of Canada

Bibliothèque nationale  
du Canada

Canadian Theses Service

Service des thèses canadiennes

Ottawa, Canada  
K1A 0N4

## NOTICE

The quality of this microform is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us an inferior photocopy.

Reproduction in full or in part of this microform is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30, and subsequent amendments.

## AVIS

La qualité de cette microforme dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de qualité inférieure.

La reproduction, même partielle, de cette microforme est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30, et ses amendements subséquents.

PROCESSING CONSTRAINTS  
ON SEGMENTAL AND SUPRASEGMENTAL  
PRODUCTION IN A FOREIGN LANGUAGE.

by

QIMING XU

A thesis submitted to the Department of Linguistics  
and the Graduate School of the University of Ottawa  
in partial fulfilment of the requirements  
for the degree of

MASTER OF ARTS

in

LINGUISTICS



National Library  
of Canada

Bibliothèque nationale  
du Canada

Canadian Theses Service    Service des thèses canadiennes

Ottawa, Canada  
K1A 0N4

The author has granted an irrevocable non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of his/her thesis by any means and in any form or format, making this thesis available to interested persons.

The author retains ownership of the copyright in his/her thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without his/her permission.

L'auteur a accordé une licence irrévocable et non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de sa thèse de quelque manière et sous quelque forme que ce soit pour mettre des exemplaires de cette thèse à la disposition des personnes intéressées.

L'auteur conserve la propriété du droit d'auteur qui protège sa thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

ISBN 0-315-70473-X

Canada



UNIVERSITÉ D'OTTAWA  
UNIVERSITY OF OTTAWA

To my parents, Xu, Zuyi and Lin, Xing, without whose profound and enduring support this project could never have been undertaken.

## ACKNOWLEDGEMENTS

I would like to take this opportunity to express my gratitude and appreciation for all my teachers and other members of the Department of Linguistics for their constant support and encouragement for my M.A. studies in the University of Ottawa.

In the first place, I am deeply grateful to my thesis supervisor, Dr. Neufeld, G., for his generosity in offering time and effort for my thesis. His conscious attitude in scientific research and erudite knowledge in his field has greatly influenced the whole process of my writing of this thesis. His critical comments and valuable discussions have contributed to the successful accomplishment of the present thesis.

Secondly, my thanks also go to Régis Foré, the technician of the linguistic laboratory. Without his assistance in my laboratory experiment and his expertise in the equipment there for painstaking data analyses, the present thesis would have been impossible.

Next, I want to thank all my Subjects who have spent time and given patience for my experiment. Their active cooperation has helped in bringing this thesis into being.

Lastly, my gratitude and thanks also go to all my friends and fellow students who have provided generous help to me and have created an atmosphere to make my work easier and more interesting.

## TABLE OF CONTENTS

	PAGE
INTRODUCTION .....	1
<b>CHAPTER I: ORIGINS OF FOREIGN ACCENT: A REVIEW .....</b>	<b>4</b>
<u>The Biologically-based Critical Period Hypothesis</u> .....	4
Theoretical Research .....	4
Empirical Studies .....	6
<u>Non-biologically Based Explanations for Foreign Accent</u> .....	9
Socio-psychological and individual Factors .....	9
Cognitive Maturation Approach .....	13
<u>Some Additional Factors Relating Accent</u> .....	15
<u>Sentence Production Models and Foreign Language Accent</u> .....	20
Fromkin's Model .....	20
Garrett's Model .....	21
Motley, Baars and Camden's Model .....	22
Neufeld's Pre- and Post-articulatory Verification (PAV) Model in L2 Sentence Production .....	23
<b>CHAPTER II: METHOD .....</b>	<b>27</b>
<u>Underlying Assumptions</u> .....	28
<u>Hypotheses</u> .....	28
Tested .....	28
Untested .....	28
<u>Procedure</u> .....	28
<u>Subjects</u> .....	29
<u>Instructional Materials</u> .....	30
Phase 1 .....	31
Phase 2 .....	33
<u>Tests</u> .....	37
Test 1 .....	37
Test 2 .....	38

	PAGE
<u>Evaluation</u> .....	40
<b>CHAPTER III: RESULTS AND DISCUSSION</b> .....	<b>42</b>
<u>Analysis</u> .....	43
Tone .....	43
Articulation .....	61
<u>Discussion</u> .....	71
<b>CHAPTER IV: SUMMARY AND CONCLUDING REMARKS</b> .....	<b>75</b>
<b>APPENDICES</b> .....	<b>80</b>
Appendix A: Instruction on Exercises .....	80
Appendix B: Test 1 .....	82
Appendix C: Test 2 (I) .....	83
Appendix D: Test 2 (II) .....	84
Appendix E: Tones in Mandarin Chinese .....	85
Appendix F: Seven Target Sounds in Sentence-initial and Sentence-final Positions .....	86
Appendix G: Five Target Sounds in Affirmative and Interrogative Sentences .....	87
Appendix H: Ten Non-English Like Sounds .....	88
<b>BIBLIOGRAPHY</b> .....	<b>89</b>

LIST OF TABLES

	PAGE
TABLE 1: SUBJECTIVE EVALUATION OF ARTICULATION AND TONE IN MIMICKING IN TEST 1 AND TEST 2 .....	45
TABLE 2: SUBJECTIVE EVALUATION OF TONE IN TEST 2 .....	47
TABLE 3: SUBJECTIVE EVALUATION OF ARTICULATION IN TEST 2 .....	48
TABLE 4: SUBJECTIVE EVALUATION OF TONE OF DIFFERENT SENTENCE LENGTHS IN TEST 2 .....	49
TABLE 5: SUBJECTIVE EVALUATION OF TONE OF DIFFERENT SENTENCE FORMS IN TEST 2 .....	58
TABLE 6: COMPARATIVE EVALUATION OF ARTICULATION OF 7 TARGET SOUNDS IN SENTENCE-INITIAL AND SENTENCE-FINAL POSITIONS IN SENTENCE CONSTRUCTION .....	62
TABLE 7: COMPARATIVE EVALUATION OF ARTICULATION OF 5 TARGET SOUNDS IN THE FORMATION OF AFFIRMATIVES AND INTERROGATIVES .....	65
TABLE 8: SUBJECTIVE EVALUATION OF ARTICULATION OF 10 NON-ENGLISH LIKE SOUNDS IN TEST 2 .....	68

## LIST OF FIGURES

	PAGE
FIGURE 1: TONAL QUALITY AND SENTENCE LENGTH	
(Six-syllable sentence) .....	52
FIGURE 2: TONAL QUALITY AND SENTENCE LENGTH	
(Ten-syllable sentence) .....	53
FIGURE 3: TONAL QUALITY AND NEGATION .....	55
FIGURE 4: TONAL QUALITY AND YES/NO INTERROGATION .....	59
FIGURE 5: ARTICULATION AND SENTENCE POSITION .....	64
FIGURE 6: ARTICULATION AND INTERROGATION .....	69
FIGURE 7: ARTICULATION AND NON-ENGLISH LIKE SOUNDS .....	70

## INTRODUCTION

An issue that continues to attract much attention in the second language field is that learners beyond the age of six begin to experience greater and greater difficulty in ridding themselves of a foreign accent when speaking L2. As will be discussed in detail in Chapter 1, opinions concerning the origin of foreign accent vary considerably from discipline to discipline within the field. Some researchers claim that child/adult differences are due to maturationally-induced structural changes in the brain that make language learning more difficult with the approach of adolescence. Others claim that these differences arise from the intrusive effects of general problem solving ability that increases dramatically as children reach puberty. Although now fewer in number, some investigators still maintain that social and psychological factors account for adults' non-standard production in second language learning. Transfer and developmental errors are likewise thought to contribute significantly to articulatory deviation in the speech of L2 learners.

More recently, several scholars have related non-standard articulation and prosody in older learners (persons beyond six years of age) to problems in sentence processing, in both perception and production. This approach contrasts markedly with more traditional positions that tend to attribute problems in pronunciation to poorly internalized phonological rules. Neufeld's Pre- and Post- Articulatory Verification (PAV) sentence production model on which the present study is based is a case in point. A fundamental assumption in this model which is critical in the present study is that sentence planning and realization in a new language does not proceed in a normal manner, at least during the initial stages of learning. As Neufeld states:

an impoverished lexicon, frequent contrasting of surface structures in L1 and L2 as well as the need to handle linguistic knowledge of an explicit as well as implicit kind combine to create an artificial environment in which the output processor must function. This processor, heavily over-taxed and forced to make numerous decisions during L2 production, many of which are based on poorly internalized rules, can no

longer assign sufficient attention to last-minute refinements in articulation. Moreover, the output processor will be forced to sacrifice paralinguistic features that have little impact on meaning of planned utterances. Therefore, articulatory and supra-segmental progress cannot keep pace with lexical and grammatical development.<sup>1</sup>

Another of Neufeld's claims is that overload conditions occur during sentence planning and production, because of the L2 learner's ever-increasing preoccupation with form, that is, with morphological and syntactic composition of utterances (see Chapter I). Thus, time that might normally be devoted to prevocal verification during motor planning is reallocated for prevocal monitoring of structural accuracy. If Neufeld is correct, segmental and supra-segmental performance could be good to excellent in production tasks that involve minimal sentence planning, as in simple imitation of short syntactic strings. As will be noted, much of the method and most of the assumptions in the present study were predicated on this hypothesis.

The objective of this study was to determine whether or not English-speaking Subjects who had been instructed during Phase 1 in production of Chinese sounds and tones would improve, retain, or lose their articulatory and tonal proficiency when subsequently introduced in Phase 2 to combinatorial rules and lexical meaning. According to the tenets of the PAV model, progress in the acquisition of phonetic skills should be rapid in Phase 1 since little more than mimicking of short phrases in Chinese is involved. On the other hand, levels of phonetic proficiency attained in Phase 1 should drop significantly in creative sentence production exercises in Phase 2 where sentence planning and vocalization are necessary. Conversely, one would expect that when returning to exercises in which only imitation is required, articulation and tonal production should return to originally attained levels. Dynamic variation of this kind, if found, would go far to explain why so many adolescent and adult L2 learners, faced initially with lessons in grammar, vocabulary and

---

<sup>1</sup>Neufeld, G., "Processing Co-existing Structures in IL Competence", in preparation.

pronunciation, fail to attain even near-native accuracy at segmental and supra-segmental levels.

## CHAPTER I

### ORIGINS OF FOREIGN ACCENT: A REVIEW

In the first section of this survey, positions based on the concept of a Critical Period (CP) for language learning that pertain specifically to foreign accent will be considered. In the second section, non-physiologically-based explanations for foreign accent will be discussed. Accounts of non-native-like articulation that are not predicated upon the CPH will then follow. Finally, some sentence production models will be examined to ascertain to what extent performance factors may underlie non-standard production in the second language.

#### The Biologically-based Critical Period Hypothesis

##### **Theoretical Research**

One of the first scholars who raised the concept of a critical period for second language learning was Penfield (1964, 1959), a well-known neurophysiologist from Montreal. According to him, the child's brain is "plastic" compared with that of an adult. He suggested that "physiological stiffening" begins to occur with the onset of adolescence. His neurologically-based argument was established primarily on his clinical studies of aphasia. In accident cases where the language centres of the left hemisphere of the brain are damaged and speech is lost, children will usually recover while adolescents and adults will normally experience considerable difficulty in recovering their original power of speech. As Penfield (1964) expressed it:

Before the child begins to speak and to perceive, the uncommitted cortex is a blank slate on which nothing has been written. In the ensuing years much is written, and the writing is never erased. After the age of 10 or 12, the general functional connections have been established and fixed in the speech cortex. After that, the speech centre cannot be transferred to the cortex of the lesser side, which is then

fully occupied with the business of perception. (1964: 75)

Lenneberg (1967) echoed Penfield's hypothesis. In addition to neurophysiological evidence from studies of aphasia, he cited the language development of the mentally retarded as evidence for a biologically based critical period for language acquisition. Like Penfield, Lenneberg linked the close of the CP to completion of lateralization for language. His claims about the upper limits of the Critical Period were based on these data which seem to show that chances for recovery of lost language functions are very different for children and adults. From this perspective, he hypothesized that language learning after childhood, for at least those aspects that pertain to pronunciation, will be impeded because of the changes in the brain that come with the onset of puberty.

Scovel (1969) strongly supported the neurophysiologically-based form of the CPH. However, it is he who first restricted this hypothesis to purely phonological and phonetic phenomena in second language acquisition and performance. Scovel claimed and continues to claim that children are usually more competent in the acquisition and use of a second language at all linguistic levels. Even though they may attain high degrees of fluency, adolescents and adults on the other hand, will never rid themselves completely of their foreign accent. He proposes that the ability to master the articulatory and supra-segmental features of foreign languages is lost with the completion of cerebral dominance which, according to him, normally occurs around the age of 12.

On the basis of studies on various types of aphasia in different age groups, Seliger (1978) argued in favour of a "multiple-critical periods" hypothesis for L2 acquisition, correlating with localization of language functions and a general loss of "plasticity".

Because localization does not take place at once, but affects different aspects of language at different periods of life, one would expect a different time-table to evolve in terms of different language abilities. That is, there would be many critical

periods, successively and perhaps overlapping, lasting probably throughout one's lifetime, each closing off different acquisition abilities. This may explain why phonology is acquirable beyond the age of five cutoff for lateralization but not much beyond the onset of puberty in most cases, and why other aspects of the language system, at least in some form, are acquirable throughout most of life. (1978: 16)

### **Empirical Studies**

Asher and Garcia (1969) claimed that children are able to acquire a new language more easily because learning is synchronized with physical movement (i.e., "Come on, Bill, let's run to the corner!"), whereas the adult learns language in static situations (i.e., "Hello, it's a beautiful day, isn't it?"). In a study of 71 Cuban immigrants to the United States, aged 7 to 19, the researchers focused on foreign accent as the dependent variable. They postulated, as Lenneberg did, that children are biologically predisposed to learn language and that this fact accounts for the absence of foreign accent in their L2 speech. Cuban subjects were compared with American controls in the manner in which they articulated English sentences in order to determine the optimal age for learning another language without accent. The measure for articulatory accuracy comprised four sentences, containing English sounds which speakers of Spanish are most apt to find difficult. Subjects read and rehearsed a sentence many times until he or she felt ready to make the utterance on tape. Immigrant and native-speaking control Subjects were grouped randomly according to age. The judges were instructed to classify a subject's pronunciation heard on tape into one of four categories: A, B, C, or D.

The results showed that members of a group who had arrived between age one and six and lived in the U.S. for five to eight years were most likely to be rated at the "near-native speaker" level. Thus, the conclusion drawn from the study supports the principle that the younger the child on arrival, the higher the probability of approaching a native accent.

Seliger, Krashen and Ladefoged (1975) presented data that showed that puberty might be an important turning point in language learning ability. They argued that phonological distinctions

which cumulatively lead to foreign accent were related to maturational differences between the child and the adult. Based on Lenneberg's biologically based "critical period" for language acquisition, extending from age two to puberty, their study investigated the validity of the maturational constraint argument. They examined 394 immigrants in the U.S. and Israel and asked if native speakers (either English or Hebrew) could identify the subjects as non-native speakers by giving an oral interview. The responses to the questionnaire revealed that 85% of those who had arrived before age 10 in the U.S. or Israel had achieved native-like pronunciation of the target language, as opposed to 50% of those in the 10-15 age range, and only 8% of those who were over 16 years of age at arrival. Thus, the authors concluded that age was an important variable and that puberty was the turning point after which native accent was harder or even impossible to achieve. This result confirmed Lenneberg's (1967) statement that "foreign accents can not be overcome easily after puberty".

In a study by Fathman (1975), an oral production test was developed to assess the ability of non-native English speaking children to produce standard English morphology and syntax. The main goal was to examine the relationship between age and aspects of the SLA process. The test was administered to approximately 200 children, aged 6 to 15, who were learning English as a second language in American public schools. The subjects had no previous English training before entering the American schools and all had been in the U.S. less than 3 years. In this oral production test, 20 subtests were given with three items per test. Each subtest was based upon a particular morpheme category or syntactic pattern, which were considered basic to learning English as a second language. For example, the three phonologically conditioned allomorphs /-s, z, -z/ were included within the present tense, possessive and plural subtests. The subjects' task was to complete the description of the pictures by supplying omitted words, phrases or sentences. In addition to answering the 60 items on the oral production test, each child was asked to give a general

description of a composite picture. On this picture description task, subjects were tape-recorded and later evaluated by two linguists. Ratings were given on a five-point scale for correctness of grammar, pronunciation and general fluency.

The data in her study showed that the older children, aged 11 to 15 years, performed better in the production of correct morphological and syntactic structures whereas the younger children, aged 6 to 10 years, performed best on English pronunciation exercises. This suggests that pre-teen children are more successful at learning the phonology of a new language. These results support those of Seliger, Krashen and Ladefoged (1975), Oyama (1973) and Asher and Garcia (1969).

A similar trend was reported by Oyama (1976) who found a positive relationship between the age of arrival and the ability of 60 male Italian immigrants to master the phonological system of their new language after more than 5 years in the U.S. Basically concerned with the idea that native-like mastery of phonology can be acquired only by those who learn early, Oyama examined whether or not there exists a "sensitive period" for acquisition of the phonological system of a non-native language. In the experiment, the ability of Italian immigrants to understand spoken English was assessed. All subjects, ranging in age from 14 to 37 years, were divided into three groups according to their arrival age: (1) age 6 to 10; (2) age 11 to 15; and (3) age 16 to 20. All of them had lived in the U.S. from 5 to 20 years. The test consisted of a short masked English passage which the subject would hear on the tape-recording and then repeat. Subjects were required to read the passage aloud and to tell an anecdote from personal experience; the recordings were then rated by two judges for degree of non-native accent. The test results showed that, as predicted, those subjects who began learning English before age 11 demonstrated comprehension scores similar to those of native speakers, whereas later arrivals did less well; those who arrived after the age of 16 showed markedly lower comprehension scores than native speakers. The author summarized her findings as follows: "The youngest arrivals perform in the range set by the controls, whereas those

arriving after age 12 do not, and substantial accents start appearing much earlier" (Oyama, 1976: 272).

On the issue of age and accent in SLA, a recent article by Patkowski (1990) summarizes the relevant literature and leads to the conclusion that there is sufficient research evidence to support the existence of an age-based critical period. In order to reject the counter-arguments expressed by Flege (see below), Patkowski has listed a number of empirical studies which proved to be consistent with a neurophysiologically-induced Critical Period. Besides the pro-CPH studies concerning foreign accent that have been reviewed above, he discussed a number of others (e.g., Tahta et al. 1981; Cochrane and Sachs, 1979) who support the CPH.

### Non-biologically Based Explanations for Foreign Accent

#### **Socio-psychological and Individual Factors**

Not everyone supports the concept that adult-child differences in speaking a second language are due to age-induced L2 learning disability caused by biological changes in the brain. Some researchers attribute foreign accent to socio-psychological and individual factors including peer pressure, stereotypes, personal attitudes, learner motivation and affective state. The degree of accuracy with which a learner pronounces an L2 may be related to the extent he or she feels inclined or obliged to pronounce it like native speakers of that language. There are a number of such studies to be discussed here.

Guiora, et al. (1972), in a series of clinical studies, found that highly "empathic" L2 learners exhibited lower degrees of foreign accent in their speech. The technique of measurement which proved successful in their studies was referred to as Micro-Momentary Expression (MME). The MME consists of silent film clips shown at various speeds during which Ss are asked to indicate observed changes in facial expressions. In this study, the MME, plus additional control tests, were

employed to test Ss' sensitivity to attend and be receptive to interpersonal cues of affective states. The results from this study as well as from the initial ones (Guiora, et al., 1969, 1967) have shown that one's empathic capacity, measured by the MME, does correlate with pronunciation accuracy. Therefore, according to the authors, second language learning in all its aspects demands that the individual take on a new identity. Since pronunciation appears to be the aspect most resistant to change in L2 learning, one might speculate that this is the most critical to the individual's identity. Thus, individual differences in pronunciation proficiency may be a reflection of a learner's degree of empathic response.

Another example is the study by Olson and Samuels (1973), who suggested environmental-sociological factors as the cause for adults' foreign accent. With the purpose of testing the commonly held assumption that younger children are superior to older learners in learning to speak accent-free L2, they tested subjects varying from 9 to 26 years old. These Ss were taught to pronounce German phonemes by modelling their pronunciation after a German voice on the tape as accurately as they could. Equivalent tape-recorded pre- and post-tests, each containing 25 target phonemes in short words and sentences to be repeated onto a blank tape, were given to each subject individually. In pre-tests, no significant difference in pronunciation was found in different age groups. However, the post-test results showed that there was a significant age group effect on accuracy of pronunciation since the junior high and college groups were largely better at pronunciation than the elementary group. Thus, the authors pointed out that the test results do not support the CPH. However, their findings of adult's initial pronunciation superiority over the younger ones are not likely to refute the overwhelming evidence of children's superiority in eventual achievement in this field. To account for this phenomenon, the authors further suggested some socio-psychological factors as its cause. To them, immigrant adults tend to associate more with peers who speak their native language than do children. Often immigrant families have tended to

settle in the areas where there are other families of similar origin. For these adults, good pronunciation models are limited. Children, on the other hand, would be more apt to come in contact with teachers and native-speaking classmates, who have a good accent to model. Thus, in the long run, children would probably have a closer approximation to native-like pronunciation because they are surrounded by good models more of the time than their adult counterparts.

Like others who believe that affective factors begin to manifest themselves quite strongly at around puberty, Krashen (1975) proposed that the self-consciousness of adolescents, their reluctance to reveal themselves and the feeling of vulnerability may have a detrimental effect on the ability to acquire a second language, building up an "affective filter" that inhibits the L2 acquisition process. Tending to rely on rules that are felt to be "correct", i.e., the rules of the L1, the adolescent is prone to developing a foreign accent and to making L1-based interference errors. This phenomenon, Krashen claims, is largely absent in younger learners.

Snow and Hoefnagel-Hohle (1977) investigated the acquisition of articulatory skills in Dutch in both laboratory and naturalistic conditions to test the biologically-based critical period hypothesis for language acquisition. Two kinds of data in their study did not support the popular CPH because older learners proved to be better in articulating foreign sounds. Adults' accents were judged to be more authentic than children's after a short period of learning, but that the reverse was true after a longer period of learning. This fact suggested, as the researchers pointed out, that younger subjects may have a greater motivation to achieve native-like skill, or a greater need to pronounce correctly in order to communicate. They contended that various motivational factors might provide an explanation for the long-term superiority of younger second language learners. For instance, factors such as wishing to fit in and to be indistinguishable from native speakers, the so-called integrative motive (Lambert et al., 1968), may have motivated the younger subjects to higher levels of achievement. Adults are presumably less subject to peer pressure to conform relative to younger

children and thus less motivated to achieve perfect mastery of L2, because of the fear of losing cultural entities.

Schumann (1976) asserted that affective factors may be more important than neurological maturation in determining success in L2 pronunciation.

In children, the initiating factors are generally favourably turned or at least sufficiently neutral so that when exposed to the target language, the child's cognitive processes will function to produce language learning. In adults, however, the development of firm ego boundaries, attitudes and motivational orientations which is concomitant with social and psychological maturation, places constraints on the initiating factors such that they may block or at least inhibit the cognitive processes from operating on the target language data to which the adult is exposed. (1976: 231-232)

In a more recent study, Schumann (1978) presented an "acculturation" model for SLA in which he stressed social factors (e.g., social dominance patterns, group integration strategies, enclosure, cohesiveness, cultural congruence) as equal in importance to affective factors in determining the degree to which the L2 is acquired. Together, he regards social and affective factors as "the major causal variables" in SLA.

Brown (1981) also discussed the affective factors which he believed influence L2 learning. As he suggests, among major human behaviour patterns, the affective domain is the most important in deciding a person's success in second language learning. This is because unsuccessful language learning can be attributed largely to affective blocks of various kinds such as egocentric (self-esteem), transactional, motivational, attitude and cultural factors. Among them, the author particularly emphasizes "motivation" to explain the success or failure of learning a new language. Therefore, Brown believes that a learner will be successful with positive motivation in second language learning. This argument reiterates the position of some earlier researchers (Gardner and Lambert, 1972; Ausubel, 1968). With regard to attitudes, Brown proposes that the second language learner benefits from positive attitudes and that negative attitudes may lead to decreased motivation

and in all likelihood unsuccessful attainment of proficiency.

There are still others who hold this social/psychological position as the explanation for foreign accent (Gardner & Smythe, 1975; Macnamara, 1972; Hanlon, 1971; Jakobovits, 1970). However, as their viewpoints are less relevant and important in terms of the present study, they will not be discussed in detail here.

### **Cognitive Maturation Approach**

In the light of the tentative and inconclusive nature of the neuro-physiological and social/psychological evidence for adult's observed foreign accent in L2 acquisition, some scholars have attempted to relate "linguistic puberty" to hypotheses in the development of cognition, e.g., Inhelder and Piaget's (1958) "formal operations", beginning around puberty. At this time, according to Piaget, the child becomes able to think abstractly.

On this cognitive hypothesis, Rosansky (1975) suggests that what acts as a block to L2 learning is the awareness of differences that comes with formal operational thought. In her viewpoint, this awareness may interfere with the child's previous ability to focus only on underlying similar studies between two languages. Rosansky also emphasizes the Piagetian notion of "disequilibrium" in association with the ability to acquire a second language. She states:

Piaget claims that a final state of equilibrium is not reached until Formal Operations which are not firmly organized until at least 14 or 15, the same age after which language acquisition does not seem to be able to occur, and the same age at which L2 learning, while not impossible, is reported to be at best laboured and usually incomplete. (1975: 97)

In another version of the formal operations hypothesis and in line with the Chomskian view that there is a separate innate faculty for language acquisition, Felix (1981) proposes that there exist highly developed "language-specific-cognitive structures" (LSC). These structures are of a formal,

abstract nature that are activated in L1 acquisition and in childhood L2 acquisition. With the development of formal operations at age 10 to 12, the individual also has access to separate "problem-solving cognitive structures" (PSC), which intervene in the acquisition of a second language. Adults, Felix maintains, are typically incapable of suppressing PSC structures in the L2 learning process. The competition between PSC and LSC structures in language acquisition "seems to be the reason why adults are inferior to children as to how successfully they achieve a native-like command in a foreign language" and "the more the PSC-structures shape the learning process at the expense of the LSC-system, the smaller the chances will be for the learner to achieve a native-like command of the second language." (Felix, 1981: 33) Although Felix did not relate his hypothesis directly to foreign accent in adults, his hypothesis is similar to the rationale of Neufeld's Pre- and Post-Articulatory Verification (PAV) model. That is, during adult L2 sentence production, cognitive operations which process metalinguistic knowledge could overload natural linguistic processes and give insufficient time for accurate pronunciation in the second language. Therefore, foreign accent occurs.

Krashen (1982) also made some interesting comments on this cognitive speculation. His position here is that "formal operations" relate directly to the ability to learn language consciously (using learning as a technical term in contrast to subconscious language acquisition). Because of their cognitive differences in language processing, the adult may not have access to the child's acquisition device but will employ a more conscious strategy to produce behaviour that appears, on the surface, similar to the results of language acquisition in children.

Although the problem of foreign accent was not addressed directly by Felix and Krashen, their work suggests that the presence of formal operations in adults may possibly lead to a change in focus when processing L2 sentences. A developing metalinguistic awareness in older language learners may increase their attention to sentence structure and meaning at the cost of articulatory

and intonational accuracy (see Neufeld's PAV model later in this chapter).

Formal operations allow the development of the conscious grammar which predicts certain child-adult differences. First, it accounts for the fact that adult metalinguistic awareness of language is typically greater than that of children. (Krashen, 1982: 209)

In sum, all these authors consider non-native-like acquisition and performance to be the result of psycholinguistic inadequacy of "general problem-solving ability" which begins competing with Universal Grammar (UG) in language learning after age five. According to their viewpoint, adult deficiencies result from a developmentally-induced change in focus in which conscious analytical procedures take precedence over unconscious language acquisition.

#### Some Additional Factors Relating Accent

During the last two decades, some second language acquisitionists began to raise arguments against the Critical Period hypothesis. Like some of the research discussed in the previous section, they rejected the commonly held CPH because their experimental findings pointed to sources other than the age factor that could lead to foreign accent. Some studies have even demonstrated that adolescents and adults are able to internalize a near-native-like representation of the phonology of the second language. These studies call into question the concept of an age-induced critical period for language learning.

One of the first scholars to challenge the CPH was Neufeld from the University of Ottawa. In his previous studies (1980; 1978), he reported that even though his Ss spoke with noticeable foreign accents, they were capable of native-like perception performance. Neufeld claims, therefore, that there may be a significant asymmetry in the perception and production performance of older learners. According to the proponents of the CPH, foreign accent is caused by an imperfectly internalized phonological system. Yet Neufeld's data with respect to the perceptive/productive

asymmetry suggests that deficient articulation in L2 is not necessarily the result of imperfectly-learned structures in these learners' interlanguage (IL) phonology, especially in cases where performance on comprehensive tests of phonological perception is native-like. He further suggests that if there is a "critical period", it may be more applicable to the domain of linguistic performance than to the ability to acquire linguistic competence. Based on these experimental conclusions, Neufeld believes that the often observed articulatory deficiencies in older L2 learners might be explained by some considerations other than the popular age factor. This important question was again addressed in Neufeld's 1988 study.

Three perception and four production tasks were conducted in the 1988 project. Neufeld reported that the results again showed that most of his subjects' phonological system in the L2 was very good and that they seemed able to use this system of rules in a native-like way. Most were English-speakers who were at an advanced level in their university study of French as a second language. The subjects obtained scores comparable to Francophone controls on a variety of measures. These measures involved foreign accent recognition, phonological intuition and detection of inappropriate allophonic variations in words in sentences. However, almost without exception, on the measures of articulatory proficiency, these same bilinguals, fluent as many were, spoke French with varying degrees of English-like accents.

The data also highlighted some factors which are highly relevant to the present study: subjects' production performance was affected by sentence complexity and length. This finding suggests that as stimulus strings increase in length, or when Ss had to produce sentences containing relative or embedded clauses, clitic pronouns, or complex compound verb structures, there was a substantial deterioration in the subjects' pronunciation. Neufeld speculated that this articulatory deficiency was due less to the acquisition process than to production difficulties involved in implementing rules that have been learned in a formal context. To account for this phenomenon,

a sentence production processing model---Pre- and Post-Articulatory Verification (PAV) was developed by Neufeld which will be discussed in more detail later in this chapter.

Phonological interference has also been cited as an important cause of foreign accent. Flege (1981) proposed that perception plays an important role in foreign accent in L2. He claimed that the target sound of the L2 learner is different from the native sound because it is based "on an acoustic model provided by pairs of similar sounds in two languages" (1981: 443). Thus, the L2 learners's mental representation would be very different from that of a native speaker of the target language. A Japanese speaker who fails to produce English /r/ and /l/ would be observed to have phonologically translated these either into Japanese sounds or sounds intermediate between English and Japanese.

Therefore, Flege rejects the CPH because he does not consider adults' accent as due to their deficient language learning ability, but as due to problems in perceptual performance. In his viewpoint, older learners articulate poorly because they perceive L2 sounds as equivalent to L1. As he observed, some language learners may perform a "phonological translation", interpreting sounds in the foreign language as being the "same" as phonetically similar sounds found in their native language. Phonetic learning in a foreign language may be based on an acoustic model supplied by "pairs" of similar sounds rather than on a single language-specific acoustic model as it is for children learning a first language. Thus, according to this hypothesis, the biologically-based position on foreign accent, which often considers foreign accent as the consequence of an age-related disability in learning to pronounce languages, is not well supported. Flege's hypothesis further predicts that even the language learner who speaks with a foreign accent may possess the same phonetic learning ability as a young child. Flege is one of the first SLA researchers who focused on learners' performance problems rather than acquisition.

Major (1987a) considers production difficulties as the main cause of adult L2 learners'

foreign accent and yet rejects Flege's hypothesis. On the one hand, Major disputes the CPH as does Flege. He argues that age may not be a major factor causing foreign accent. Instead, it might be just a "concomitant variable" with other factors such as cultural and affective considerations in SLA. Age may be merely correlated with such factors as integrative motivation especially in immigrants. In general, younger learners tend to, and want to, assimilate more than older learners. Thus, integrative motivation may be a primary factor and age a secondary one.

On the other hand, the author disagrees with Flege's position which attributes adults' accent to their faulty perception. He points out that this speculation fails to explain his data as well as those from other research studies. For instance, there are students of phonetics who can identify pharyngeal fricatives but are unable to produce them. There are L2 learners of Spanish who are able to hear the trilled /r/ as distinct from the English /r/, attempt to produce the trill and fail, but are able to hear their own foreign accent. According to Major, there can be a great deal of variation in learners' perception and production abilities. Therefore, the author proposes a model dealing with the interrelationship of interference and developmental processes to which an adult's foreign accent can be attributed. In support of this model, he cites evidence from previous studies and his own pilot study. In his conclusion, an important and enlightening question is addressed which has also been repeatedly proposed in Neufeld's studies: What is the relationship between perception and production; e.g. does development in perception parallel development in production? In other words, does an adult's foreign accent stem from acquisition ability or production problems?

Eckman's Markedness Differential Hypothesis (1981, 1977) approaches the accent problem from a rather different angle. In order to explain why some sounds and sound sequences are acquired more easily than others, Eckman uses Markedness to integrate Contrastive Analysis and UG theory. According to him, the degree of difficulty in L2 learning corresponds to markedness relations. For instance, voice contrasts in the final position are more marked and thus more

difficult to acquire than those in the medial position, those in medial position more marked and thus more difficult than those in the initial position. Take the English and German languages for example, one difference between these two lies in the maintenance (in English) versus non-maintenance (in German) of a word-final voice contrast. According to this hypothesis, English is more marked than German relative to the positions in which a voice contrast is maintained. Therefore, the German speaker would have greater difficulty with English word-final contrasts. When these learners utter these sounds, phonological errors would occur, articulatory accuracy would be greatly affected and so an accent would be heard.

Yet another source of foreign accent has been advanced by Tarone (1980) in her discussions of syllable structure in interlanguage. The author proposes an interesting alternative to approaching the accent problem: the Open Syllable Structure hypothesis. According to this position, an open syllable, particularly a CV syllable pattern, is preferred as a universal or unmarked tendency in L2 acquisition. Thus, language learners tend to treat syllables in specific positions as "very probably open", hence affecting their articulation and IL phonology. This speculation found support in Tarone's pilot study of six Ss from three language groups: Cantonese, Korean and Portuguese. In this study, Ss have been found to convert syllable structure of a foreign language to the very simple CV patterns of pronunciation of their native language. Therefore, the author suggests that the universal tendency towards a CV structure accounts for these errors. On the other hand, Sato (1984) found that her Vietnamese Subjects who were learning English tended toward closed syllables in their speech.

### Sentence Production Models and Foreign Language Accent

Based on Neufeld's findings on the asymmetry in older learners' performance in his previous studies, one could take the position that L2 learners' knowledge of language should be separated from their actual production performance. Since the learners in Neufeld's study proved to be able to reach native-like proficiency in perception performance, it is possible that foreign accents in the older L2 learners' speech may be related to problems that arise during sentence planning in the second language. In order to identify these problems leading to foreign accent, one must have some knowledge about how utterances are planned and subsequently vocalized in L2. Unfortunately, not much research has been done in this field. However, sentence processing models in L1 may aid our understanding L2 speech production.

How is language produced and, more precisely, at what level or levels of processing does faulty pronunciation or foreign accent emerge?

#### **Fromkin's Model**

One of the most significant contributions in the area of sentence production processing is Fromkin's 1971 study. She used speech errors to illuminate the underlying units of linguistic performance and the production of speech. For, as has often been observed, speech errors are "powerful indicators" of the on-line processing that underlies speech. Through painstaking analyses of spontaneous speech errors and "slips of the tongue" covering spoonerisms, blends, phoneme and syllable displacements and morpheme and word shifts, the author finally derived the following five steps as the order of actual generation of an utterance:

1. **Creating sentence meaning:** As in all other models, the initial step in building a sentence is to determine what the message to convey is from a

conceptual standpoint.

2. **Framing syntactic structures and semantic features:** Since the lexicon has not yet been searched, this second stage is still very skeletal, consisting of semantically and syntactically-marked slots for morphemes.
3. **Specifying the word slots for a syntactic structure with semantic and syntactically features achieved in Step 2.**
4. **Selecting words and assigning stress:** Fromkin's lexicon contains words, word stems, and affixes, word-stress included.
5. **Editing phonological and morphological elements:** At the final stage, affixation is completed along with phonological modifications at phonetic levels, or forms derived from the lexicon. This information is then "automatically" converted into neuromotor sequences that are then sent to the vocal apparatus.

### **Garrett's Model**

Based on a similar source as the above model, Garrett (1975) analyzed spontaneous speech errors by native speakers of English and derived the following sentence processing model. These errors include exchanges, shifts, additions, deletions and copying. From them arise two relevant processing levels: a **functional** level, in which phrasal membership and grammatical functions of words are determined, and a **positional** level, in which the serial order of words and some aspects

of their form are specified. Garrett also divides sentence planning into two sets of processes: the general problem of language production --- **message formulation** (meaning), and the specific problem of sentence production --- **translation process** (form). This concept has later influenced the development of Neufeld's PAV model. In response to the question how to discover what sorts of structure are processed on-line by the speaker, and in what sequence, Garrett has developed a sentence processing model. One striking difference that lies between Fromkin's model and this one is that the latter gives greater emphasis to semantic parameters (stage 2 in this model vs stage 3 in Fromkin's) and posits a more abstract lexicon without word stress. Word stress is claimed to be determined during stage 4 as in the model outlined below:

1. Locating meaning source.
2. Selecting, by semantic factors, lexical formatives and syntactic frames.
3. Structuring both syntactic and lexical formatives.
4. Polishing phonetic phonological elements.
5. Transferring to neuromotor sequences.

#### **Motley, Baars and Camden's Model**

In contrast to the first two models, Motley, Baars and Camden (1983) relied largely upon laboratory-induced speech errors, rather than spontaneous utterances, in their research on sentence production processing. These errors have provided a partial model of "prearticulatory editing". In fact, Neufeld, in his recent paper (1990), has pointed out that the most significant feature that distinguishes this model from others is that it inserts this "prearticulatory editor" in the final stage. While most popular models of speech production assume the system to be so rule-governed as to "avoid" erroneous formulations, the authors have argued that structure plans are formulated during

early production stages but are corrected (i.e., "edited") if they are erroneous during later encoding stages. According to these authors, the general error-free nature of speech output results from "post-formulation operations" -- Prearticulatory Editing -- to correct anomalous formulations before articulation. This language encoding model is presented in "levels" as follows:

1. Defining message.
2. Elementary syntactic framing and lexical search.
3. Options filter (lexical and syntactic).
4. Lexical, morphological and syntactic formulation of the utterance.
5. Phonological coding.
6. Neuromotor coding.
7. Prearticulatory editing.

#### **Neufeld's Pre- and Post-articulatory Verification (PAV) Model in L2 Sentence Production**

The PAV model chiefly emerged from Neufeld's data in the three studies mentioned above.

It is relevant to this study, particularly in the following three respects:

##### **1. Growth of Metalinguistic Knowledge and Linguistic Focus on Form:**

Older L2 learners tend to be more concerned with form -- proper sequencing of linguistic constituents than just with sentence meaning. According to Piaget, cognitive "formal operations" begin around puberty, and with adolescence there comes an increasing linguistic interest in introspective observations (metalinguistic) about language and explicit explanations of grammar. Normally, to produce sentences under real time constraints, the output processor must rely upon linguistic information or rules in competence that are "naturally" and unconsciously acquired as one

acquires his L1. However, structures based on metalinguistic knowledge and explicit rules constitute pseudo rules (structures) that are incompatible with the natural sentence production processor. Therefore, under such circumstances, the model predicts that this linguistic processor simply can not process and produce sentences in a normal manner. How, then, is metalinguistic knowledge used during sentence planning, and how does the processing of pseudo rules influence articulation and supra-segmental production?

## 2. Pseudo-Sentence Processor:

The older learner is often observed to focus more on positioning linguistic constituents within the utterance and formal explanations of L2 grammar. The model assumes that linguistic knowledge that is assessed by the output processor must be of an entirely "acquired" or natural kind. If the model is correct, during initial stages of SLA after childhood, this processor will be severely impaired due to incompatible input. As a result, one possibility for the functioning of the linguistic processor under real-time constraints is predicted in this model as follows:

To handle "non-natural" structures, supplemental processing routines of a pseudo-linguistic kind must be constructed to generate morphological and syntactic sequences in clauses which embody 'non-natural' elements. (Neufeld, 1990: 32)

Thus, the output processor would be forced to temporarily call upon a pseudo-linguistic processor of a cognitive (non-language-specific) nature to supplement the normal output processor for constructing the actual utterance. The function of this cognitive processor would be to process "raw" input such as introspective observations and explicit rules about language, and translate them into compatible input (acquired rules type) for the natural linguistic processor. It is assumed that these supplemental procedures demand extra time and place an additional burden on, or overload, the processor. According to Neufeld, pre-school children usually do not need this supplemental ad

hoc processor as they rarely attempt to speak L2 with the aid of formally learned grammatical rules and metalinguistic knowledge.

### 3. Pre- And Post-Articulatory Verification:

Based on the above assumptions of a pseudo-sentence processor for "non-natural" structures, the model further predicts that, in Real Time communication, to compensate for time lost during pseudo-processing, the linguistic output processor would simply have no time for last-minute pre- and post-articulatory and fine-tuning editing procedures at segmental and supra-segmental levels. It will have to sacrifice these last verifications since they are least likely to affect sentence meaning and structure.

Neufeld's data on asymmetries in perception and production suggest that a number of articulatory errors which lead to foreign accent lie somewhere in the later stages of sentence production, either during morphophonemic adjustment or during motor planning. Neufeld assumes that as focus shifts more and more to the ordering of linguistic constituents and deductive analysis of grammar, attention to aspects of language that do not contribute directly to meaning will be de-emphasized during sentence planning and execution.

\* \* \*

The aim of the present research is to learn more about the role of an overloaded production processor in generating foreign accented speech. The central question to be addressed in this thesis is whether processing and implementing rules for sentence production affect the ability to faithfully produce foreign sounds. To achieve this aim, a small-scale study was conducted by the author with four adult English-speaking Ss. By varying linguistic parameters in elicited production tasks, the

author hoped to learn more about the specific conditions in sentence processing that promote articulatory and suprasegmental degradation during sentence planning and production in L2.

## CHAPTER II

### METHOD

This study was designed to test the hypothesis that while imitative capacity in adults may not deteriorate, the ability to accurately reproduce sounds and supra-segmentals in a new language during the initial phases of learning decreases when the need to process for form and meaning is present. As discussed earlier, a fundamental assumption of this research is based upon Neufeld's Pre- and Post-Articulatory Verification (PAV) model: difficulties in linguistic performance rather than deficiencies in linguistic competence underlie many articulatory problems in L2 learners beyond six to seven years old.

This study consisted of two phases. Phase 1 was restricted to phonetic training in the manner of Neufeld (1978) and Schneiderman et al. (1988). Phase 2 supplemented initial phonetic training with instruction in grammar and vocabulary learning. The imitation exercises in this phase consisted of two types: mimicking as in Phase 1, and semi-imitation. Mimicking here refers to parrot-like repetition with minimal linguistic processing at phonological, semantic and syntactic levels. The term "semi-imitation" is used here to refer to imitation involving some linguistic processing<sup>1</sup>. This phase also included creative sentence production exercises in which the Subjects (Ss) had to answer questions spontaneously or construct their own sentences with given key words. All these exercises were used to elucidate the extent to which deterioration in articulatory and tonal accuracy occurs when Ss must rely on lexical and grammatical knowledge to faithfully imitate or

---

<sup>1</sup>Based on George Miller's "the magic number 7 plus or minus 2" formula (1963), the distinction between mimicking and semi-imitation can be made here. According to this formula, strings of 7 or less syllables in recall tasks may be assumed to be possible, with or without Ss' knowledge of the target language. With strings longer than 7 syllables, recall tasks are assumed to involve phonological, morphonological, syntactic and/or semantic processing.

create sentences in Chinese.

### Underlying Assumption

L2 learners after age five retain their capacity (potential ability) to accurately perceive and reproduce new sounds and sound sequences in a new language.

### Hypotheses

#### **1. Tested:**

- a. Articulatory and tonal accuracy in Chinese achieved in Phase 1 by native English speakers will significantly deteriorate in Phase 2 with additional processing tasks involving lexical meaning and simple rules of grammar.
- b. Degraded articulatory and tonal production will return to original levels of proficiency when sentence processing is reduced to a minimum in Phase 2.

#### **2. Untested:**

Older L2 learners (persons beyond five years of age) are more preoccupied with form and content than they are with linguistic parameters that do not directly relate to meaning.

### Procedure

Four native English speakers followed a nine-hour mini-course in Chinese over a period of four consecutive weeks, two weeks for Phase 1 and two for Phase 2. This program was designed for individualized instruction.

In both phases, Ss were seated at a small console in the Linguistics Laboratory at the

University of Ottawa. A pair of close-fitting headphones was used for each lesson to reduce extraneous outside noise. Attached to these headphones was a sensitive microphone positioned immediately in front of the subject's mouth. In Phase 1, Ss were required to listen very carefully to the model and then to imitate what they heard. Then, they were to repeat each stimulus twice.

In Phase 2, by means of English translation, Ss were taught the meanings of the sound sequences that they had repeatedly imitated in Phase 1. Along with the lexical meanings introduced in Phase 2, Ss were taught simple rules of grammar to enable them to plan and articulate short sentences in Chinese. Practice in listening and imitation was continued during this phase.

### Subjects

Fifteen English-speaking student volunteers at the University of Ottawa were interviewed for the program. Four female students were chosen according to the following general selection criteria:

- 1) Between eighteen to twenty-two years old.
- 2) Of native English-speaking parents.
- 3) No previous contact with the target language Chinese.
- 4) Born and raised in the Ottawa region with social-economic backgrounds matched for middle class level.

This information was obtained through a questionnaire. Since the experiment was to be conducted on a small scale, it was considered important to keep the backgrounds of Ss as similar as possible. Ss were told that they would be involved in an experiment for which they would receive full reports of the goals and results of the study upon their request after the completion of the project. No other information was given to Ss at that time, except to say that all pertinent details

would be covered as the program proceeded.

### Instructional Materials

One four-hour program in Phase 1 (phonetic training) and one five-hour program in Phase 2 (grammatical and lexical training) were prepared for individualized Chinese instruction. The Chinese language was chosen in order to reduce the chance that Ss would have to be rejected because of prior contact with the language. Phase 1 consisted of four lessons, while Phase 2 had five. The format for each lesson in each phase was identical. The one-hour lessons were divided into two twenty-five minute sections with a ten-minute break after the first section. The instructions for all lessons were in English and recorded by a native English speaker. The remaining material was in the target language and was recorded by the author of this study. As can be seen in the schedule below. Phase 1 was characterized by listening and imitation tasks. New sounds were expected to be better perceived since listening was very much emphasized at this stage. For the first two exercises of each lesson in Phase 1, Ss were instructed not to utter any sound whatsoever. In subsequent exercises Ss were required to imitate. The difficulty level for imitation increased from Lesson One to Lesson Four (from one syllable to seven syllables). Phase 1 was designed to provide Ss with some time to observe and establish correct sound patterns in the new language.

Although Phase 1 also required reproduction of sounds, words and phrases, the major difference in Phase 2 was that Ss had to creatively construct phrases from memory and by rules. The same Chinese words were used in both Phase 1 and Phase 2, but in Phase 2 the words were used in novel phrases and sentences. After trying out the teaching materials and methods with two trial Ss, some important changes were made concerning both instruction material and methodology. The procedure of the teaching finally adopted for this program is described in detail below.

Because the majority of the course was based on the use of recordings and most of Ss'

learning would involve listening to and repeating the recorded model, a high-quality sound recording was desirable. The quality of the recording was believed to have a potential impact upon the articulation of Ss' sounds and tones as well as the overall results of the study. The original recordings were made in the sound booth of the Linguistics laboratory at the University of Ottawa. From these recordings, the master tapes containing instructions as well as stimulus materials were prepared by means of a computer equipped with digital speech processing facilities. This allowed us to systematize the whole recording by standardizing and digitizing each sound and sound sequence on all of the recorded materials. For instance, on the original tape-recording, each Chinese sound or sound sequence was pronounced twice, and the more accurate one was retained as the model.

#### **Phase 1 (four lessons)**

This was a preparatory phase to lay a foundation for the Ss' imitation and creative sentence production in Phase 2. The aim in this phase was to introduce new sounds and sound patterns in Chinese to Ss and to test the extent to which adult L2 learners were able to faithfully mimic these sounds and sound sequences in the absence of meaning and structural rules. Each lesson in Phase 1 was divided into two sections (Section A and Section B) which were conducted using only recordings. Four exercises were presented in each of these sections and were preceded by simple and clear English instructions (See Appendix A) that specified the Ss' task in each exercise. Similar formats were used in these four tasks. By the end of Phase 1, it was expected that Ss would have become fairly proficient in articulating new sounds and sound sequences.

#### **LESSON ONE**

**Section A (twenty-five minutes):** There were four exercises in this section. The stimuli used

included fifteen Chinese one-syllable words but no phrases or sentences.

In Exercise One, Ss were required to listen to both segmental sounds and the tones of these fifteen items, but no imitation was allowed at this stage. Each word was presented twice on tape with a three-second pause before the next item. In the instruction which preceded each exercise, the need to listen carefully was emphasized. The instructor helped Ss perceive the sounds better by quietly mouthing them in time with the recording. Except for this role, and that of providing explanations of tasks upon Ss' request, the only requirement of the instructor was simply to start or stop the tape-recorder.

In Exercise Two, the same fifteen Chinese sounds as in Exercise One were played again on the tape recorder. This time, however, Ss' mental or subvocal repetition was required. They were instructed that as soon as a word was heard, they should repeat it in their mind. Ss were also told not to speak aloud at this stage because it was believed that by holding back their oral production once again, Ss would concentrate better on perception of sounds.

Exercise Three contained the same sounds in a different order to preclude previously rote-learned responses. Ss were asked to repeat the sounds in a normal voice as soon as they heard them. The model voice on the tape spoke each item twice. A microphone attached to the headsets, together with repetition of each item, enabled Ss to hear themselves clearly and thus facilitated their self-correction. To reduce undesirable variation in instructing each individual, no correction was given from the instructor.

The last exercise, Exercise Four, was identical to the previous one except that items were in a different order. Ss were required to repeat aloud once more so that they could correct themselves if necessary.

**Section B** (twenty-five minutes after the break): The four exercises in the second section of Lesson One had an identical format as Section A, except that they contained solely Chinese

phrases and sentences, which varied from two to five syllables in length. The words employed were exactly the same as those used in Section A.

### LESSONS TWO AND THREE

Lessons Two and Three had the same format as Lesson One. Another fifteen Chinese sounds were introduced in the same manner: nine in Lesson Two and six in Lesson Three. However, as the program proceeded, the length of phrases and sentences was increased to seven syllables.

### LESSON FOUR

The last lesson of Phase 1 was different from the rest. There was a twenty-five minute general review in Section A and a twenty-five minute test in Section B. In the review, Ss were requested to be as accurate as possible in articulating foreign sounds. All the phrases and sentences from the previous lessons were re-played during the review. The first three exercises (listening, subvocal imitation and normal-voice imitation) of each lesson were repeated. After the review, Ss were tested on their imitative ability in Section B. A full account of this test will be provided in a separate section below.

### Phase 2 (five lessons)

After two weeks of learning Chinese sounds and tones independent of meaning and structural rules, Ss started another five-hour program in the two weeks immediately following Phase 1. At this stage, the author intended to observe if the level of accuracy in pronunciation achieved in Phase 1 would be maintained when the learning tasks increased in complexity and difficulty with the introduction of grammatical rules and the meanings of vocabulary items. It was also important

to find out whether Ss' pronunciation would return to their original proficiency levels when sentence processing was minimized in Phase 2. The Chinese vocabulary presented in Phase 2 was exactly the same as in Phase 1. However, the meanings of all the words and the structural patterns used to combine these words into phrases and sentences were introduced. To achieve this, a carefully-designed recording was prepared by the same native speaker of Chinese as in Phase 1.

Once again, there were two sections, each with two main tasks required of Ss. The first task in Section A required imitation --- listening to and imitating sounds and sound sequences. Section B involved vocabulary and grammatical instruction --- learning meanings and structures. However, even with this goal, half of the time was devoted to mimicking and semi-imitation to keep Ss well-practised in listening to and imitating the sounds and sound sequences. In other words, were there to be any articulatory deterioration in Phase 2, it would not be due to lack of sufficient practice.

In the second task in Section B, the meanings of Chinese words were learned through their English counterparts. To learn the grammatical patterns and rules, Ss had to repeat the same sentence structures over and again so that they could observe and deduce the combinatorial rules themselves. The difficulty level increased from Lesson Five through Lesson Nine: both the sentence length and the complexity of structural rules increased. As in Phase 1, all the exercises in Phase 2 were described to Ss with pre-recorded English instructions.

## LESSON FIVE

**Section A:** There were five exercises in Section A. Exercises One and Two were mimicking exercises: Ss listened to and repeated twenty Chinese phrases and sentences which had all appeared in Phase 1. As before, Ss would listen to, and then repeat each Chinese item twice so that they could correct themselves if necessary.

Exercises Three, Four and Five were the lexical and grammatical instruction part of each

lesson. The meanings of Chinese words and structures of Chinese phrases and sentences were introduced and learned through these three exercises. All together, eleven Chinese items, consisting of words, phrases and sentences were heard on the recording. Each was coupled with its English equivalent. Since this was the beginning of instruction in Phase 2, the items that had been chosen were fairly easy and short (three syllables at most) such as "I", "you", "I am", "you are not" and so on. Only four new words were introduced at this point. Simple declaratives, with and without negation, were also introduced in this lesson.

Exercise Three was a listening exercise where each Chinese word, phrase or sentence was accompanied by its English correspondent. Ss would hear an English item first, and then its Chinese equivalent. Each pair was presented twice on the tape recording. Ss were required to listen to and remember the meanings of Chinese items provided through their English counterparts.

In Exercise Four, the same English-Chinese pairs were re-played on the tape-recording. However, repetition of the Chinese items was required of Ss as soon as they heard them. Up to and including this point then, Ss were only asked to listen to and imitate what they heard on the recording.

Exercise Five, however, was somewhat different from the others. This time, only English words, phrases or sentences were heard, and then Ss were given three to six seconds to speak aloud their Chinese counterparts. If a Subject did not respond within the given time, the correct answer in Chinese was given. However, Ss were encouraged to supply all the answers themselves.

**Section B:** The second section of Lesson Five was composed of exercises of the same five types, employing identical methods as in Section A. In the imitation part, there were twelve Chinese items to be heard, all of which had been introduced in previous exercises. Items in this section were up to seven syllables in length. As Ss were exposed to grammatical rules and structures, eighteen Chinese phrases and sentences were taught which consisted of seven new words

and three types of sentence structure: affirmative declarative sentences such as "I am a Canadian"; negative declarative sentences such as "I am not a Canadian"; and yes/no interrogative sentences such as "Are you a Canadian?".

#### LESSONS SIX, SEVEN AND EIGHT

These three lessons had the same format as Lesson Five except that the imitation part was drawn from the imitation task of Section B in each previous lesson. Two unrecorded exercises were added in Section A in each of these three lessons. These were conversations held between the student and instructor. The instructor asked from five to eight questions in Chinese, using words and patterns Ss had learned in previous lessons, and Ss were required to respond in Chinese (later referred to as "question-answer" exercises). In the second of these unrecorded exercises, Ss were given three Chinese words or phrases, and then required to use them to construct a complete sentence (later referred to as "sentence-making" exercises). There were about six sentences to be built in this way for each Subject. These sentences were designed in such a way that the average length of Ss' response sentences was about seven syllables. For the sake of consistency among Ss, the instructor attempted to keep the dialogues as similar as possible.

The remaining exercises were similar to those of Lesson Five, and were all pre-recorded. The difficulty level, i.e., sentence length, manipulation of vocabulary and sentence structures, increased with each lesson.

In Lesson Six, ten more new words were introduced. In Section B of this lesson, Ss were given Chinese phrases and sentences varying from two to seven syllables. Twenty-five items were presented in Section A and eighteen in Section B. All the sentence types previously introduced were used. However, the level of complexity was increased by the use of multi-word noun phrases as subject or predicate, for example "My friend is a teacher" or "You are not a Chinese student".

In Lesson Seven, there were three more new words in fifteen phrases and sentences introduced in Section A and four more new words in seventeen phrases and sentences presented in Section B. The sentence patterns involved were not only the statements with the copula Ss had encountered before ("I am a teacher") but this time included affirmative, negative and interrogative versions containing new verbs. For instance, "My friend speaks Chinese"; "Do Canadian students speak Chinese?" or "Chinese teachers do not speak French". Although the longest sentences were still seven syllables as before, the average length of sentences increased from five syllables in Lesson Six to six in this lesson.

Lesson Eight was the last lesson in which the new material was introduced. The meanings of the last two new words were taught, bringing the total number of vocabulary items to thirty Chinese words. These items were the same as those used in the listening and imitation tasks of Phase 1. In both sections of Lesson Eight, there were fifteen Chinese items in each sentence construction exercise. All the teaching procedures remained primarily the same as those in the previous lessons.

Lesson Nine consisted of two parts: a general review and a test. In the fifteen-minute review, Ss would do question-answer and sentence-making exercises again. The words used were drawn from Lessons Six, Seven and Eight. After a short break of ten minutes, Test 2 was administered. The details about this test are described below.

### Tests

#### **Test 1 (fifteen minutes)**

Test 1 was given at the end of Phase 1 in order to measure Ss' ability to articulate Chinese sounds and tones. Ss were not told of this test beforehand. They were told that this would be the last review exercises for them to "practice" what they learned in Phase 1. By keeping the coming

test unknown to them, the author hoped to reduce unnecessary stress which could affect Ss' performance. They were told that their task in these exercises was not very difficult, but required a great deal of their attention. The test had the same format as previous lessons. Recordings of their performance on this test were made without Ss' knowledge. These mimicking recordings were to be compared with those in Test 2 to find out if the oral proficiency achieved in Phase 1 would change after five more hours in Phase 2.

The test took the form of three exercises. The first involved only listening, while the latter two required imitation. The test included twenty Chinese sentences which Ss had been hearing and practising throughout Phase 1. These twenty sentences varied from two to seven syllables in length. Each sentence was presented on the recording twice in each of the three exercises. In Exercise One, Ss were requested to pay close attention to each sound or sound sequence, especially to the tones. Exercise Two was an imitation task, using the same twenty Chinese sentences as Exercise One. Ss were instructed to repeat each sentence twice. Vocalizations by Ss were recorded in this exercise. The task required of Ss in Exercise Three was exactly the same as that in Exercise Two except that the sentences were in a different order. Exercise Two was recorded instead of Exercise Three because it was noticed that Ss' later attempts were generally worse than the first ones, perhaps because of boredom or inattention (See Appendix B for detailed materials for Test 1).

#### Test 2 (thirty minutes)

At the end of Phase 2, Ss were given Test 2. This test used exactly the same Chinese words as in Test 1 but sentences varied in length and type. There was a significant difference between this test and the previous one. Test 1 measured only the ability to mimic new segmental sounds and their tones. Test 2, however, was designed to contrast articulatory and tonal accuracy under two different processing conditions: mimicking using the results from both Test 1 and Test 2; and semi-

imitation and creative sentence production.

As in Test 1, Ss were not informed that a test was taking place. The test began with mimicking of the same twenty Chinese sentences which were used in Test 1. Again, the Chinese stimulus sentences, each of which was presented twice, were played on the tape-recorder and Ss were to repeat what they heard after the model voice. This took about six minutes. The recordings were to be contrasted with those made in Test 1. These data relate to the hypothesis that Ss' imitative ability would prove to be very good when there is little sentence planning involved in uttering foreign sounds and tones.

The next task required of Ss was to create Chinese sentences, using lexical and syntactic knowledge they had observed and learned during their lessons in Phase 2. This task was implemented in two conversation exercises: question-answer and sentence-making.

In question-answer conversations, ten questions in Chinese were posed by the instructor and Ss were expected to answer them in the same manner that they had answered in previous exercises in Phase 2. However, none of these ten questions had been encountered before. Thus, Ss had to make novel responses, using available vocabulary and employing known patterns of sentence construction. The questions had an average length of twelve syllables: the longest was seventeen syllables. For example, the instructor would ask: "My friend and I speak Chinese. Do your friend and you speak Chinese?" (seventeen syllables in Chinese); or "I am a Chinese. I study English and French. What about you?" (fifteen syllables in Chinese). The average length of the responses was eight syllables and the longest reached fourteen syllables. For instance, to answer the first question given above, Ss would have to say, "My friend and I speak/don't speak Chinese." (eight/nine syllables in Chinese); or in response to the second question given above, something like "I am a Canadian. I study French and Chinese." (fourteen syllables in Chinese). For each question, the instructor would repeat, if necessary, no more than three times. If Ss failed to answer a certain

question, the instructor would simply move on to the next question since there would be enough data for later evaluation (See Appendix C for the complete test material of this section).

For the other task of sentence construction, Ss were given three words or phrases with which to make Chinese sentences. In all, they were presented with ten such sets for the construction of ten sentences. The words and phrases provided were mostly nouns or verbs, together with a few grammatical words such as "bu" ("not") or "ma" (interrogative particle). These given items were designed in such a way that the average sentence would be eight syllables long and the longest responses would contain fourteen syllables in two sentences (Appendix C). Ss' performances were recorded again. This took about ten minutes to complete.

The last task of Test 2 was semi-imitation. The twenty Chinese model sentences that Ss were to imitate were exactly the twenty responses expected in the question-answer and sentence-making tasks described above. In this exercise, the average sentence length was eight syllables and the longest reached thirteen syllables. Ss' imitation was recorded for a comparison with their earlier sentence construction performance (Appendix D).

The materials used in the tests and instruction were prepared by a native Chinese speaker with experience in L2 teaching. This person was also the instructor for the entire program (For detailed information about the materials used in the tests, please contact the author).

### Evaluation

A four-point impressionistic scale, similar to that of Neufeld's (1978), was developed to assess tonal and articulatory accuracy both of isolated words and of words within sentences. A Visi-Pitch device and Digital Sona-graph were used to produce graphic illustrations of Ss' speech production. Based on comparisons with the recorded Chinese models, Ss' utterances in Chinese were evaluated by the author and placed into one of the following four categories:

### IMPRESSIONISTIC SCALE

1. Strongly foreign accented; (Poor)
2. Good approximation, but noticeably foreign; (Fair)
3. Native Chinese-like with slight traces of foreign accent; (Good)
4. Unmistakeably native Chinese-like. (Excellent)

Three types of data were analyzed in the test materials:

1. Tone and articulation of all of the recorded test items were evaluated using this scale. These data provided a general impression of Ss' tonal and articulatory performance on the three tasks, i.e. mimicking, semi-imitation, and creative sentence production.

2. Subsets of the test items were used to address specific linguistic questions on either tone or articulation. For example, one subset included all interrogative sentences, for which Ss' tonal production was evaluated.

3. From the subsets, some words or sentences are given as illustrations in this study and used for more specific discussions of tone or articulation. In this case, the first occurrences of the items in the applicable data subset were used. For example, when negative and affirmative sentences were to be compared, the first occurrence of each type of these sentences was analyzed. As was done for specific analyses of tone, illustrations are also provided for specific analyses of articulation. But, in this case, the choice of items for articulatory analyses was further limited in that only sounds or sound sequences which are rare or absent in English were used, e.g. [ʃɿ], [ʃuɛ], and [xan]. Although other groups of sounds, such as nasal consonants or back vowels, could have been chosen, non-English-like sounds were selected because a comparison of production of these sounds between imitation and creative sentence construction could better differentiate the sources of articulatory errors.

## CHAPTER III

### RESULTS AND DISCUSSION

It was hypothesized in this study that foreign accent in older L2 learners' speech results partially from problems arising during sentence construction and articulation. A study was designed to explore the conditions in sentence planning in which articulatory and tonal accuracy might degrade. It was hoped that the results of the present study might throw light on the question of whether processing metalinguistic knowledge and executing grammatical rules would affect these learners' ability to accurately reproduce foreign sounds, especially when they have shown themselves able to utter these sounds correctly in imitation exercises. To facilitate interpretation of the results discussed below, the tests, administered at the end of Phases 1 and 2, will be briefly reviewed here:

During a nine-hour Chinese mini-course, two tests were given: Test 1 after four hours of the course and Test 2 at the end of the course. Test 1 consisted only of mimicking of twenty Chinese sentences which varied in length from two to seven syllables. After only four hours of exposure to the target language, Ss' articulatory and tonal imitation was observed to be between "fair" and "excellent" (see earlier definitions in Chapter II), with mostly 2s, 3s and even some 4s on the four-point scale (see Table 1a).

Test 2 contained two types of imitation: mimicking and semi-imitation (see Chapter II, footnote 1), and two types of sentence construction: question-answer and sentence-making exercises. A comparative analysis was conducted between Ss' mimicking in Test 1 and Test 2. It was found that on the same phrases and sentences from Test 1, Ss' tonal and articulatory accuracy in mimicking improved noticeably in Test 2, with mostly 3s ("good") and some 4s ("excellent"), particularly for tone (see Table 1b). Some of Ss' utterances, especially short phrases of two, three or even four syllables, compared favourably with native-like or near-native-like performance.

Also, it was in this test that a significant disparity in articulatory and tonal quality was found between Ss' semi-imitation and creative sentence production<sup>1</sup>. When semi-imitation was required, even though the longest string reached ten syllables, the average score of most Subjects was well above 2 ("fair") for both tone and articulation (see Tables 2 and 3). This will be further illustrated in the discussions below. However, when Ss were required to plan and articulate these same sentences, tone and articulation usually suffered, with an average of about 1 ("poor") for them all. How and why did tonal and articulatory deterioration take place? In other words, after Ss had achieved a reasonably good level in imitation of Phase 1, under what circumstances did their tonal and articulatory quality decrease? These questions will be addressed at some length in this chapter.

### Analysis

#### Tone

During creative sentence production, Ss' tones in Chinese degraded markedly when additional processing tasks such as the following were involved:

1. when the sentence length increased.
2. when the sentence changed from affirmative to negative.
3. when the sentence changed from affirmative to interrogative.

#### 1. Tonal Quality and Sentence Length

Of twenty sentences that Ss were required to construct in Test 2, the shortest three sentences were five or six syllables in length. It was found that the disparity between imitation and

---

<sup>1</sup>Throughout this and other chapters, "creative sentence production" or "sentence production" or "sentence construction" are frequently used to distinguish the imitation exercises (mimicking and semi-imitation, see Chapter II footnote 1). The former refers to the "question-answer" and "sentence-making" tasks wherein Ss had to actively plan and process sentences in Chinese rather than to imitate them.

sentence construction in these three sentences was very small, in contrast with the disparity in longer sentences. Most Ss scored between fair (2s) and good (3s) in both tasks with the three shortest sentences. The remaining sentences were of 7 to 14 syllables in length. The tonal degradation between these two tasks was more serious in these sentences, becoming worse as the sentence length increased. In the imitation exercises of 11-14 syllable sentences, all Ss could still average "fair", while in sentence construction, they all dropped to "poor" (see Table 4).

TABLE 1

SUBJECTIVE EVALUATION OF ARTICULATION AND TONE IN MIMICKING  
IN TEST 1 AND TEST 2

a.

## TEST 1

	S1		S2		S3		S4	
	Art	Ton	Art	Ton	Art	Ton	Art	Ton
I1	2	4	3	4	2	3	2	3
I2	2	4	3	3	3	3	2	3
I3	2	3	4	4	3	3	2	3
I4	3	4	3	4	3	2	3	4
I5	2	4	4	4	2	3	3	3
I6	2	4	2	2	3	3	2	2
I7	3	3	2	4	2	3	2	2
I8	2	3	2	4	2	2	2	4
I9	2	2	3	3	2	3	3	3
I10	3	3	2	3	2	3	2	4
I11	3	3	2	2	2	2	2	2
I12	2	2	3	4	2	3	3	2
I13	2	4	3	3	2	2	2	3
I14	2	4	2	3	2	3	2	2
I15	2	2	1	2	1	2	2	2
I16	1	2	1	2	2	3	2	1
I17	2	4	2	3	2	3	3	3
I18	2	3	3	3	3	3	3	2
I19	2	2	2	3	2	2	2	2
I20	1	2	2	2	2	2	2	2
Ave	2	3	2	3	2	3	2	2

b.

## TEST 2

---

	S1		S2		S3		S4	
	Art	Ton	Art	Ton	Art	Ton	Art	Ton
I1	3	3	3	4	4	4	3	2
I2	3	3	3	4	4	4	2	3
I3	3	4	4	4	3	4	2	4
I4	3	4	4	4	3	4	2	4
I5	2	4	3	4	3	4	3	3
I6	2	4	3	3	4	4	3	3
I7	2	3	3	4	3	3	2	2
I8	3	4	3	4	2	4	2	3
I9	3	3	2	4	2	4	2	4
I10	3	4	4	4	3	4	3	3
I11	3	4	2	3	2	3	3	3
I12	2	3	3	3	3	4	2	2
I13	2	4	4	4	3	4	2	3
I14	3	4	3	4	3	4	2	3
I15	2	3	2	4	2	3	2	3
I16	2	3	3	4	1	2	2	2
I17	3	4	2	3	2	4	3	3
I18	3	4	4	4	3	4	3	3
I19	2	2	3	4	2	3	2	3
I20	3	3	3	3	3	4	2	2
Ave	2	3	3	3	3	3	2	3

---

Key: S = Subject  
 I = Item  
 Ave = Average  
 Art = Articulation  
 Ton = Tone

TABLE 2  
SUBJECTIVE EVALUATION OF TONE IN TEST 2

	S1		S2		S3		S4	
	S.I.	S.C.	S.I.	S.C.	S.I.	S.C.	S.I.	S.C.
I1	4	2	4	2	3	1	2	1
I2	4	3	3	3	2	2	2	2
I3	2	1	3	1	3	1	1	1
I4	3	1	3	2	3	1	2	1
I5	4	1	3	1	2	1	2	1
I6	1	1	2	2	2	1	2	1
I7	2	1	3	1	3	1	1	1
I8	2	1	3	2	1	1	1	1
I9	2	1	3	1	2	1	2	1
I10	3	2	2	1	3	2	1	1
I11	1	1	3	1	2	1	1	1
I12	3	1	4	2	4	2	2	1
I13	0*	1	0	1	0	1	0	1
I14	3	1	2	1	2	1	1	1
I15	0	0	2	2	3	1	1	1
I16	0	1	0	1	0	1	0	1
I17	0	1	3	1	3	1	2	1
I18	2	2	3	2	3	2	2	1
I19	3	1	4	1	4	1	2	1
I20	3	1	3	1	3	2	1	1
Ave	3	1	3	2	3	1	2	1

\* Ss would receive "0" score upon the sentences that they failed to complete.

Key:           S = Subject  
               I = Item  
               Ave = Average  
               S.I. = Semi-imitation  
               S.C. = Sentence Construction

TABLE 3

## SUBJECTIVE EVALUATION FOR ARTICULATION IN TEST 2

	S1		S2		S3		S4	
	S.I.	S.C.	S.I.	S.C.	S.I.	S.C.	S.I.	S.C.
I1	2	1	3	1	2	2	2	1
I2	4	2	3	2	3	2	2	2
I3	3	1	2	1	2	1	1	1
I4	4	2	3	1	3	2	2	1
I5	2	1	2	1	3	1	2	1
I6	2	1	2	2	2	1	1	1
I7	3	1	2	2	2	1	2	1
I8	2	1	3	2	2	2	1	1
I9	2	2	2	1	2	1	1	1
I10	3	1	2	1	3	1	2	2
I11	1	1	3	2	2	1	1	1
I12	2	2	1	1	2	1	2	1
I13	0*	1	0	1	0	1	0	1
I14	2	1	2	1	3	1	2	1
I15	0	1	0	1	2	1	0	1
I16	0	1	0	1	0	1	0	1
I17	2	1	2	1	3	1	1	1
I18	2	2	3	1	3	2	2	1
I19	1	1	2	1	3	1	2	1
I20	3	2	2	1	3	1	1	1
Ave	2	1	2	1	3	1	2	1

\* Ss would receive "0" score upon the sentences that they failed to complete.

Key: S = Subject  
 I = Item  
 Ave = Average  
 S.I. = Semi-imitation  
 S.C. = Sentence Construction

TABLE 4  
 SUBJECTIVE EVALUATION OF TONE OF DIFFERENT SENTENCE LENGTHS  
 IN TEST 2

	S1		S2		S3		S4		Ave	
	S.I.	S.C.	S.I.	S.C.	S.I.	S.C.	S.I.	S.C.	S.I.	S.C.
I1	3	3	3	3	3	3	2	2	3	3
I2	3	2	3	3	3	2	2	1	3	2
I3	3	1	3	2	3	2	2	1	2	1
I4	2	1	3	1	3	1	2	1	2	1

Key: S = Subject  
 I = Item  
 S.I. = Semi-imitation  
 S.C. = Sentence Construction  
 I1 = Average Scoring of 3 sentences with 6 Syllables or less  
 I2 = Average Scoring of 6 sentences with 7-8 Syllables  
 I3 = Average Scoring of 7 sentences with 9-10 Syllables  
 I4 = Average Scoring of 4 sentences with 11 Syllables or more

In order to further illustrate the relationship between sentence length and tonal deterioration, the first two affirmative sentences from the data are shown here as examples: one of six syllables (see Figure 1) and the other of ten syllables (see Figure 2). In the six-syllable sentence (I2, Table 2), Ss' tonal accuracy in both semi-imitation and sentence construction was between fair and excellent (2s to 4s). Ss' tonal accuracy in both these tasks was consistent and the degradation from one task to the other was very minor. Figure 1 illustrates this finding. The tonal patterns produced appear close to the model of the native Chinese speaker. The pause lengths between sentence constituents are judged to be normal.

However, in the ten-syllable sentence (I10, Table 2), an obvious disparity was found between Ss' performance in semi-imitation and that in sentence construction. In imitation, despite the considerable sentence length (10 syllables), Subjects did surprisingly well in terms of tonal accuracy (Figure 2.1). Three of them were able to keep fairly accurate tones, scoring between "fair" and "good". Only one S appeared to have some difficulty in tonal accuracy, scoring "poor". Yet, when one looks at Figure 2.2<sup>2</sup> for the creative sentence production of the same sentence, the tonal quality of all Ss can be seen to decrease markedly when compared with their imitation performance, or when compared with both imitation and sentence production of a six-syllable sentence. Tonal production of all Subjects was observed to be distinctly non-native-like, with scores of only 1. Their contour patterns give an impression of "tonelessness" in contrast with the Chinese model. In addition, in this ten-syllable sentence, all Ss made unnaturally long pauses between phrases.

---

<sup>2</sup>In the following illustrations, long pauses have been removed, as indicated by blank space.

## 2. Tonal Quality and Negation

Comparison of sentence types in Ss' performance also reveals some interesting differences in the quality of tonal production. The two selected sentences are both six syllables long, but one is in an affirmative form (the same sentence as in Figure 1) and the other is in a negative form (Figure 3). As was seen in the previous section, the tonal accuracy achieved in the imitation of this short affirmative sentence was maintained in the creative sentence production. In other words, tonal deterioration was minimal between these two tasks. However, in the corresponding negative sentence (I1, Table 2), a marked difference in tonal quality was observed between Ss' performance in imitation and sentence construction tasks. In imitation, tone was very good, averaging above 3 ("good"). During sentence construction, however, tonal quality was much worse. All Ss' performance on tone was noticeably non-native-like. Note that the tonal contours are much flatter (Figure 1 cf. Figure 3).

In the sentence construction tasks of Test 2, six of the twenty sentences were negatives. For all Ss, even negatives of only six syllables in length showed considerable decline in tonal quality when compared to the affirmative sentences of the same length (I1 cf. I2, Table 5). In negative sentences, the average deterioration between imitation and creative sentence production was much greater than that in affirmative sentences. In affirmative sentences, Ss' performance was judged to be between "fair" and "good" in both exercises. Imitation of negative sentences was also "fair" to "good", but when required to construct these same negative sentences, all Ss' tonal quality decreased to "poor". In addition, all Subjects had a tendency to hesitate and pause longer in the negatives.

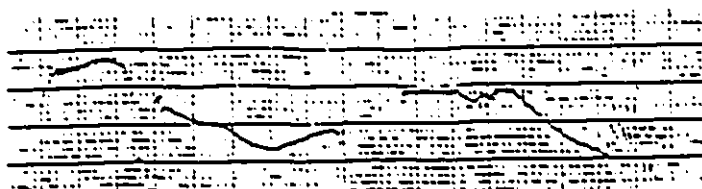
FIGURE 1

TONAL QUALITY AND SENTENCE LENGTH

Six-syllable sentence: Zhong guo ren shuo han yu.

(The Chinese speak Chinese)

CHINESE MODEL



SEMI-IMITATION

SENTENCE CONSTRUCTION

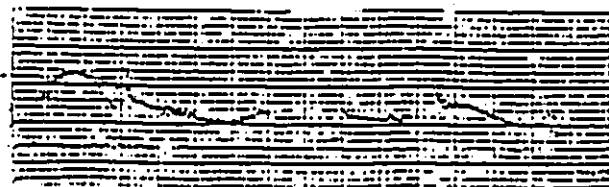
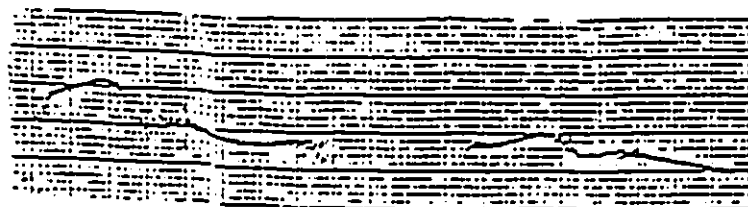
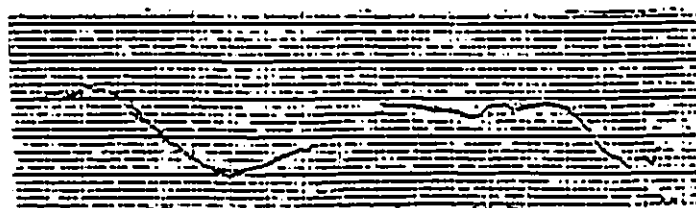
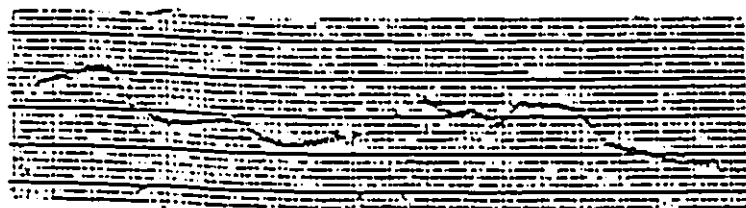
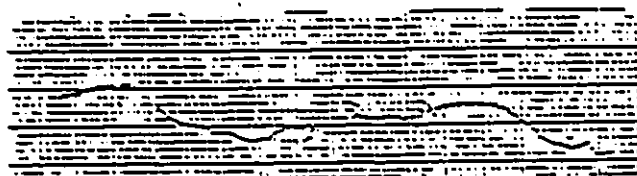
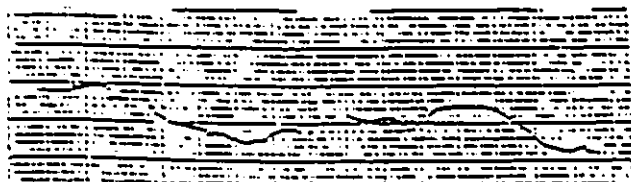
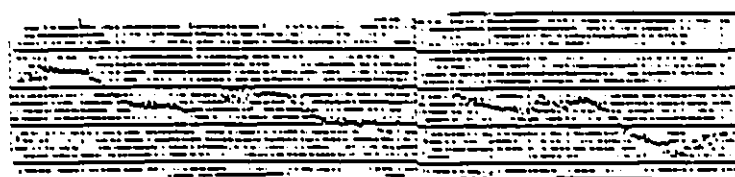
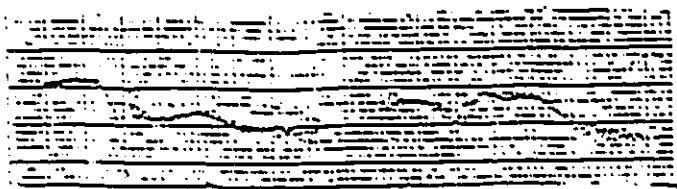
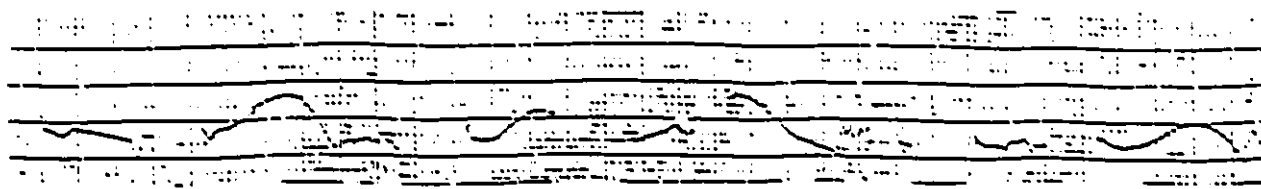


FIGURE 2.1

## TONAL QUALITY AND SENTENCE LENGTH

Ten-syllable sentence: Wo peng you xue xi han yu he fa yu.  
 (My friend studies Chinese and French)

## CHINESE MODEL



## SEMI-IMITATION

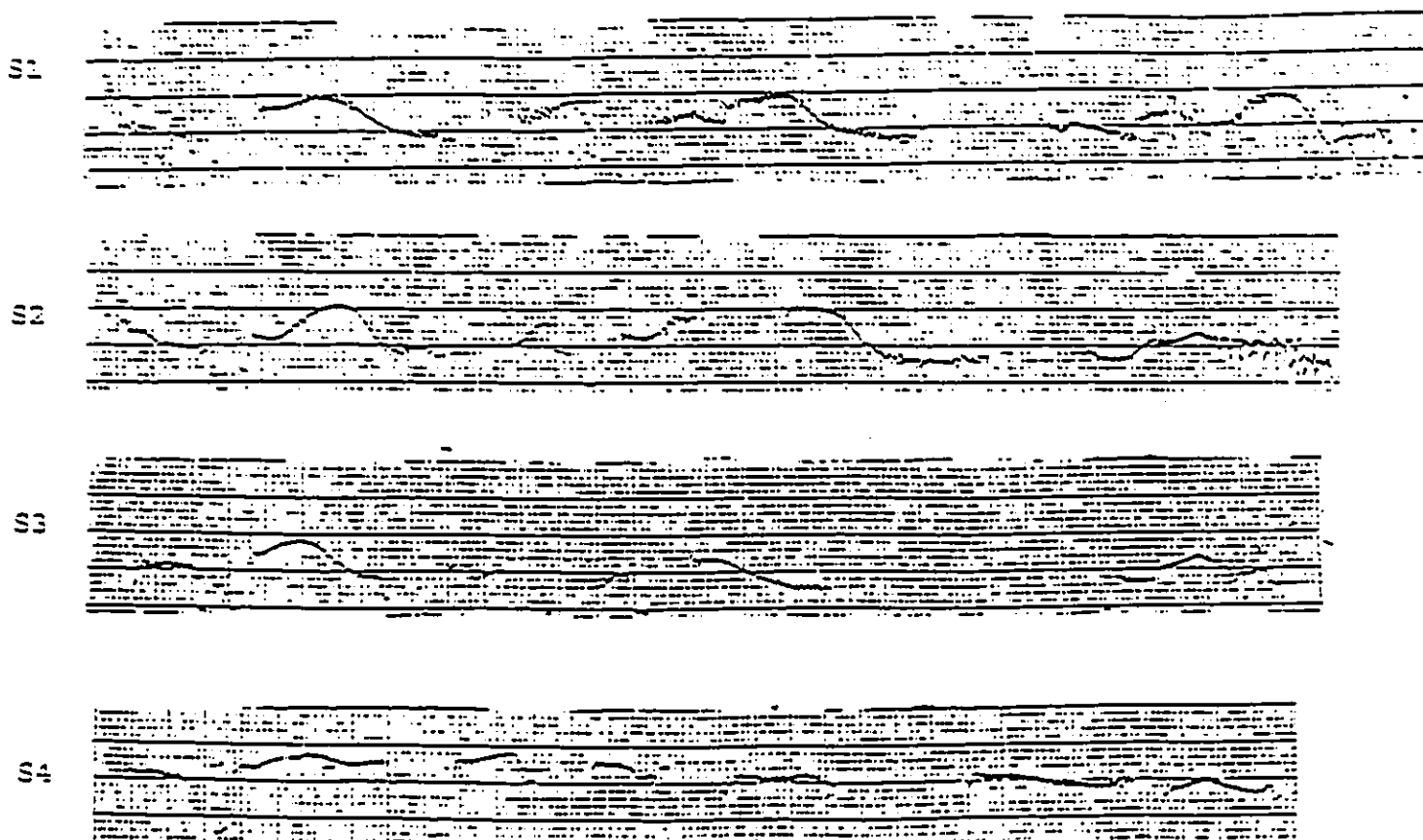


FIGURE 2.2 (Continued)  
SENTENCE CONSTRUCTION

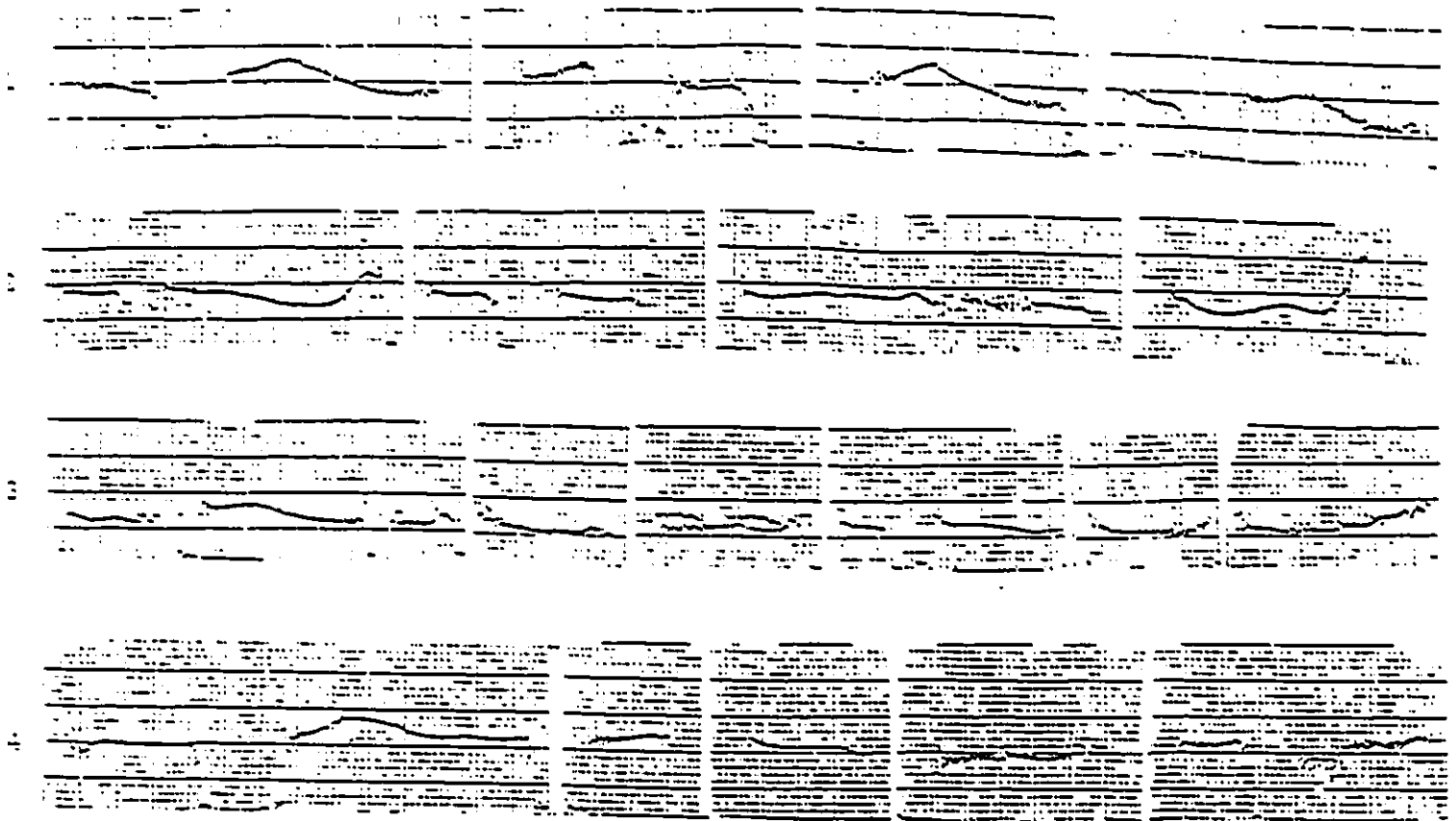
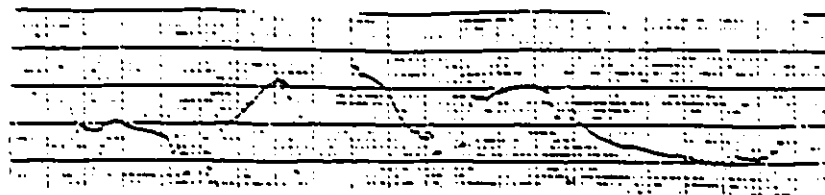


FIGURE 3

TONAL QUALITY AND NEGATION

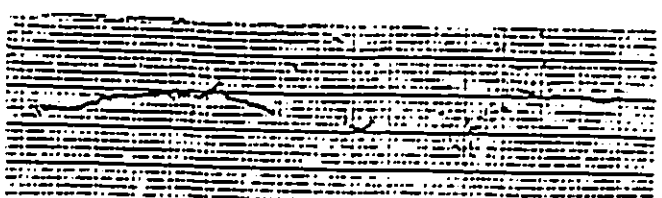
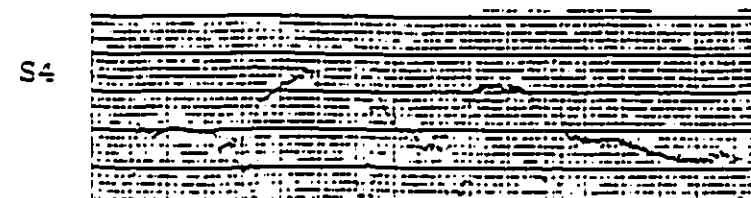
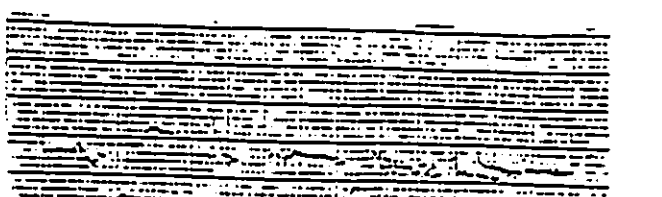
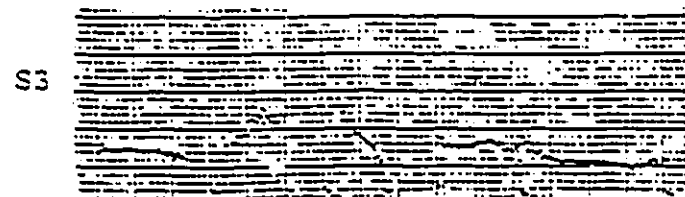
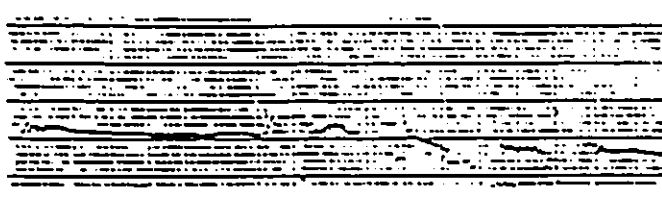
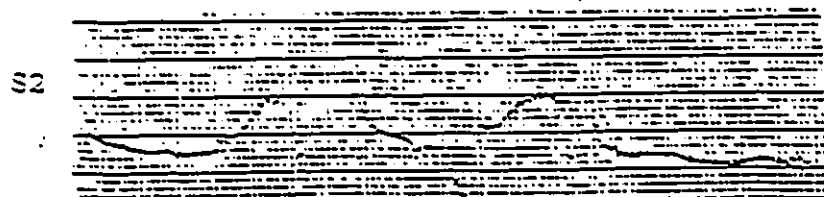
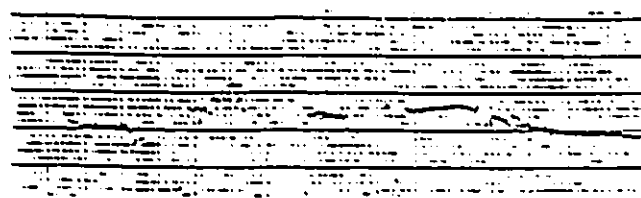
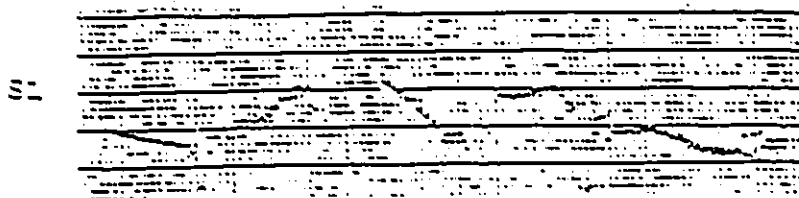
Negative sentence: Wo bu shi zhong guo ren.  
(I am not a Chinese)

CHINESE MODEL



SEMI-IMITATION

SENTENCE CONSTRUCTION



### 3. Tonal Quality and Interrogation

In the creation of a yes/no interrogative<sup>3</sup>, Ss apparently mapped English intonation onto the Chinese sentence (Broselow, et al., 1987). Accuracy of production of Chinese tones was thereby diminished. An English yes/no question is indicated by a rising pitch at the end of the sentence. In North American English, the onset of this pitch rise begins fairly high in the pitch range (Cruttenden, 1986). In contrast, a Chinese interrogative sentence is indicated by the use of the interrogative particle "ma" as the final word of the question. This interrogative word has a neutral tone<sup>4</sup>. Thus, a yes/no interrogative Chinese sentence, unlike its English counterpart, does not have a rising pitch at the end of the sentence.

The first interrogative sentence in the data was taken as an example to show how Ss treated such sentences. At the semi-imitative level, most Ss were able to make tonal contour patterns similar to the model (see Figure 4.1). Three out of four produced the tone of the last word "ma" and other tones in the sentence with a good level of accuracy, with the average score of 3 ("good") on the scale (15, Table 2). They accurately used a neutral tone at the end of a yes/no interrogative sentence. The other S was scored 2 ("fair") since there was some deviation from both the level pitch of the neutral tone and general tonal production of the model. In general, the tonal contours of all Ss' semi-imitation were much closer to the Chinese model than to the English model shown in Figure 4.2.

A rising pitch on the Chinese particle "ma" was universal among Ss when they were required

---

<sup>3</sup>This term is used to distinguish these from Wh-interrogatives which use "What", "Where", "How" and so on. Yes/No questions, unlike Wh-questions, may be answered with a simple "yes" or "no".

<sup>4</sup>In Mandarin Chinese, a neutral tone is characterised by a low-mid or mid level pitch (See Appendix E for a description of the tones). It is low following the first, second and fourth tones and mid following the third tone. In addition, syllables with neutral tones are shorter than those with other tones.

to "creatively construct" these sentences. Without exception, Ss appear to have mapped the pitch rise, characteristic of yes/no questions in English, onto all these Chinese questions. This was true of all four Subjects, and of all six such questions in Test 2.

TABLE 5

SUBJECTIVE EVALUATION OF TONE OF DIFFERENT SENTENCE FORMS  
IN TEST 2

	S1		S2		S3		S4		Ave	
	S.I.	S.C.	S.I.	S.C.	S.I.	S.C.	S.I.	S.C.	S.I.	S.C.
I1	3	3	2	3	3	3	2	2	3	3
I2	2	1	3	1	3	1	1	1	2	1
I3	3	1	3	1	3	1	2	1	3	1

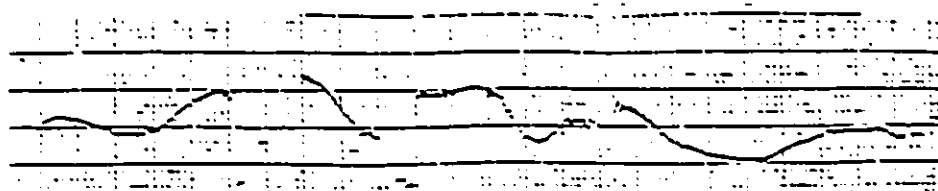
Key: S = Subject  
I = Item  
Ave = Average  
S.I. = Semi-imitation  
S.C. = Sentence Construction  
I1 = Average of 7 Affirmatives  
I2 = Average of 6 Negatives  
I3 = Average of 7 Interrogatives

FIGURE 4:

TONAL QUALITY AND YES/NO INTERROGATION

Yes/no interrogative question: Ni men shi jia na da ren ma?  
(Are you a Canadian?)

CHINESE MODEL



SEMI-IMITATION

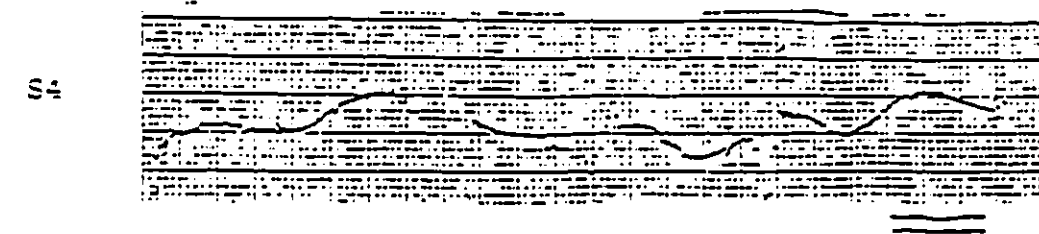
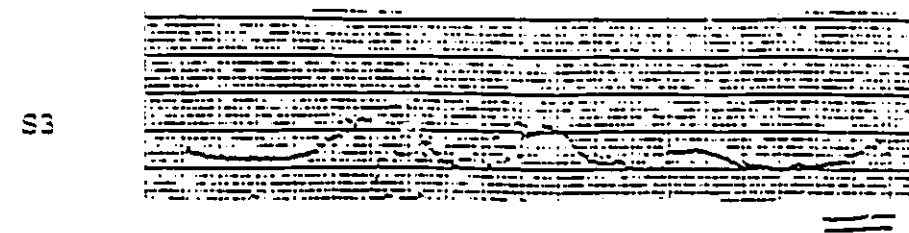
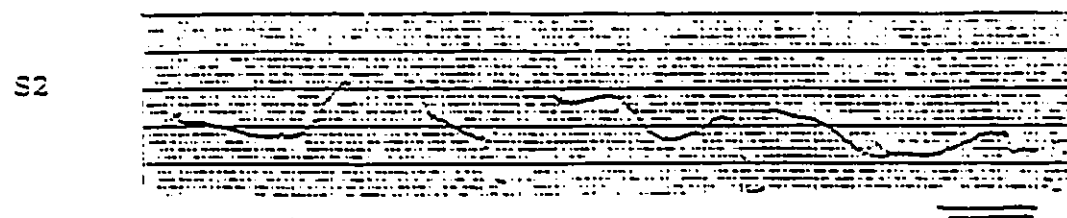
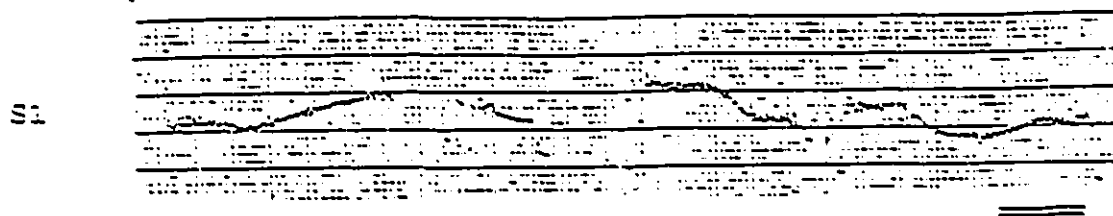
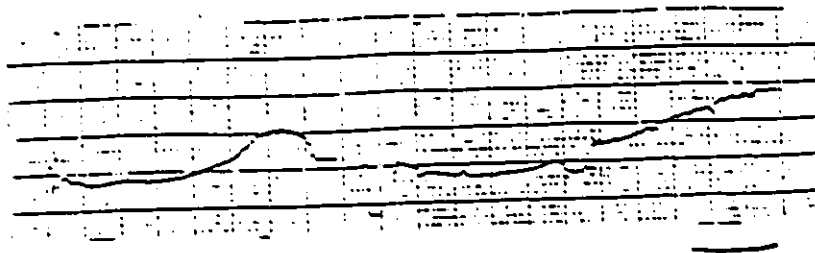
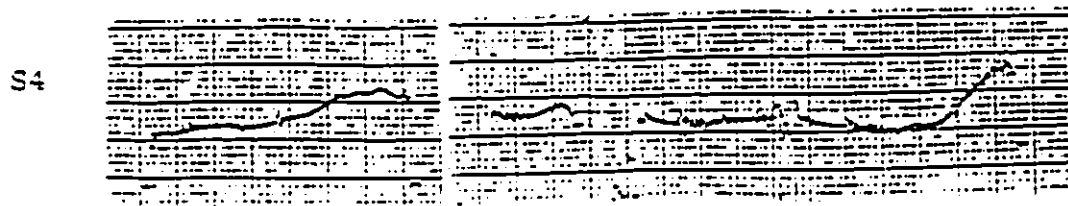
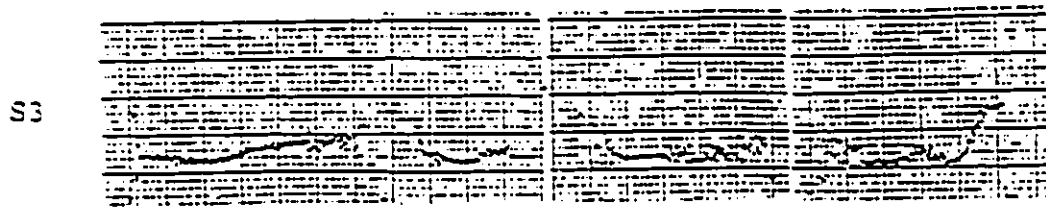
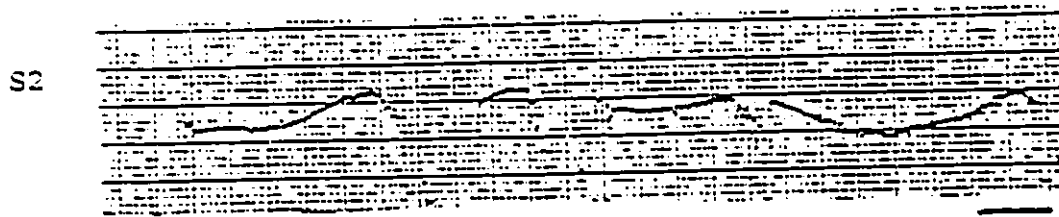
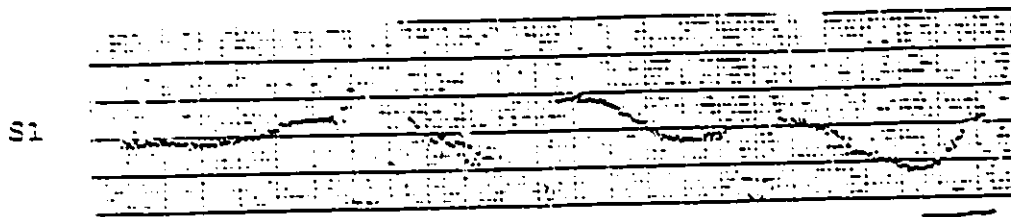


FIGURE 42 (Continued)

ENGLISH MODEL



SENTENCE CONSTRUCTION



## Articulation

During sentence production that involved sentence planning, there were more articulatory errors in Chinese especially:

1. in words near the end of a sentence rather than near the beginning.
2. when a sentence was in the interrogative rather than the declarative form.
3. with sounds or sound sequences that appear rarely or never in English.

### 1. Articulation and Sentence Length

Articulatory accuracy in Ss' creative sentence production was found to be related to the position of a word or words occurring in a sentence. Segmental articulation at the beginnings of sentences tended to be more accurate than in the middle or ends of sentences. In Test 2, there were seven words that appeared both in sentence-initial and sentence-final positions (Appendix F). A comparative evaluation of these words in both positions was made on Ss' sentence construction performance (see Table 6). The results showed that when these words occurred near the beginning of a sentence, three out of four Ss had higher articulatory scores than when these words occurred towards the end of a sentence.

In order to illustrate this point, two sentences of eight syllables were selected which contained one of these target words. In the first sentence (see Figure 5.1), the target word "da" (phonetically [ta]) in the phrase "jia na da" (Canada) appeared in the third position in this

TABLE 6

COMPARATIVE EVALUATION OF ARTICULATION OF 7 TARGET SOUNDS  
IN SENTENCE-INITIAL AND SENTENCE-FINAL POSITIONS IN SENTENCE  
CONSTRUCTION

	S1		S2		S3		S4	
	I.P.	F.P.	I.P.	F.P.	I.P.	F.P.	I.P.	F.P.
I1	2	1	3	2	3	1	3	1
I2	3	2	3	2	3	2	4	2
I3	2	1	3	2	2	1	3	1
I4	3	2	3	2	3	1	2	1
I5	3	1	2	1	3	2	3	1
I6	3	1	3	2	3	1	3	2
I7	4	2	2	1	1	1	2	1
Ave	3	1	3	2	3	1	3	1

Key: S = Subjects  
I = Item  
Ave = Average  
I.P. = Initial Position  
F.P. = Final Position

eight-syllable sentence. In the second sentence, the target word [ta] occurred in the seventh slot in the sentence. When the target word appears near the initial position as in the first sentence, all Ss' articulations in both semi-imitation and sentence construction were rated "excellent": [ta] was pronounced [ta] by all of them.

In the second sentence, Ss were able to accurately imitate the target. However, when they were required to create this sentence on their own, the target underwent significant articulatory degradation. Two Subjects pronounced [ta] as [t<sup>h</sup>a]; one pronounced it as [dʌ]. Only one articulated close to the model but employed a rising tone "/" instead of a falling tone "\" as in the model (see Figure 5). Why was there such articulatory deterioration in creative sentence production but not in semi-imitation, and why was sentence-initial position resistant to deterioration in both imitation and sentence construction? These questions will be discussed below (see Discussion).

## 2. Articulation and Interrogatives

Like the relationship between tonal deterioration and the interrogative, articulation also became worse when Ss were asked to create an interrogative sentence. Five words that appeared in both affirmative and interrogative sentences in Test 2 were chosen as targets (Appendix G). Most Ss scored "poor" on these targets when required to create these interrogatives. Only one S was judged "fair" on half of the target words (see Table 7).

FIGURE 3

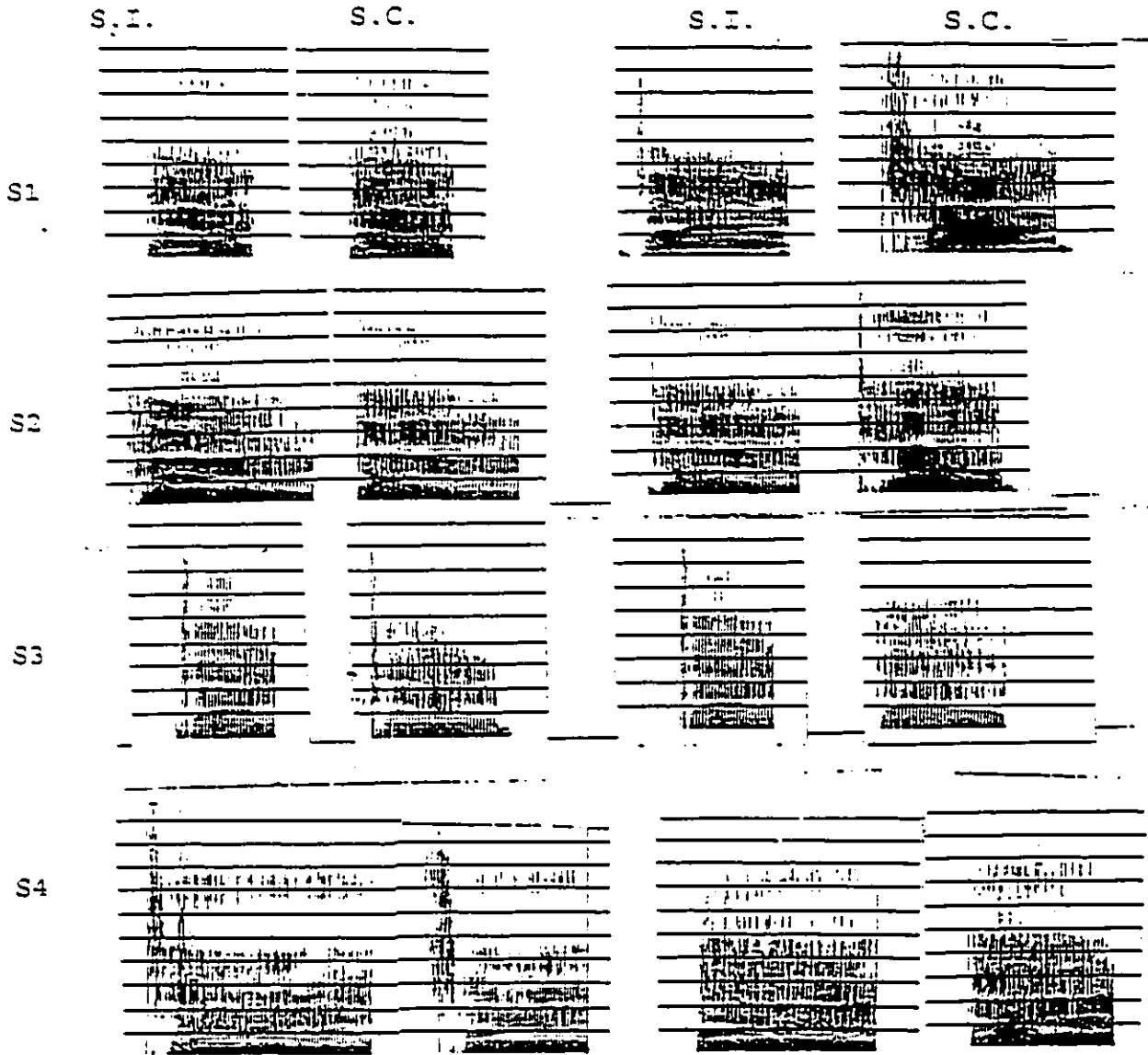
ARTICULATION AND SENTENCE POSITION

Sentence-Initial position:

Jia na da xue sheng shuo  
han yu. (Canadian students  
speak Chinese.)

Sentence-Final position:

Ni men shi jia na da xue sheng.  
(You are Canadian students.)



Key: S.I. = Semi-imitation  
S.C. = Sentence construction

TABLE 7

COMPARATIVE EVALUATION OF ARTICULATION OF 5 TARGET SOUNDS  
IN THE FORMATION OF AFFIRMATIVES AND INTERROGATIVES

	S1		S2		S3		S4	
	Aff	Int	Aff	Int	Aff	Int	Aff	Int
I1	4	2	2	2	3	1	3	1
I2	3	2	3	1	3	2	4	2
I3	2	1	3	1	2	1	2	1
I4	3	2	3	1	3	1	2	1
I5	3	2	2	1	3	2	3	1
Ave	3	2	3	1	3	1	3	1

Key: S = Subjects  
I = Item  
Ave = Average  
Aff = Affirmatives  
Int = Interrogatives

An example consisting of two sentences, an affirmative and an interrogative, is given here (see Figure 6). The target word was [ʃɪ] in both sentences. Both sentences are the same except that one is a declarative: "Wo peng you shi jia na da ren." (My friend is a Canadian.) and the other is an interrogative: "Wo peng you shi jia na da ren ma?" (Is my friend a Canadian?). In the affirmative sentence, the target word was articulated well by all Ss in both semi-imitation and sentence construction tasks, averaging above 3 ("good") on the scale. In the interrogative sentence, however, there was a marked contrast between Ss' articulation in these two tasks. All Ss could still score 3 ("good") and above when imitating, but when they had to create this interrogative on their own, three Subjects had only 1s ("poor") and one scored 2 ("fair") on this same word. The original in Chinese was pronounced as [sɑ̃] by two Ss; as [fə] by one S and as [fɪ] by another.

### 3. Articulation and non-English like sounds

In Test 2, there were about ten sounds which are rare or absent in English (Appendix H). With few exceptions, Ss were able to accurately imitate these sounds, but when forming their own sentences, most would fail to articulate them correctly. As shown in Table 8, four Ss' imitations of these targets were evaluated as mostly "good" with occasional "fair" and a few "poor". Yet, in their sentence construction performance, the results were just the opposite: their articulations were mostly "poor", with some "fair" and a few "good".

The following is a typical example of this trend. The target item [ɕuɛ] ("study") contains sound sequences that are absent in English. In English, since there is no such a consonant as [ɕ] nor a vowel as [uɛ], this word was expected to be difficult for English-speaking learners. However, most Ss had no difficulty accurately articulating this sound in imitation (see Figure 7). Only one S mispronounced the word. Yet, during their creative sentence production, Ss' articulation degraded dramatically: none of them pronounced the word correctly. The target sound was

produced as [ʃə] by two Ss. as [ʃi] by one and as [ʃu] by another.

TABLE 8

SUBJECTIVE EVALUATION OF ARTICULATION OF 10 NON-ENGLISH LIKE  
SOUNDS IN TEST 2

	S1		S2		S3		S4	
	S.I.	S.C.	S.I.	S.C.	S.I.	S.C.	S.I.	S.C.
11	2	1	3	2	3	1	3	1
12	3	2	3	1	3	1	3	1
13	3	1	2	1	3	1	3	2
14	3	3	3	2	3	2	3	2
15	3	1	1	1	3	3	3	3
16	3	1	3	2	3	1	3	1
17	2	2	2	1	1	1	2	2
18	3	2	3	1	3	2	3	2
19	3	2	3	2	3	1	3	1
110	3	2	3	1	3	2	3	2
Ave	3	2	3	1	3	1	3	2

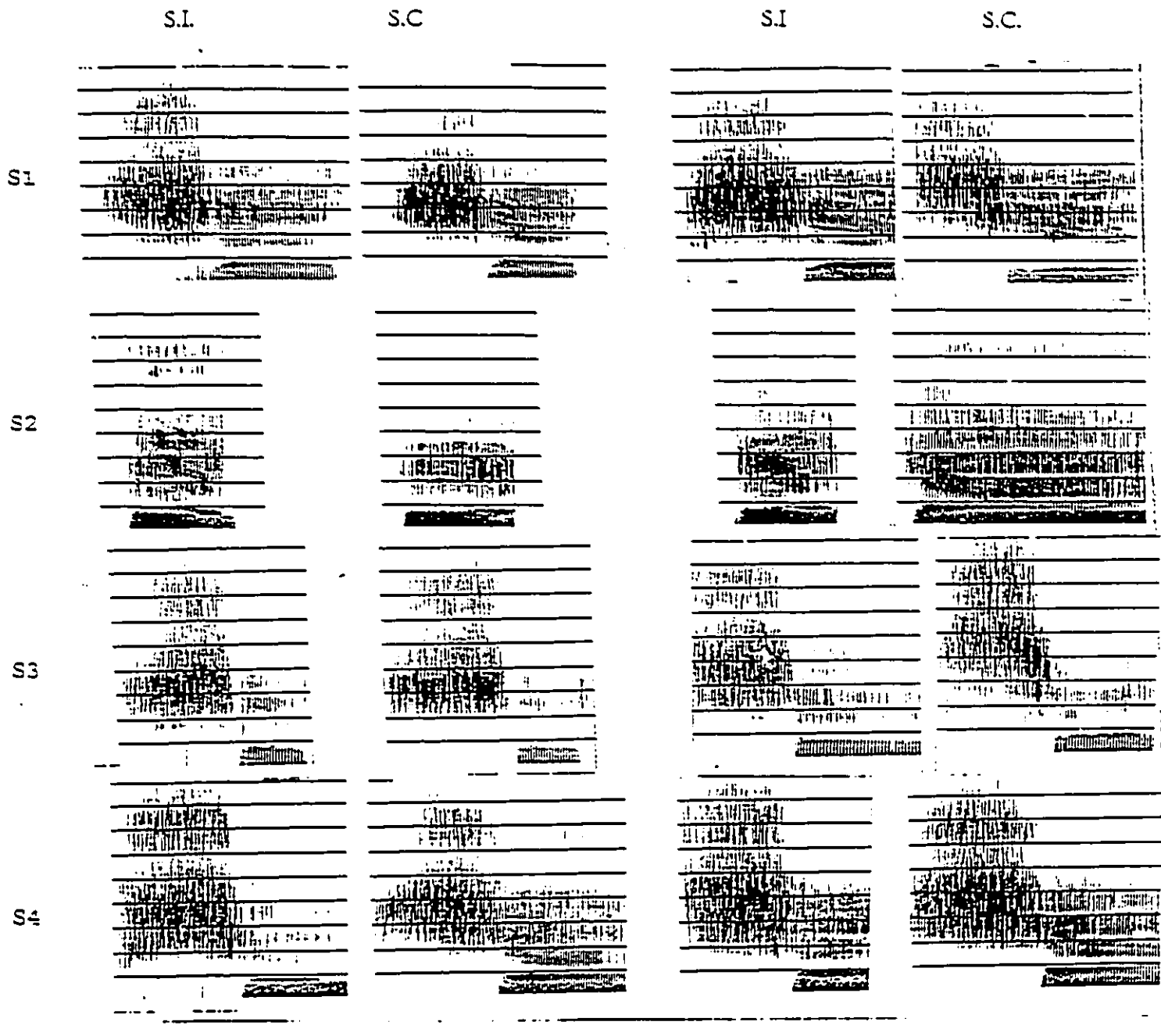
Key: S = Subject  
I = Item  
Ave = Average  
S.I. = Semi-imitation  
S.C. = Sentence Construction

FIGURE 6

ARTICULATION AND INTERROGATION

Declarative Sentence: Wo peng you shi jia na da ren.  
(My friend is a Canadian.)

Interrogative Sentence: Wo peng you shi jia na da ren ma?  
(Is my friend a Canadian?)

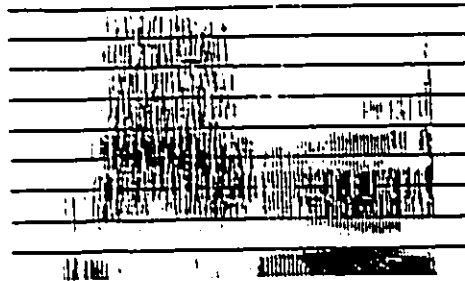


Key: S.I. = Semi-imitation  
S.C. = Sentence construction

FIGURE 7

ARTICULATION AND NON-ENGLISH LIKE SOUNDS

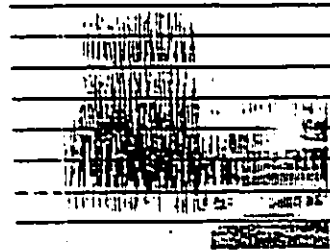
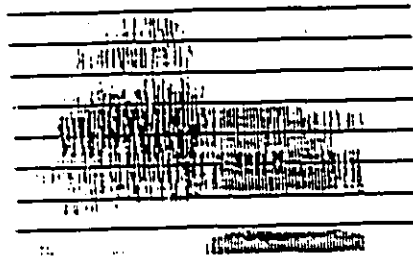
CHINESE MODEL



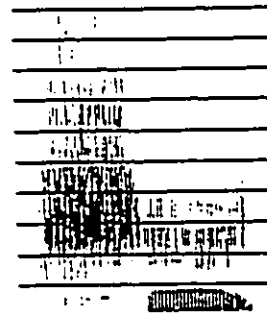
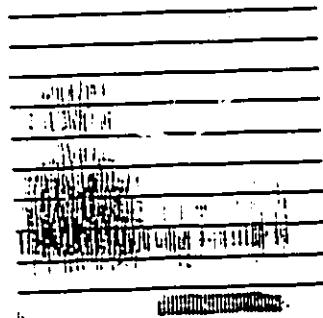
SEMI-IMITATION

SENTENCE CONSTRUCTION

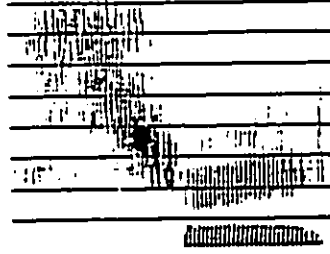
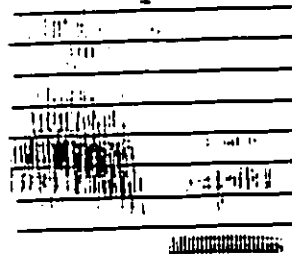
S1



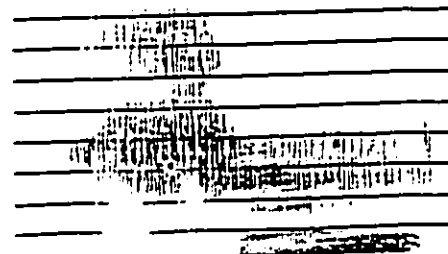
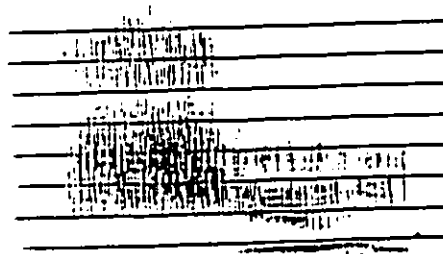
S2



S3



S4



## Discussion

In order to arrive at a plausible interpretation of these findings, Neufeld's PAV (Pre- and Post-Articulatory Verification) model, discussed at the end of Chapter I, will be referred to. According to this model, foreign accent in older L2 learners may arise partially due to overload conditions in the linguistic output processor. This model suggests that there are three primary causes of overload in this processor:

- a. preoccupation with ordering of linguistic constituents.
- b. the necessity to process metalinguistic information during sentence planning.
- c. psychological stress.

Although this model was originally developed to account for articulatory deficiencies, the author found it applicable to tonal deterioration in this study as well.

According to the data, articulatory and tonal accuracy was inversely related to increases in grammatical activity during sentence processing. The present data show that as the degree of difficulty of production tasks increased from mimicking, through semi-imitation, to shorter and longer sentence construction, there was a gradual degradation in Ss' tonal and articulatory quality (Tables 1, 2, 3, and 4). In the context of the PAV model, these results are not difficult to understand. In the gradations from mimicking a short phrase to creating a long sentence, sentence planning and processing required of Ss gradually increased. For instance, to construct a long sentence of ten or more syllables, Ss had much more to do in arranging linguistic constituents and utilizing observed prescriptive rules about Chinese grammar than either to merely mimic sounds or to make a short sentence of two or three syllables. The additional time and focus required of Ss in the creation of longer sentences placed a heavier burden on the output processor of these learners, especially when they were still at the initial stages of learning. As a result, they probably

could no longer concentrate upon tonal and articulatory accuracy. Attention to these areas would resume when their processing tasks were reduced. Thus, in imitation and even in sentence construction of shorter sentences where minimal sentence planning was involved, the quality of tone and articulation was generally good.

Why would articulatory and supra-segmental accuracy be sacrificed in this case? According to Neufeld's PAV model, if L2 learners concentrate mainly on form during sentence planning, the linguistic output processor would have to reduce its focus on articulatory and suprasegmental quality. One may speculate that, to the overloaded Ss, this accuracy is less important relative to sentence meaning and syntactic composition. This might largely explain tonal and articulatory deterioration observed particularly in the creative sentence production of a longer sentence.

Sentence length was found to affect both segmental and suprasegmental accuracy in this study. The observed disparity between articulatory proficiency early and late in a sentence is consistent with this finding. This could be due to sentence length as such or it could be due to syntactic or semantic complexity. Perhaps sentence length as such is not really the important factor in segmental and suprasegmental deterioration. Longer sentences, for example, are not necessarily semantically complex. One may be able to utter a long string of familiar words accurately e.g., "I got up at seven, had breakfast at eight, went to school at half past eight and sat down", but may not be able to correctly articulate a short embedded sentence that is logically complicated, e.g., "My uncle's only child's cousin arrived yesterday". Length, therefore, may be nothing more than a non-causal correlary of degree of language processing, at all linguistic levels, from phonological to semantic.

Another interesting finding in the present study relates to different grammatical sentence forms (Table 5, and Figures 3 and 4). Negation and interrogation were implicated as possible sources of tonal and articulatory deterioration. Despite the fact that Ss were able to imitate

negatives and questions well, tonal and articulatory quality decreased markedly when they were required to create these same sentences. Although it is possible that the affirmative form may be inherently simpler than the other two forms, one can also explain this deterioration by the manner in which grammatical structures were first introduced to the students in this Chinese course. This might have been crucial in determining the way they processed these sentences.

In the lessons, an affirmative sentence structure was used as a base structure from which negative and interrogative sentences were built. This might have created an impression in Ss that the negation or interrogation was formed from the affirmative structure. During their learning process, Ss had been required to make a negative sentence by inserting a negative adverb in the predicate of an affirmative structure or to make an interrogative by adding an interrogative particle to the end of a declarative sentence. Therefore, Ss' production of a negative sentence or an interrogative sentence might have involved formal rule processing.

However, younger children learning negatives and interrogatives may proceed otherwise. For one thing, when children learn a new language, grammatical structures are not generally introduced and explained to them in a systematic way as these were to Ss. Pre-schoolers are likely to encounter all sorts of sentence forms (e.g., affirmatives, negatives and interrogatives) at once in informal learning environments such as at home, in the streets or on T.V. Therefore, formal rule application may simply not exist in the course of their processing and production of different sentence structures. Of course, as this study did not involve younger Ss, this explanation remains highly speculative.

Because of this hypothetical use of formal rules involved in sentence planning, Ss' processing might have been greatly affected. It is possible that Ss were forced to make extra efforts in applying the introspective observations and formal rules to form a negative or an interrogative. For example, in the Chinese lessons, a yes/no question was introduced by adding the interrogative particle "ma"

to the end of an affirmative. Thus, preoccupation with form in sentence planning would have increased as Ss had to make efforts in changing from an affirmative to an interrogative. The more attention they gave to form or structure during sentence planning and production, the less attention they could keep on tonal and articulatory accuracy. As a result, their tone and articulation in Chinese drifted back to their familiar English intonation and sound patterns.

Ss' use of English-like sounds, as shown in Table 7, can be similarly explained. Once again, their excessive focus on form may greatly reduce articulatory and suprasegmental editing. As a result, during creative sentence production, Ss could not pay enough attention to the accuracy of vocal configurations for sounds, particularly the sounds that are absent in English. Therefore, Ss returned to their familiar English-like articulation.

## CHAPTER IV

### SUMMARY AND CONCLUDING REMARKS

One of the most difficult hurdles to overcome for adult L2 learners is to rid themselves of foreign accent in their speech. Accent persists in most, even when they control syntactic and semantic features well. Attempts to explain this deficiency have been made by numerous researchers in the field. The principal aim of the present study was to explore one of these positions: Neufeld's Pre- and Post-Articulatory Verification (PAV) sentence production model. Based on this model, the present study was designed to test the hypothesis that articulatory and suprasegmental features can be fairly accurate in sentence production exercises in L2 provided that little attention is given to rules and meaning. Another hypothesis that is closely related to the first was that, as the need for linguistic processing increases, L2 learners of ten years or older can no longer focus normally on tone and articulation.

Four English-speaking university students were given a nine-hour Chinese mini-course. In the four hours of Phase 1, recorded programs were restricted to phonetic training of listening and imitation only. No instruction in vocabulary and grammar were given. At the end of Phase 1, Ss' imitative utterances were tape-recorded and retained for analysis. During Phase 2, additional tasks, containing spontaneous and creative sentence production, were required of Ss. Grammatical rules and vocabulary were introduced during this phase. At the end of the course, Ss' performance in both imitation and sentence construction was tested and tape-recorded.

The tests were scored by the author, using instrumental analysis and a four-point impressionistic scale. The results of the study are summarized as follows:

- 1) When Ss were required merely to mimic strings of foreign sounds in Phase 1, some of their articulatory and tonal production could be associated with near-native-like performance.
- 2) When Ss had to use lexical and grammatical knowledge to construct sentences on their own, there was considerable deterioration in articulatory and tonal accuracy.
- 3) When Ss were required merely to mimic strings of foreign sounds in Phase 2, this deterioration was reversed and their articulatory and tonal accuracy was as good as, or even better than that in Phase 1.
- 4) The quality of articulation and tone was particularly affected by sentence length and by negative and interrogative structures in creative sentence production tasks.
- 5) When lexical meaning and combinational rules were introduced, the tone was found to be the linguistic feature that suffered most.

\* \* \*

Most explanations for foreign accent in the speech of adult L2 learners point to deficient structures in their interlanguage phonology which lead to erroneous articulation. The factors that are alleged to cause these deficiencies vary from physiological maturation, to phonological transfer from the first language, to developmentally-induced disabilities. These theories and hypotheses that pertain to phonological competence in L2 account for many articulatory errors in second language

performance, especially those that can be traced to rules. However, not all articulatory deviations can be easily predicted. For instance, non-systematic phonetic errors are not sufficiently explained by these theories.

Some recent studies have generated compelling counter-arguments and hypotheses relating to theories of second language performance. These authors contend that there are causes of foreign accent which originate neither with deficiencies in linguistic competence nor with neurophysiological constraints. One of the most persuasive arguments comes from the work of Neufeld (e.g. 1988, 1980, 1978, 1974). Based on his research findings during the last ten years, Neufeld proposes a non-competence related explanation for some of the non-systematic articulatory deficiencies in adult L2 learners. Two predictions in his PAV model are that developmentally-induced changes in linguistic focus as well as increased metalinguistic activity may result in overload conditions in the output processor. These changes are likely to require depriorization of analyses and editing of linguistic levels that do not have a direct influence on meaning and morphosyntactic composition. Therefore, in early stages of L2 acquisition, some difficulties (e.g. foreign accent) may arise from problems in production performance of L2 learners rather than from deficiencies in their linguistic competence.

This speculation is consistent with the findings of the present study, and aids in its interpretation. As Neufeld's model predicts, when sentence planning was minimized, Ss were able to perceive and imitate Chinese sounds and sound sequences well. When additional processing tasks involving vocabulary and grammatical rules were demanded in sentence production their articulatory and tonal proficiency deteriorated significantly. However, as soon as output processing was reduced as Ss returned to mimicking tasks, this deterioration disappeared and good pronunciation resumed. These results have provided evidence that some of the deficiencies in L2 learning lie more with difficulties during processing and using the language rather than with deficiencies in phonological acquisition. For this reason, there is a need for further development

of theories and models that relate to second language processing.

If Neufeld's PAV model is correct, some testable hypotheses and speculations emerge for future research in this field. One important prediction, strongly indicated in the present study as well as in Neufeld's earlier research, is that there seems to be a positive correlation between attention given to language form and the extent of articulatory deterioration. One explanation, suggested in the PAV model, is that, because of the impact of general cognitive development with the coming of adolescence, older L2 learners may experience developmentally-induced changes in linguistic focus from the meaning of planned utterances (function) to the syntactic structure of those utterances. If learners concentrate mainly on the form of a planned utterance in the second language, three consequences are anticipated in the initial stages of L2 learning: 1) Form-oriented learners would rely heavily upon prescriptive rules of grammar and knowledge to produce L2 utterances. Their metalinguistic analyses would increase considerably especially during early phases of L2 acquisition. 2) Form-oriented learners may acquire a sound knowledge of an L2 phonology and demonstrate this knowledge by correctly comprehending, judging and constructing some L2 utterances (Neufeld, 1988). For example, they may make less grammatical errors in sentence production than function-oriented learners. 3) Form-oriented learners would suffer heavier foreign accent than would function-oriented learners. This is because the former give only minimal attention to the linguistic features that have no direct and immediate impact upon sentence meaning and structure, i.e., segmental and suprasegmental components.

However, as the model implies, the inverse of these predictions would apply to L2 learners whose focus is on the meaning of an utterance rather than on the syntactic components of that utterance. That is, if the learner focuses more on function as younger learners do, then the linguistic processor would be expected to construct sentences in a normal manner, i.e., without overload and without the need to sacrifice pronunciation during sentence planning. Because

metalinguistic processing would not be involved, it would not be necessary for additional procedures, e.g., adjunct co-processors in the PAV model, which would require extra time for sentence processing and force the speaker to give up linguistic components of lower priority as mentioned above. Thus, it is predicted that high, perhaps even accent-free, proficiency will be achievable at articulatory and suprasegmental levels, limited by the extent of metalinguistic activities and attention to form.

Yet, there are still important theoretical questions remaining unanswered concerning this model. For example, can function-oriented L2 learners achieve accent-free speech? In other words, how does the degree of the shift from meaning to form vary from individual to individual and how does it affect L2 pronunciation? If learners focus mainly on the meaning of utterances, would they have more syntactic or semantic errors than would form-oriented learners? These are interesting future research issues that will throw more light upon the relationship between form/function and the degree of foreign accent in L2 acquisition. These topics will also help to better explain overload conditions in the linguistic output processor and the occurrence of many performance-based non-systematic phonetic errors in L2 sentence processing.

APPENDIX A  
INSTRUCTION ON EXERCISES

PHASE 1

There will be four lessons in Phase 1, five in Phase 2. In each lesson, there are two 25-minute sections with a 10-minute break. Each of these sections includes four exercises. Remember that if at any time you are not sure about what you are to do, just ask the instructor for help.

Lesson One

**EXERCISE ONE:** In this exercise, you will hear some Chinese sounds, phrases and sentences where each of them will be pronounced twice. All you are required to do here is to listen very carefully to both pronunciation and tone. Tone is considered very important in Chinese. Please do not imitate what you hear; just listen during this exercise.

**EXERCISE TWO:** In this exercise, you will hear the same Chinese sounds, phrases and sentences again. This time, however, we would like you to mentally or subvocally reproduce what you hear. This means that as soon as you hear a sound, or a phrase or a sentence you should repeat it in your mind. You may move your lips but please do not speak aloud. Now let's start.

**EXERCISE THREE:** You will hear the same sounds, phrases and sentences again but in a different order this time. In this exercise, you are to repeat them at a normal voice as soon as you hear them. Please repeat each item twice as before. In this way, you will be able to correct yourself. Let's begin.

**EXERCISE FOUR:** This exercise is identical to the previous one except that items are in a different order. Again, please listen carefully then speak aloud what you hear, correcting yourself if necessary. Let's begin.

PHASE 2

## Lesson Six

EXERCISE FIVE: This is a listening exercise where your closest attention is called upon not only on pronunciation but also on their meanings as well. Each Chinese word, phrase or sentence is coupled with its English correspondent. Therefore, what you will hear in a moment will be an English word, phrase or sentence and then its Chinese equivalent. Each such a group will be pronounced twice. Your task is to listen carefully and try to understand what each Chinese item means since its English equivalent is provided. Now let's start.

EXERCISE SIX: You are going to hear the same English-Chinese groups again. However, you are required to repeat them aloud as soon as you hear them. Now let's begin.

EXERCISE SEVEN: This time, you are to hear only English words, phrases or sentences and will be given three seconds to speak aloud their Chinese counterparts. After these three seconds, the answer will be pronounced on tape. However, you should try your best to supply them yourself.

## APPENDIX B

## TEST 1

(Imitation of twenty Chinese phrases and sentences)

1. Ni hao
2. Zai jian
3. Xie xie
4. Zhong guo
5. Xue xi
6. Jia na da
7. Xu lao shi
8. Zhong guo ren
9. Shuo han yu
10. Wo peng you
11. Jia na da ren
12. Xu xi han yu
13. Shuo han yu ma
14. Ni shuo han yu.
15. Shi zhong guo ren.
16. Wo bu shi xue sheng.
17. Wo men xue xi han yu.
18. Wo shi jia na da ren.
19. Xue sheng bu xue xi ma?
20. Ni bu shi wo men pengyou.

## APPENDIX C

## TEST 2 (I)

**Ten Questions in Question-answer Tasks:**

1. Wo shi zhong guo ren. Ni shi zhong guo ren ma?
2. Han yu lao shi he ni shi zhong guo ren ma?
3. Zhong guo ren shuo han yu. Ni shuo han yu ma?
4. Jia na da ren shuo yin yu he fa yu. Ni ne?
5. Ni peng you xue xi fa yu he han yu ma?
6. Lao shi shuo yin yu, fa yu he han yu. Ni ne?
7. Wo shi zhong guo ren. Wo xue xi ying yu he fa yu. Ni ne?
8. Wo he wo peng you shuo han yu. Ni he ni peng you shuo han yu ma?
9. Zhong guo lao shi bu shuo ying yu. Jia na da lao shi ne?
10. Wo peng you xue xi han yu. Ni peng you shuo han yu ma?

**Ten Sets of Phrases in Sentence-making Tasks:**

1. Wo /zhong guo xue sheng /peng you
2. Wo men lao shi /shuo /ma
3. Zhong guo xue sheng /jia na da xue sheng /peng you ma
4. Ni men /jia na da /ma
5. Zhong guo ren /jia na da ren /han yu
6. Han yu lao shi /ni peng you ma
7. Zhong guo ren /han yu /jia na da
8. Wo men /he /ying yu ma
9. Jia na da /bu shuo /ma
10. Wo peng you /he /han yu

## APPENDIX D

## TEST 2 (II)

(Imitation after Sentence Construction Tasks)

1. Wo bu shi zhong guo ren.
2. Zhong guo ren shuo han yu.
3. Wo shi jia na da ren.
4. Han yu lao shi bu shi zhong guo ren.
5. Ni men shi jia na da ren ma?
6. Wo peng you shi jia na da ren ma?
7. Ni men shi jia na da xue sheng.
8. Wo he wo peng you bu shuo han yu.
9. Jia na da xue sheng shuo han yu.
10. Wo peng you xue xi han yu he fa yu.
11. Wo peng you shi jia na da ren.
12. Wo he wo peng you bu shi zhong guo xue sheng.
13. Wo men lao shi shuo han yu ma?
14. Zhong guo xue sheng he jia na da xue sheng shi peng you ma?
15. Zhong guo ren he jia na da ren bu shuo han yu.
16. Zhong guo ren shuo han yu. Jia na da ren bu shuo yin yu.
17. Han yu lao shi shi ni peng you ma?
18. Peng you he wo men shuo ying yu.
19. Jia na da ren shuo han yu ma?
20. Wo peng you shuo ying yu he fa yu.

## APPENDIX E

## TONES IN MANDARIN CHINESE

TONES:	First	Second	Third	Fourth	Neutral
TRANSCRIPTION:	ma	ma	ma	ma	ma
DESCRIPTION:	high level	mid-rising	falling-rising	high-falling	low-mid; mid level
EXAMPLES:	"mother"	"numb"	"horse"	"to scold"	question particle

## APPENDIX F

SEVEN TARGET SOUNDS  
IN SENTENCE-INITIAL AND SENTENCE-FINAL POSITIONS

1. ren
2. yu
3. han
4. shuo
5. peng
6. zhong
7. he

## APPENDIX G

FIVE TARGET SOUNDS  
IN AFFIRMATIVE AND INTERROGATIVE SENTENCES

1. yu
2. you
3. ren
4. shi
5. jia

## APPENDIX H

## TEN NON-ENGLISH LIKE SOUNDS

1.	shi	[ʃɿ]
2.	zhong	[tʃʊŋ]
3.	ren	[ʒɛŋ]
4.	yu	[yɯ]
5.	da	[ta]
6.	shuò	[ʃuə]
7.	xuè	[ɕuɛ]
8.	sheng	[ʃɛŋ]
9.	xi	[ɕɿ]
10.	han	[xan]

## BIBLIOGRAPHY

- Andersen, R. (ed.), (1981): New Dimensions In Second Language Acquisition Research. Rowley, MA: Newbury House.
- Arabski, J. (1984): "The role of age in second/foreign language acquisition", GLOTTODIDACTICA 17, 65-71.
- Armstrong, E. & C. Ward, (1931): Handbook Of English Intonation. Cambridge: Heffer.
- Asher, J. & G. Garcia, (1969): "The optimal age to learn a foreign language", MODERN LANGUAGE JOURNAL 38, 334-341.
- Asher, J. & B. Price, (1967): "The learning strategy of the total physical response: some age differences", CHILD DEVELOPMENT 38, 1219-1227.
- Ausubel, D. (1964): "Adults versus children in second language learning: Psychological considerations", MODERN LANGUAGE JOURNAL 48, 420-424.
- Baily, N. & C. Madden, (1973): "Is second language learning like first language learning?", A paper presented at the third annual conference of the city university of New York.
- Beebe, L. (1980): "Sociolinguistic variation and style shifting in second language acquisition", LANGUAGE LEARNING 30, 433-447.
- Bever, T. (1981): "Normal acquisition processes explain the critical period for language learning", in Individual Differences And Universal In Language Learning Aptitude. Diller, K. (ed.), Rowley MA: Newbury House, 176-196.
- Bialystok, E. (1978): "A theoretical model of second language learning", LANGUAGE LEARNING 28, 69-83.
- Brennan, E. & J. Brennan, (1981): "Accent scaling and language attitudes: Reactions to Mexican-American English speech", LANGUAGE SPEECH 24, 207-221.
- Broselow, E. (1983): "Non-obvious transfer: on predicting epenthesis errors", in Language Transfer In Language Learning. Gass, S. and L. Selinker (eds.). Rowley, MA: Newbury House, 269-280.
- Broselow, E., R. Hurting & C. Ringen, (1987): "The perception of second language prosody", in Interlanguage Phonology. Ioup, G. & S. Weinberger (eds.). Rowley, MA: Newbury House, 350-361.
- Brown, H. (1981): "Affective factors in second language learning", in The Second Language Classroom. Alatis, J., H. Altman and P. Alatis (eds.). New York: Oxford University Press. 111-129.

- Caramazza, A., G. Yeni-Komshian, E. Zurif & E. Carbone. (1973): "The acquisition of a new phonological contrast: the case of stop consonants in French-English bilinguals", *JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA* 54, 421-428.
- Chao, Yuen Ren (1968): A Grammar Of Spoken Chinese. Berkeley and Los Angeles: University of California Press.
- Cochrane, R. (1980): "The acquisition of /r/ and /l/ by Japanese children and adults learning English as a second language", *JOURNAL OF MULTILINGUAL AND MULTICULTURAL DEVELOPMENT* 1, 331-360.
- Cochrane, R. & J. Sachs, (1979): "Phonological learning by children and adults in a laboratory setting", *LANGUAGE AND SPEECH* 22, 145-149.
- Cruttenden, A. (1986): Intonation. Cambridge and New York: Cambridge Press.
- Eckman, F. (1981): "On the naturalness of interlanguage phonological rules", *LANGUAGE LEARNING* 31, 195-216.
- Eckman, F. (1977): "Markedness and the contrastive analysis hypothesis", *LANGUAGE LEARNING* 27, 315-330.
- Eisenstein, M. (1983): "Native Reactions to Non-Native Speech: A Review of Empirical Research", *STUDIES IN SECOND LANGUAGE ACQUISITION* 5, 160-176.
- Ekstrand, L. (1978): "English without a book revisited: the effect of age on second language acquisition in formal settings", in Child-adult Differences In Second Language Acquisition. Krashen, S. & others (eds.). Rowley, MA: Newbury House, 136-158.
- Ellis, R. (1986): Understanding Second Language Acquisition. Oxford: Oxford University press.
- Fathman, A. (1975): "The relationship between age and second language productive ability", *LANGUAGE LEARNING* 25, 235-245.
- Flege, J. (1988): "Factors affecting degree of perceived foreign accent in English sentences", *JOURNAL OF ACOUSTICAL SOCIETY OF AMERICA* 84, 70-79.
- Flege, J. (1987): "A critical period for learning to pronounce foreign language", *APPLIED LINGUISTICS* 8, 162-177.
- Flege, J. & J. Hillenbrand, (1984): "Limits on pronunciation accuracy in adult foreign language speech production", *JOURNAL OF ACOUSTICAL SOCIETY OF AMERICA* 76, 708-720.
- Flege, J. (1981): "The phonological basis of foreign accent: a hypothesis", *TESOL QUARTERLY* 15, 443-455.
- Felix, S. (1981): "The effect of formal instruction on second language acquisition", *LANGUAGE LEARNING* 31, 87-112.

- Fromkin, V., S. Krashen, S. Curtiss, D. Rigler & M. Rigler, (1974): "The development of language in Genie: a case of language acquisition beyond the 'critical period'", *BRAIN AND LANGUAGE* 1, 81-107.
- Fromkin, V. (1971): "The non-anomalous nature of anomalous Utterances", *LANGUAGE* 47, 27-52.
- Gardner, R. & P. Smythe, (1975): "Motivation and second-language acquisition", *CANADIAN MODERN LANGAUGE REVIEW* 31, 218-230.
- Gardner, R. (1972): "Ethnic stereotypes: their consequences for second language acquisition". Research Bulletin No. 262, Department of Psychology, University of Western Ontario.
- Gardner, R. & W. Lambert, (1972): Attitudes And Motivation In Second Language Learning. Rowley MA: Newbury House.
- Garrett, M. (1975): "The analysis of sentence production", in The Psychology Of Learning And Motivation. Bower, G. (ed.). New York: Academic Press, 133-176.
- Gass, S. (1984): "Development of speech perception and speech production in adult second language learners", *APPLIED PSYCHOLINGUISTICS* 5, 51-74.
- Guiora, A., B. Beit-Hallahmi, R. Brannon, C. Dull & T. Scovel, (1972): "The effects of experimentally induced changes in ego states on pronunciation ability in a second language: An exploratory study", *COMPREHENSIVE PSYCHIATRY* 13, 139-150.
- Hanlon, C. (1971): "The effects of social isolation and characteristics of the model on accent imitation in fourth grade children", *JOURNAL OF EXPERIMENTAL PSYCHOLOGY* 2, 322-336.
- Hecht, B. & R. Mulford, (1987): "The acquisition of a second language: interaction of transfer and developmental factors", in Interlanguage Phonology. Ioup, G. & S. Weinberger (eds.). Rowley, MA: Newbury House, 213-228.
- Hill, J. (1970): "Foreign accent, language learning and cerebral dominance revisited", *LANGUAGE LEARNING* 20, 237-248.
- Inhelder, B. & Piaget, J. (1958): The Growth Of Logical Thinking Frrom Childhood To Adolescence. New York: Basic Books.
- Ioup, G. (1979): "Is there a structural foreign accent?", Paper presented at the 13th Annual TESOL Convention, Boston.
- Jakobovits, L. (1970): Foreign Language Learning. Rowley MA: Newbury House.
- Krashen, S (1982): "Accounting for child-adult differences in second language rate and attainment", in Child-adult Differences In Second Language Acquisition. Krashen, S. M. Long & R. Scarcella (eds.). Rowley MA: Newbury House, 202-226.

- Krashen, S. (1973): "Lateralization, language learning and the critical period: some evidence", *LANGUAGE LEARNING* 23, 63-74.
- Krashen, S., M. Long & R. Scarcella, (1979): "Age, rate and eventual attainment in second language acquisition", *TESOL QUARTERLY* 13, 573-584.
- Krashen, S. & H. Seliger, (1975): "Maturational constraints in the acquisition of second language and second dialect", *LANGUAGE SCIENCE* 38, 28-29.
- Krashen, S. & R. Harshman, (1972): "Lateralization and the critical period", *UCLA WORKING PAPERS IN PHONETICS* 23, 734-738.
- Lamendella, J. (1977): "General principles of neuro-functional organization and their manifestation in primary and non-primary language acquisition", *LANGUAGE LEARNING* 27, 155-196.
- Lane, R. (1962): "Some differences between first and second language learning", *LANGUAGE LEARNING* 12, 1-14.
- Larew, L. (1961): "The optimum age for beginning a foreign language", *MODERN LANGUAGE JOURNAL* 45, 203-206.
- Lenneberg, E. (1967): Biological Foundations Of Language. New York: John Wiley and Sons
- Long, M. (1978): "Towards a neurolinguistic explanation for the effect of learner age on secondary language acquisition", Unpublished paper, UCLA.
- Macnamara, J. (1972): "Cognitive basis of language learning in infants". *PSYCHOLOGICAL REVIEW* 79, 1-13.
- Major, R. (1987a): "Foreign accent: recent research and theory", *IRAL* 25, 185-202.
- Major, R. (1987b): "A model of interlanguage phonology", in *INTERLANGUAGE PHONOLOGY*. Icup, G. and H. Weinberger (eds.). Rowley MA: Newbury House. 101-124.
- Mclaughlin, B. (1987): Theories Of Second Language Learning. London: Edward Arnold.
- Motley, M., B. Baars & C. Camden, (1983): "Experimental verbal slip studies: a review and an editing model of language encoding", *COMMUNICATION MONOGRAPH* 50, 79-101.
- Naiman, N. (1974): "The use of elicited imitation in second language acquisition research", *WORKING PAPERS ON BILINGUALISM* 2, 1-37.
- Neufeld, G. (1990): "Sentence Processing and Articulatory Production in the Second Language: Sentence Production Processing in the Second Language", in preparation.

- Neufeld, G. (1989): "Post-articulatory verification in sentence production processing: a follow-up study of the origins of foreign accent", a research project presented to Social Sciences and Humanities Research Council of Canada.
- Neufeld, G. (1988): "Processing Co-existing Structures in FL competence", in preparation.
- Neufeld, G. (1988): "Phonological asymmetry in second language learning and performance", *LANGUAGE LEARNING* 38, 531-560.
- Neufeld, G. (1980): "On the adult's ability to acquire phonology", *TESOL QUARTERLY* 14, 285-298.
- Neufeld, G. (1978): "On the acquisition of prosodic and articulatory features in adult language learning", *CANADIAN MODERN LANGUAGE REVIEW* 34, 163-174.
- Neufeld, G. & E. Schneiderman, (1980): "Prosodic and articulatory features in adult language learning", in *Research In Second Language Acquisition*. Krashen, S. & R. Scarcella (eds.), Rowley, MA: Newbury House, 105-109.
- Oyama, S. (1976): "The sensitive period for the acquisition of non-native phonological system", *JOURNAL OF PSYCHOLINGUISTIC RESEARCH* 5, 261-287.
- Olson, L. (1984): "Phonological processes in second language acquisition: another interlanguage syllable structure", *LANGUAGE LEARNING* 34, 43-57.
- Olson, L. & R. Purcell. (1980): "Predictors of pronunciation accuracy", *LANGUAGE LEARNING* 30, 177-189.
- Olson, L. & S. Samuel. (1973): "The relationship between accuracy and foreign language pronunciation", *JOURNAL OF EDUCATIONAL RESEARCH* 66, 263-267.
- Patkowski, M. (1990): "Age and Accent in a Second Language: A Reply to James Emil Flege", *APPLIED LINGUISTICS* 11, 73-89.
- Penfield, W. (1964): "The Uncommitted Cortex: The Child's Changing Brain", *THE ATLANTIC* July 1964 issue, 71-77.
- Penfield, W. & L. Roberts. (1959): *Speech And Brain Mechanisms*. Princeton: Princeton University Press.
- Politzer, R. & S. Weiss. (1969): "Developmental aspects of auditory discrimination, response and recall", *MODERN LANGUAGE JOURNAL* 53, 75-85.
- Purcell, E. & R. Purcell. (1980): "Predictors of pronunciation accuracy: a reexamination", *LANGUAGE LEARNING* 30, 271-287.
- Rosansky, E. (1975): "The critical period for the acquisition of language: some cognitive developmental considerations", *WORKING PAPERS ON BILINGUALISM* 6, 92-102.

- Sapon, S. (1952): "An application of psychological theory to pronunciation problems in second language learning", *MODERN LANGUAGE JOURNAL* 36, 111-114.
- Sato, J. (1984): "Phonological processes in second language acquisition: another look at interlanguage syllable structure", *LANGUAGE LEARNING* 34, 43-57.
- Scarcella, R. & C. Higa, (1982): "Input and age differences in second language acquisition", in Child-adult Differences In Second Language Acquisition. Krashen, S., R. Scarcella & M. Long (eds.). Rowley, MA: Newbury House, 175-201.
- Schneiderman, E., J. Bourdages & C. Champagne (1988): "Second-language accent: the relationship between discrimination and perception in acquisition", *LANGUAGE LEARNING* 38, 1-19.
- Schumann, J. (1978a): "The relationship of pidginization, creolization and decreolization to second language acquisition", *LANGUAGE LEARNING* 28, 367-379.
- Schumann, J. (1978b): The Pidginization Process: A Model For Second Language Acquisition. Rowley MA: Newbury House.
- Schumann, J. (1978c): "Social and psycholinguistic factors in second language acquisition", in Understanding Second And Foreign Language Acquisition. Richards, J. (ed.). Rowley, MA: Newbury House.
- Schumann, J. (1976): "Affective factors and the problem of age in second language acquisition". *LANGUAGE LEARNING* 25, 53-60.
- Scovel, T. (1988): A Time To Speak. Rowley, MA: Newbury House.
- Scovel, T. (1969): "Foreign accents, language acquisition and cerebral dominance", *LANGUAGE LEARNING* 19, 245-254.
- Seliger, H. (1978): "Implications of a multiple critical periods hypothesis for second language learning", in Second Language Acquisition Research. Ritchie, W. (ed.). New York: Academic Press, 11-19.
- Seliger, H., S. Krashen, & P. Ladefoged, (1975): "Maturational constraints in the acquisition of a native-like accent in second language learning", *LANGUAGE SCIENCES* 38, 20-22.
- Smith, B. (1978): "Temporal aspects of English speech production", *JOURNAL OF PHONETICS* 6, 37-67.
- Smythe, P., R. Stennet & R. Gardner, (1975): "The best age for foreign language training: issues, options and facts", *CANADIAN MODERN LANGUAGE REVIEW* 32, 10-23.
- Snow, C. & M. Hoefnagel-Hohle, (1978): "The critical period for language acquisition: evidence from L2 learning", in Child-adult Differences In Second Language Acquisition. Krashen, S., R. Scarcella & M. Long (eds.). Rowley, MA: Newbury House. 93-112.

- Snow, C. & M. Hoefnagel-Hohle. (1977): "Age differences in the pronunciation of foreign sounds". *LANGUAGE AND SPEECH* 20, 357-365.
- Soudak, L. (1977): "Error analysis and the system of English consonants", *ELT JOURNAL* 31, 125-130.
- Suter, R. (1976): "Predictors of pronunciation accuracy in second language", *LANGUAGE LEARNING* 30, 271-287.
- Tahta, S., M. Wood & K. Lowenthal, (1981): "Foreign accents: factors relating to transfer of accent from the first language to the second language", *LANGUAGE AND SPEECH* 24, 265-272.
- Tarone, E. (1987): "The phonology of interlanguage", in *Interlanguage Phonology*.
- Ioup, G. & S. Weinberger (eds.). Rowley, MA: Newbury House, 70-85.
- Tarone, E. (1980): "Some influences on the syllable structure of interlanguage", *IRAL* 18, 139-152.
- Taylor, B. (1978): "Acquiring vs. learning a second language", *CANADIAN MODERN LANGUAGE REVIEW* 34, 455-472.
- Taylor, B. (1974): "Toward a theory of language acquisition", *LANGUAGE LEARNING* 24, 23-34.
- Thogmartin, C. (1982): "Age, individual differences in musical and verbal aptitude and pronunciation achievements by elementary school children learning a foreign language", *IRAL* 20, 66-70.
- Thompson, I. (1984): "Experimental study of foreign accents". Unpublished Ph.D. Thesis. Washington University.
- Tomaszczyk, J. (1980): "On accented speech: the Polish of Polish Americans", *STUDIA ANGLICA POSNANIENSIA* 1-2, 121-137.
- Valette, R. (1964): "Some reflections on second language learning in young children", *LANGUAGE LEARNING* 14, 91-98.
- Walsh, T. & K. Diller, (1981): "Neurolinguistic considerations on the optimal age for second language learning", in *Individual Differences And Universals In Language Learning Aptitude*. Diller, K. (ed.). Rowley, MA: Newbury House.
- Williams, L. (1979): "The modification of speech perception and production in second language learning". *PERCEPTION AND PSYCHOPHYSICS* 26, 95-104.
- Williams, L. (1977): "The perception of stop consonant voicing by Spanish-English bilinguals". *PERCEPTION AND PSYCHOPHYSICS* 21, 289-297.
- Wojcik, R. (1981): "Natural phonology and foreign accent", Paper presented at the linguistic society of American Annual Meeting, San Antonio, TX.

Zobl, H. (1980): "L1 acquisition, age of L2 acquisition and the learning of word order". in Language Transfer And Language Learning. Gass, S. & L. Selinker (eds.). Rowley, MA: Newbury House, 205-221.

## ABSTRACT

One of the most difficult hurdles to overcome for adult L2 learners is to rid themselves of foreign accent in their speech. Accent persists in most, even when they control syntactic and semantic features well. Attempts to explain this deficiency have been made by numerous researchers in the field. The principal aim of the present study was to explore one of these positions: Neufeld's Pre- and Post-Articulatory Verification (PAV) sentence production model. Based on this model, the present study was designed to test the hypothesis that articulatory and supra-segmental features can be fairly accurate in sentence production exercises in L2 provided that little attention is given to rules and meaning. Another hypothesis that is closely related to the first was that, as the need for linguistic processing increases, L2 learners of ten years or older can no longer focus normally on tone and articulation.

Four English-speaking university students were given a nine-hour Chinese mini-course. In the four hours of Phase 1, recorded programs were restricted to phonetic training of listening and imitation only. No instruction in vocabulary and grammar were given. At the end of Phase 1, Ss' imitative utterances were tape-recorded and retained for analysis. During Phase 2, additional tasks, containing spontaneous and creative sentence production, were required of Ss. Grammatical rules and vocabulary were introduced during this phase. At the end of the course, Ss' performance in both imitation and sentence construction was tested and tape-recorded.

The tests were scored by the author, using instrumental analysis and a four-point impressionistic scale. The results of the study are summarized as follows:

- 1) When Ss were required merely to mimic strings of foreign sounds in Phase 1, some of their articulatory and tonal production could be associated with near-native-like performance.

- 2) When Ss had to use lexical and grammatical knowledge to construct sentences on their own, there was considerable deterioration in articulatory and tonal accuracy.
- 3) When Ss were required merely to mimic strings of foreign sounds in Phase 2, this deterioration was reversed and their articulatory and tonal accuracy was as good as, or even better than that in Phase 1.
- 4) The quality of articulation and tone was particularly affected by sentence length and by negative and interrogative structures in creative sentence production tasks.
- 5) When lexical meaning and combinational rules were introduced, the tone was found to be the linguistic feature that suffered most.