

Effects of Short-Term Environment Change on Language Attrition: Cross-Linguistic Case Studies

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ABSTRACT

In this study, language attrition is examined from the perspective of both first and second language. Using the bilingual language mode continuum model proposed by Grosjean (2001) and further developed by Schmid (2007), an interview-based study was designed to track shifts in linguistic performance both before and after a change in linguistic environment. This change was from an L2-dominant environment to an L1-dominant environment, and was “short-term” because it lasted for a period of days, rather than a period of years as in previous attrition studies. The study included a story-telling task, a phonetically-prompted vocabulary listing task, and a semantically-prompted vocabulary listing task. All three tasks were performed in both of each speaker’s languages in each of two interviews: one before and one after the change in environment. The subjects included one native speaker each of Mandarin Chinese, Cantonese Chinese, and Korean. All spoke English as a second language. The study found that a shift in language mode could be detected over this short-term timeframe, and that this shift left a measurable effect (improvement in L1, decline in L2, in accordance with the continuum theory) for at least several days after the subjects returned to the L2-dominant environment.

1. Introduction

This study looks at the topic of language attrition, best categorized as a branch of the linguistics subfield of bilingualism. It does not deal with language attrition in the sense of the complete loss of a language; instead, it endeavors to analyze attrition and recovery of language as complementary processes along a single continuum. To this end, a set of three case studies was undertaken, involving one speaker each of Mandarin Chinese, Cantonese Chinese, and Korean, all of whom were second language learners of English. Some relevant background information is presented in section 2; the study is described in detail in section 3, with the results presented in section 4 and analyzed in section 5.

2. Background

The rigorous study of language attrition has only relatively recently begun to undergo any significant development (according to Köpke & Schmid's (2002) survey, work in this field only began in the 1980s), and so there is a wide range of possibilities for researchers to explore. Therefore, to set the context for the present study, this section will provide the reader with an introduction to language attrition, an overview of relevant theoretical frameworks, and a sampling of previous related research. This information should then serve to illuminate the subsequent summary of the goals of the present study.

2.1 Introduction to Language Attrition

With means of communication constantly developing and spreading throughout the world, contact between speakers of different languages constantly grows more common, and where speakers of different languages meet, bilingualism must arise. Two-thirds of all children now grow up in bilingual environments, while 41 percent of the world's English speakers are bilingual (Crystal 1997). Among the many linguistic interactions that stem from bilingualism, one fascinating area is the topic of language attrition.

While the term *attrition* is sometimes used to refer to language loss through aphasia or old age, within the context of the current study it refers to the apparent loss of language as the result of two competing linguistic systems within the same speaker. An observation by Muysken (2004: 149) concerning code mixing also holds true for this kind of language attrition: “three approaches are combined in it in essential ways: contrastive linguistics, sociolinguistics, and psycholinguistics.” The causes and results of all kinds of bilingual phenomena, including language attrition, are therefore so complex that they cannot be fully accounted for without considering all three of these angles.

Just as bilingual phenomena cannot be reduced to a single subfield of linguistics, bilingualism cannot be reduced to simply-stated explanations. As Grosjean (2004) points out, bilingualism is not just an occurrence of two monolingual systems in the same speaker; instead, it is the interface of two systems (or more) interacting in a way that does not happen in a monolingual system. It is the nature of this interaction that is the core question of all bilingual investigations, including language attrition.

In this spirit, the question “Can a speaker forget a language?” (stated by Köpke & Schmid 2002a: 8) is another oversimplification, this time directed specifically at the language attrition problem. Therefore, as the scope of the language attrition topic is narrowed over the course of the subsequent sections, it is important to remember that while the focus of a single study must be narrow, this paper only examines one facet of a much larger system.

2.2 Theoretical Frameworks for Language Attrition

It has long been recognized that language attrition seems to operate along a continuum; that is, given a native language (L1) and a learned language (L2), a speaker’s abilities in one language will gradually decrease as ability in the other language gradually increases.

In some of the earlier formalizations of language attrition, this continuum was understood to be a one-way transition: as a speaker learned an L2, L1 abilities would drop off. This is the commonly studied case of L1 attrition, and is the basis for the model referred to in Seliger & Vago (1991). The continuum in this model has three landmarks, or stages: compound I bilingualism, coordinate bilingualism, and compound II bilingualism. In essence, it suggests that the speaker’s master grammar – that is, the grammar system through which all languages are ultimately interpreted – transitions from being that of the speaker’s L1 in compound I, to being split between the L1 and L2 in the coordinate stage, to being the grammar of the speaker’s L2 in compound II. The speaker’s changing linguistic abilities are therefore explained in this theory by a shift in

competence, or underlying linguistic knowledge, as opposed to *performance*, or ability to utilize that knowledge under given conditions¹.

However, Cook (1991, 2003) recognized the fact that many bilingual speakers can switch between languages fluently; furthermore, Cook (2003) argues that a bilingual speaker's linguistic knowledge will not be quite the same as monolingual knowledge of either the L1 or the L2. Therefore, rather than describing the bilingual speaker as possessing an L1 grammar that morphs into an L2 grammar, Cook coins the term "multi-competence," which more accurately captures the abilities of bilingual speakers. At the same time, this terminology implies that bilingual speakers will retain this multi-*competence*, even if *performance* in L1 or L2 varies; this principle will seem to be an underlying assumption of the most recent theories of bilingual ability.

The earliest incarnation of the model being used in the current study was Grosjean's (2001) language modes. According to this model, one language – whichever was dominant at a given time – was the base language, while the other varied in levels of activation along a continuum from low (the monolingual language mode) to high (the bilingual language mode). A speaker's exact location along this continuum is set by a variety of situational factors (such as location, conversation partners, speech content, and speech purpose), and is thought to switch as soon as the speaker's situation changes (Grosjean even claims to have manipulated subjects' language modes in a laboratory study).

¹ Köpcke & Schmid (2002: 21) state the difference between *competence* and *performance* as the difference between "a restructuring of what is known about the language" and "difficulties in control of that knowledge." They cite Sharwood Smith (1983) as the first researcher to point out the need for this distinction when dealing with language attrition.

Schmid (2007) further developed this continuum model for use with attrition studies. Instead of the basic monolingual-to-bilingual continuum, she proposed a continuum with the bilingual position in the center, and the monolingual mode for each language at the opposite ends (Figure 1, below). The landmarks along this continuum are labeled from Type I (L1 monolingual language mode) to Type V (L2 monolingual language mode), with Type III being the bilingual mode. Under this representation, language attrition occurs in a language when the speaker is in the other language's monolingual mode for a prolonged period: L1 attrition occurs at Type V, while L2 attrition occurs at Type I.

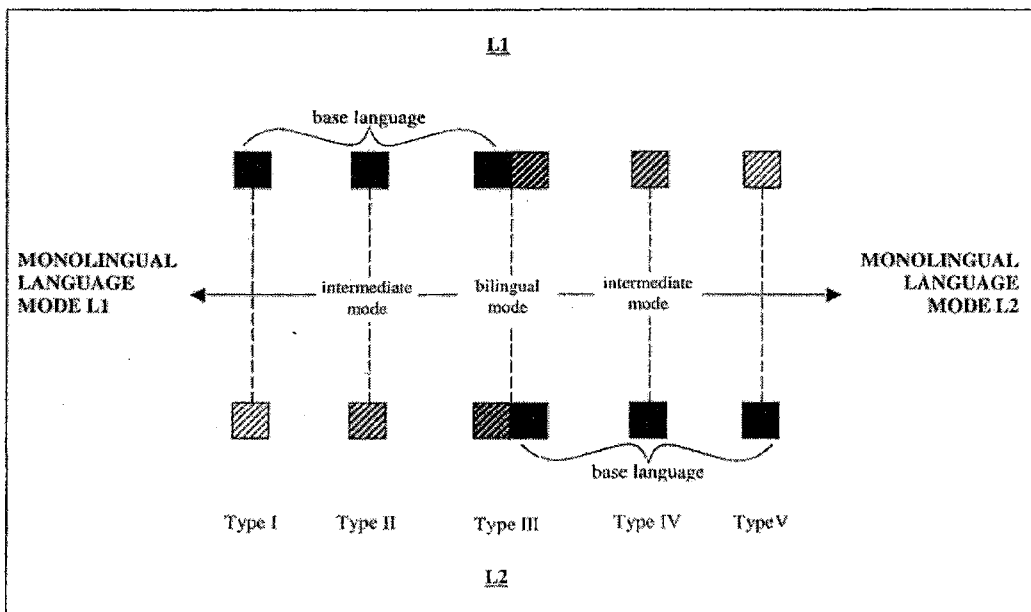


Figure 1. The bilingual language mode continuum (Schmid 2007: 139, her Fig. 2)

At each point along the continuum, the shift in language mode is carried out by the processes of *activation* and *inhibition*. The more relevant language for the given

mode is activated to a higher level, while the other language is inhibited. For example, Type V language use necessitates the inhibition of L1; if this inhibition is carried out for an extended period of time, the L1 performance ability of that speaker should be diminished. This diminished performance ability is L1 attrition.

In this paper, I will use the shorthand “Type *X* speaker” to refer to “speaker who habitually operates in the Type *X* language mode, and who possesses the associated activations and inhibitions of that Type.” This convention will represent a significant convenience, since the present study will deal with habitual language patterns more than moment-to-moment fluctuations.

2.3 Previous Research in Language Attrition

Among the symptoms of language attrition that have been found in the past, some are related to syntax (Seliger & Vago (1991) cite examples of rule generalization and literal translation, for instance), but the earliest and most striking deficiencies are lexical; Olshtain & Barzilay (1991) specifically use the issue of lexical retrieval as the measurement of language attrition; their study uses a story-telling task to assess the level of L1 attrition in English learners of Hebrew living in Israel².

The finding that lexical retrieval is one of the primary effects of language attrition is consistent with the understanding that attrition itself is a performance phenomenon: while syntactic operations are thought to be largely innate, the arbitrary nature of lexical

² Note that these findings apply to adult language attrition and exclude *heritage languages*, where a child learns the language of his parents in an environment where that language is a foreign language. For a recent discussion of heritage languages, see Polinsky & Kagan (2007).

items means that they must be learned and memorized; like other memorized data, this means they are also subject to being forgotten.

This hypothesis is supported by a variety of psychological research. Paradis (2004), for example, proposes the Activation Threshold Hypothesis. According to his theory, a lexical item is retrieved or “activated” by a number of neural impulses, where

[t]he amount of impulses necessary to activate the item constitutes its activation threshold. Every time an item is activated, its threshold is lowered and fewer impulses are required to reactivate it. Thus, after each activation, the threshold is lowered – but it gradually rises again. If the item is not stimulated, it becomes more and more difficult to activate over time. Attrition is the result of long-term lack of stimulation (Paradis 2004: 28).

Therefore, if a speaker habitually operates at a mode along the bilingual continuum other than Type III, the disuse of the non-dominant language should cause the activation threshold for that language’s lexical items to increase, thereby causing retrieval difficulty for that speaker.

Similar support is provided by Levy et al. (2007) in their finding that a general psychological phenomenon called Retrieval-Induced Forgetting (RIF) applies to lexical retrieval, too. The general principle is that the brain, when faced with two related concepts in its memory, will suppress one to facilitate the retrieval of the other; the one that gets suppressed is the one that is not retrieved as often. Therefore, given two words for the same concept in different languages, the brain will inhibit retrieval of the language that is less frequently used in order to speed up retrieval of the language that is currently dominant. If this principle is applied across the entire lexicon, then, we are provided not only with an accurate description of, but also with an explanation for the necessary

inhibition of lexical items in one language complementing the increased activation of the lexical items in the other language, as illustrated by the bilingual language mode continuum.

Such a model is also consistent with the extreme case studied by Footnick (2007), in which she explored the nature of “hidden languages.” The subject in her case study believed that he was monolingual, though he had learned a second language as a child. Footnick showed that he had retained his competence in both languages, however, since she was able to elicit performances in the second language under hypnosis. Clearly, in this case, the subject had developed severe performance inhibitions, but the underlying competence was still intact. Speakers experiencing language attrition generally would not reach such extreme poles of the language continuum, but Footnick’s study supports the claim that their competence is maintained through all language modes.

If the studies mentioned above fail to demonstrate the significance of the bilingual language mode continuum, there is more evidence to be found in Schmid’s own work, in which she shows that simpler measures of language use are not adequate for predicting rates of attrition. In Schmid (2002a), she finds that the most important factor correlating to L1 attrition in German immigrants living in Anglophone countries was date of emigration – the length of time they had spent living as Type V speakers – and not other factors, such as simple frequency of L1 use. She also reiterates in her findings that competence is not completely lost during attrition, but rather that performance level is determined by inhibitions. Such a result is compatible with the notion that movement along the bilingual continuum is possible. In Schmid (2007), she again determines that

the simple frequency of L1 use cannot predict the rate of L1 attrition; it is the language mode that matters.

2.4 The Present Study

The research to this point has provided us with a promising theoretical framework, but the same research has only begun to test the predictive power of that framework. For instance, the continuum model makes simultaneous predictions about both L1 and L2 performance, but most recent studies focus only on the L1 attrition aspect, while even fewer focus only on the L2 attrition aspect. Schmid (2007: 151), whose own studies fit into the former category, concludes that “it is relatively meaningless to study the attrition and use of only one of a bilingual’s languages in isolation, and exclude the development and use of the other.” The present study therefore attempts to examine speakers’ L1 and L2 simultaneously.

Another somewhat under-explored part of the model is the degree of mobility along it. While Grosjean and Schmid both seem to believe that individual instances of language use can be classified as being of different Types, Schmid (2007) in particular seems to suggest that prolonged use of a given mode has a lasting effect on a speaker’s performance abilities. For Schmid (2007), “prolonged” is apparently equated to “at least 10 years”; however, it has not been investigated whether or not a more short-term change in language use can effect a similar change, even if to a lesser degree.

The present study, in an attempt to resolve some of these issues, will look at the L1 and L2 performance of speakers at two points in time: at the first point in time, they are assumed to be in a Type V language mode. At the second point in time, they will

have just spent a period of days – instead of years – operating in a mode similar to Type I. This change in mode was presumably effected by a change in environment, from an L2-dominant environment to an L1-dominant environment. A full description of the study follows.

3. Methods

In an effort to observe the effects of a relatively short-term environment change on the first- and second-language faculties of a speaker, the following interview-based study was designed, based on some of the proposals of Schmid (2002b) and the designs of Schmid (2007), Olshtain & Barzilay (1991), and Cohen (1989).

3.1 Overview

The subjects chosen were undergraduate college students who were second language learners of English, and native speakers of a language other than English. Some subjects spoke more than two languages, but all were highly fluent in English, which they used as their primary language while at school in the United States, while their native language was their primary language while at home abroad. Each subject's linguistic system, therefore, can be described according to the language continuum, with their native languages (either Mandarin, Cantonese, or Korean) at the dominant L1 end, and English at the dominant L2 end.

The subjects were selected because they were all about to return to their home countries for a period of about two or three weeks, constituting a temporary change in linguistic environment. For more long-term changes, the continuum theory predicts that, normally, each speaker would eventually shift from Type V to Type I. If time is considered as a factor, however, it remains to be seen to what extent the continuum theory is borne out. Specifically, the questions of interest are

1. Can a shift in linguistic performance abilities be detected in the given timeframe? and
2. If there is a shift, will the speakers' first- and second- language faculties shift in a complementary manner, as the continuum theory predicts?

To search for signs of this shift, each subject was recorded both before and after the two-week environment change. Presumably, during the first session, they all would have been in the Type V language mode, since they had been living in an English (L2) dominant environment for a full academic semester, or several months. The second session then, at the end of their L1 environment stay, should capture them at the time when they are shifted as far as possible toward the L1 end of the continuum, given the timeframe. Since the continuum theory actually makes predictions about *both* L1 and L2 performance, each subject was recorded speaking in both L1 and L2.

3.2 Subjects

All subjects were 20 to 22 years old. One speaker each of Mandarin Chinese, Cantonese Chinese, and Korean was interviewed; the Chinese speakers were male, and the Korean speaker was female. In addition, one male and one female native speaker of American English was interviewed to provide reference data for the English portions of

the study. These two “control” speakers were interviewed in one session each, but otherwise procedures were the same as for the other speakers.

For the non-native English speakers, the first interview took place at the end of an academic semester, so they had been in the United States for about four months, more if they had stayed for the summer before. They then returned home for break, and the second interview took place as close as possible to their departure from their home country at the end of that break. For the Cantonese and Korean speakers, the second session was conducted in the United States within a few days of the speakers’ return. Since the Mandarin speaker was not returning directly to the United States but visiting a third country with English-speaking friends, a packet of instructions was prepared that allowed him to record himself on his last day in China. The exact times for each speaker are given in Table 1, below.

Table 1. Linguistic environment timetable.

Speaker	Days in home country	Days in U.S. before Interview 2
Cantonese	20	5 (first several days spent with Cantonese-speaking friends)
Korean	24	1
Mandarin	10	0 (self-recorded in China)

3.3 Recording Tasks

Recording sessions were split into three parts. First, the subject was given a wordless picture book (Wiesner 2006) and was instructed to describe the pictures as if telling a friend (who couldn’t see the pictures) the story suggested by the images. Time

was allowed for the subject to practice story-telling in both languages using this book, and the stories were not recorded. The semantic areas suggested by this book had little overlap with the books chosen for the stories that were recorded, in an attempt to avoid any priming effects.

The second part of the recording session captured each subject speaking in English. First, the subject was given another wordless picture book (Mayer 1969). This book is part of a collection of similar “frog” books. They were used in Olshtain & Barzilay (1991), and have the advantage of presenting a relatively narrow range of plot interpretations while suggesting a variety of different vocabulary items. The story was split into two approximately equal sections; the first half of the story was recorded in the first interview, and the second half of the story was recorded in the English portion of the second interview. A second story (Mayer 1973) was used for the native language portion of both interviews, with one half recorded in the first interview and the other half recorded in the second. No time limit was placed on these recordings, and subjects were allowed to progress through the story at their own pace.

After the English story-telling task, the subjects produced two English vocabulary lists, one based on a phonetic prompt and the other based on a semantic prompt (see Table 2, below). For each list, the speakers were given one minute to freely list as many words fitting the prompt as possible. For the phonetic lists, speakers were instructed to disregard orthography and rely only on sound when selecting words.

For the final part of each recording session, the story-telling task and the vocabulary task were performed in the speaker’s native language.

Table 2. Prompts used for timed vocabulary lists.

	First Interview	Second Interview
L1, Phonetic	words beginning with /m/	words beginning with /k/
L1, Semantic	fruits and vegetables	things that make noise
L2, Phonetic	words beginning with /f/	words beginning with /s/
L2, Semantic	things found in museums	things found in the ocean

3.4 Expectations

The language mode continuum predicts that, with a change from an L2-dominant environment to an L1-dominant environment, as the speakers in this study experienced, the bilingual mode of the speaker should shift from somewhere in the Type V area to somewhere closer to the Type I area – in other words, L1 performance improve while L2 performance should suffer. Each test should therefore reflect a performance change in the direction appropriate for the language it is in (worse for English, better for native languages).

4. Results

The procedures described above yielded a total of twelve recordings per speaker, or three before and after pairs for each language: story-telling, phonetically-based list, and semantically-based list. Each type of these pairs was analyzed individually to compare the pre- and post-environment change performance of each speaker.

4.1 Methods of Analysis

All stories were examined in general descriptive terms. In addition, the English stories were transcribed and entered into a database so that vocabulary lists for each speaker could be compiled and compared. The vocabulary lists provided a more objective measure of linguistic performance; the English data was further refined by comparing it to data produced by native English speakers.

4.1.1 Non-English Analysis

While the author was able to complete the analysis of the English data, some care had to be taken in finding evaluators for Mandarin, Korean, and Cantonese. The challenge was to find accessible informants who also met the correct linguistic conditions. Since the goal of this study was to analyze the language of native speakers for irregularities that arise due to their English-language surrounding environment, the ideal evaluator would be a native speaker in the Type I mode (note that the author is currently a Type I speaker of English). Type I speakers of non-English languages are not available in the United States, however, so this study had to rely on Type II speakers.

According to the continuum theory (Schmid 2007: 140), an individual teaching his or her native language in a foreign language environment maintains a higher level of fluency in that language than would otherwise be expected. Since none of the speakers in the study taught their native languages, they therefore would be expected to be in the mode of Type III, IV, or V while living in the United States. Under these conditions, a Type II speaker should be capable of evaluating flaws in the higher-numbered modes,

and should be able to detect an improvement from any of those modes; finer-grained distinctions are not necessary for the purposes of this study.

Compared to the English data, the scope of the analysis in this paper of the non-English data will not be as broad. This is partly because obtaining a level of analysis comparable to that of the English analysis would have required many more resources, including a substantially greater demand on the Type II evaluators and the need for Type I control subjects in each language. Additionally, a wealth of previous research has shown the effects of linguistic environment on L1 performance alone (Schmid 2007, Yagmur 1997, Olshtain & Barzilay 1991, for example), while this study aims to show how changes in L2 performance coincide with these L1 changes over a relatively short period of time.

4.1.2 Story-telling Analysis

All stories were evaluated by native speakers, who were instructed to listen for “anything that stands out to you concerning pronunciation, grammatical mistakes, or odd word choice (e.g. ‘body of water’ instead of ‘pond’).” During the second interview, each subject was also given the opportunity to perform a self-evaluation on the native-language story-telling recording from the first interview. The comments these evaluations produced are further supported by a lexicon analysis for the English recordings:

For this analysis, a database of lexical items was created from the transcriptions of the English story-telling recordings, with each entry tagged for which speaker used it, and whether it was used in the first interview or in the second. The stories produced by the

native English speakers, though they were originally recorded all at once, were split for the purposes of tagging at the same point in the story as the recordings of the English learners; in this way, a more accurate comparison could be carried out.

To obtain a numerical representation of speakers' retrieval of appropriate vocabulary, a subset of the database was selected, composed of words that had been used by both native English speakers in their stories, suggesting that these words constituted the "core vocabulary" necessary for a full description of the story by a maximally fluent speaker. The percentage of this lexicon subset used by each speaker before and after the environment change was then calculated.

Another calculation – this time using the entire lexicon produced by each speaker, instead of the subset – was the ratio of "types" (unique words) to "tokens" (every instance of word use), after Cohen (1989). Inflectional permutations of the same word (e.g. plurals, conjugations) were merged into one "type." Cohen's study used multiple tellings of the same story; however, since the current study is comparing two halves of the same story, the average types-to-tokens ratios (TTR) of the English speakers were used to control for differing degrees of variety in the content of each half. The final numbers compared were therefore ratios of the TTR of each speaker to the average English TTR for each half of the story.

The final comparison carried out was between the vocabulary used in this study and the words Olshtain & Barzilay (1991) found to be particularly difficult for English attriters (*jar*, *cliff*, *pond*, *gopher*, and *deer*). This comparison did not prove to be particularly interesting, however, since none of my subjects had any difficulty retrieving these words, with the exception of *gopher*, which no speaker (including the native

English speakers) used. The picture is, in fact, rather ambiguous to anyone who is not particularly well versed in distinctions among hole-digging rodents, and as a result the possibilities produced included a range of terms from plausible (*groundhog* or *mole*) to rather far off the mark (*squirrel* and *beaver*, both of which were produced by the native English speakers!). Only the Korean speaker avoided the issue completely by leaving all mention of the animal out of her story, a strategy that Olshtain & Barzilay found to be rare, even within a larger (21) group of speakers.

4.1.3 Vocabulary List Analysis

The number of lexical items in each list was counted by native speakers. For the English data, various instances of inflection for the same word were counted as one word, while derivational changes were counted separately. The evaluators for the non-English languages were informed of the inflectional/derivational divide, which was illustrated by examples from English, but were instructed to allow their intuitions of wordship to be the ultimate deciding factor in their counting.

For the L1 data, the number of words produced in the first interview for each of the two types of lists (phonetic and semantic) for each speaker was compared to the number produced in the second interview for the same type and speaker. No further calculations were performed on this data.

The English data was first calculated as a percentage of the baseline for each list prompt, where the baseline was the average score of the native English speakers. This baseline was used to control for any inequalities inherent in the lexicon among the total numbers of words meeting the requirements of the various prompts. The percentages

from the first and second interviews were then compared for each list type for each speaker.

4.2 Mandarin Speaker Results

The results from the Mandarin speaker are perhaps the most puzzling; the facts are presented below, and an attempt is made at explaining them in the Discussion.

4.2.1 Mandarin Speaker: Story Results

The speaker's own assessment (in the second interview) of his first-interview recording cited only one literal translation (for "pet dog), which he claimed is grammatically acceptable, but not the term normally used. He also felt that the story was not very fluent, with the repeated use of "然后", roughly equivalent to "and then..."

The Mandarin (Type II) evaluator³, however, found problems mainly in the story from the second interview, including unacceptable literal translations from English and the use of both an object marker and a passive marker in the same sentence, which is not grammatical⁴. It appears, therefore, that the second-interview performance was not as good as the first interview's, contradicting the predictions of the continuum theory.

The English story data for the Mandarin speaker better met expectations. The first interview contained very few odd expressions or mistakes: in one instance, a plural

³ Many thanks to Rongzhen Li of Yale University.

⁴ The phrase in question would be glossed 'OBJ small frog PASS grabbed ASP,' where OBJ is the object marker, PASS is the passive marker, and ASP is an aspect marker indicating completion. The correct uses of these markers would have been either 'OBJ small frog grabbed ASP' "grabbed the small frog" or 'small frog PASS grabbed ASP' "the small frog was grabbed."

ending was incorrectly added to a gerund (“callings”), and there were some scattered pronunciation mistakes, but these were minor compared to some of the errors in the second interview.

The speech in the second interview seemed to have somewhat less accurate production of certain consonants and clusters, such as /q/ and /mf/, either substituting other segments or epenthesizing vowels. Perhaps more importantly, though, a couple of examples betray significant interference with lexical retrieval. The phrase “halted to a stop,” for example, demonstrates that this speaker was not accessing the full semantic representation of *halt*, which includes *stop* (this is similar to the occurrences of “pond of water” found by Olshtain & Barzilay (1991)). Other examples of interference in lexical retrieval include use of general terms in places of a more appropriate specific term (“part of a tree trunk” instead of “log,” the term the other two subjects and both English speakers used⁵) and use of a specific term when a more general one would have been more appropriate (“little dog” was self-corrected to “puppy”; while the dog was small, there was no indication that it was a baby, a requisite feature of *puppy*).

The results of the numerical analyses were as follows: the Mandarin speaker used 28.42% of the words used by both English speakers in the first interview; the figure for the second interview was 25.45%, representing a drop of 2.97%. The TTR (controlled as a percentage of the corresponding English average) for the first interview was 96.54% and 84.56% for the second, a drop of 11.99%.

⁵ Circumlocution of *log* is actually one of the examples Olshtain (1986: 193) cites as symptomatic of attriters of English as an L2.

4.2.2 Mandarin Speaker: List Results

For the L1 phonetic prompts, the Mandarin speaker produced 18 words in the first interview, and 27 in the second. For the L2 phonetic prompts, he produced 102.44% of the English average in the first interview, and 110.64% of the English average in the second. Therefore, for these lists, the L1 data patterns as expected, but the L2 data is the opposite of the expected change.

For the semantic prompts, the speaker produced 21 words before and 15 after in L1, contrary to expectations. Compared to the English averages, he produced 75.00% before and 73.47% after.

4.3 Cantonese Speaker Results

The Cantonese speaker's results were rather lopsided toward L2 attrition; the change in L1 performance seems to have been less. It is possible that these results are due to language use conditions that actually work as factors in determining language mode; this line of thought will be explored further in the Discussion.

4.3.1 Cantonese Speaker: Story Results

In his self-evaluation of the first-interview recording, the Cantonese speaker reported some irregularity in word choice, which he described as "limited" and at times inappropriately formal. Similar to the Mandarin speaker's self-evaluation, he also thought the story was not very fluent, with repeated use of connecting words as a stalling strategy. No speaker meeting the appropriate theoretical qualifications was available, so

further analysis of the Cantonese story was not possible. (The lists were evaluated by a native speaker living in the United States; although he does not teach the language, determining word boundaries is a task that requires a relatively low level of fluency; even a non-native speaker could do it with a high degree of accuracy.)

In the English portion of the story-telling task, there was no immediately noticeable difference in the fluency of the two interviews; there were, however, two occasions during the second interview when he knew the word he was using was incorrect, but could not think of the appropriate word⁶. There were no such difficulties in the first interview, thereby supporting the continuum theory.

The results of the numerical analyses were as follows: the Cantonese speaker used 33.68% of the words used by both English speakers in the first interview; the figure for the second interview was 20.00%, representing a drop of 13.68%. The TTR (controlled as a percentage of the corresponding English average) for the first interview was 94.66% and 76.32% for the second, a drop of 18.34%.

4.3.2 Cantonese Speaker: List Results

For the L1 phonetic prompts, the Cantonese speaker produced 11 words in both interviews. For the L2 phonetic prompts, he produced 102.44% of the English average in the first interview, and 76.60% of the English average in the second. Therefore, for these lists, the L1 data represent an unexpected lack of change, and the L2 data patterns as expected.

⁶ One case was the use of “horns” instead of *antlers*, which is another of the examples of attrition symptoms cited in Olshtain (1986: 193). He also knew a word for “walking through the pond” existed, but could not think of *wading*.

For the semantic prompts, the speaker produced 22 words in both interviews. Compared to the English averages, he produced 70.00% before and 73.47% after. Neither of these comparisons fits with the expected pattern.

4.4 Korean Speaker Results

The data from the Korean speaker exhibited the most consistent patterns, best aligning with the expectations from the continuum theory.

4.4.1 Korean Speaker: Story Results

In her self-evaluation, the Korean speaker mentioned that some things sounded strange (“not how I normally say it”), and that some of the grammatical particles she used were chosen incorrectly. The Type II evaluator⁷ concurred on this point, though she also found a grammatical mistake in the recording from the second interview, and judged both recordings to be very fluent overall. The main difference the evaluator found between the two recordings was the cohesiveness of the story: the earlier recording was “incohesive,” giving the impression of two different stories, while the second recording was judged to be “cohesive.”

For the English story-telling, some minor mistakes, such as the use of incorrect prepositions, were made in both recordings, and the speaker used an avoidance strategy in both recordings to deal with words she could not think of (she ignored the animal coming out of the ground – according to Olshtain & Barzilay (1991), a gopher –in the

⁷ Many thanks to Angela Lee-Smith of Yale University.

first recording, and instead of trying to refer to the deer's antlers in the second recording, she simply placed the boy on the deer's "head"). Perhaps the most striking difference, however, was the Korean speaker's use of "kid" throughout the first interview to refer to the boy, and the less appropriate "child" throughout the second. While "child" refers to the correct concept, it is typically only used in casual speech to contrast with "adult"; "kid" would be a less marked choice for this context (i.e. telling a children's story to a peer). This knowledge does not seem to have been accessed during the second interview.

The results of the numerical analyses were as follows: the Korean speaker used 48.42% of the words used by both English speakers in the first interview; the figure for the second interview was 34.54%, representing a drop of 13.88%. The TTR (controlled as a percentage of the corresponding English average) for the first interview was 125.95% and 109.99% for the second, a drop of 15.96%.

4.4.2 Korean Speaker: List Results

For the L1 phonetic prompts, the Korean speaker produced 17 words in the first interview, and 24 in the second. For the L2 phonetic prompts, she produced 117.07% of the English average in the first interview, and 80.85% of the English average in the second. Both sets of data therefore pattern as expected.

For the semantic prompts, the speaker produced 19 words before and 21 after in L1. Compared to the English averages, she produced 75.00% before and 53.06% after, also in accordance with expectations.

4.5 Data Summary: Story-telling Task

The native language story data does not seem to paint a clear picture. While there is some evidence from the Korean speaker that an L1 attrition-reversal effect was experienced, there is also (inexplicably) evidence from the Mandarin speaker to suggest that L1 attrition was in fact *enhanced* during the stay in the L1 environment.

The English language story data, fortunately, is more uniform, and seems to consistently point to various forms of reduction in lexical access over the course of the L1 environment stay. In the comparison to the set of words used by both English speakers, the subjects experienced an average decrease of 10.18% of the “core vocabulary.” In the TTR comparison, the subjects experienced an average drop of 15.43% of the English speaker average TTR. While these data, shown in Table 3 below, establish a trend supportive of the continuum theory, a one-way ANOVA on each set of data yields unimpressive levels of significance ($F(1,2) = 2.282, p = 0.270$ for the “core vocabulary” test; $F(1,2) = 3.682, p = 0.195$ for the TTR test).

Table 3. Overview of numerical data from story-telling task.

<u>Speaker</u>	<u>CV% 1</u>	<u>CV% 2</u>	<u>TTR% 1</u>	<u>Tokens 1</u>	<u>TTR% 2</u>	<u>Tokens2</u>
Mandarin	28.42	25.45	96.54	467	84.56	434
Cantonese	33.68	20.00	94.66	609	76.32	656
Korean	48.42	34.55	125.95	202	109.99	255
	<u>CV 1</u>	<u>CV 2</u>	<u>TTR 1</u>	<u>Tokens 1</u>	<u>TTR 2</u>	<u>Tokens 2</u>
English Avg.	95	55	0.3105	534.5	0.3815	354.5

Number of words used by both English speakers, or “core vocabulary” (CV) and the percentages of those CVs used by each subject (CV%); Average type-to-token ratio for the English speakers (TTR) and percentages of those averages achieved by each subject (TTR%); Total number of tokens used by each speaker; Both first interview (1) and second interview (2).

4.6 Data Summary: Vocabulary List Task

The results from the vocabulary listing tasks are presented below in Table 4.

On the whole, the data from the phonetic prompts demonstrates a simultaneous increase in L1 performance and decrease in L2 performance. A one-way ANOVA on the English data shows that it has a low level of significance ($F(1,2) = 1.791, p = 0.313$); however, in many ways the Mandarin speaker was an anomaly, showing contradictory trends for the same language on different tasks. Therefore, the significance was recalculated excluding the Mandarin speaker, yielding much better results ($F(1,1) = 35.760, p = 0.105$). Further justification of this alteration and possible sources of this irregularity are suggested in the Discussion.

The data from the semantic prompts, on the other hand, is much more muddled, with two of the three speakers contradicting expectations on a least one task, while the rest of the data tends towards expectations. It is possible that the prompts for the semantic task (see Table 2) were too specific, measuring the speakers' experience with a specific area more than lexical retrieval ability. At any rate, these data are not at all significant ($F(1,2) = 0.736, p = 0.481$), and therefore cannot be taken to represent any changes in linguistic performance.

Table 4. Overview of vocabulary listing task.

Speaker	Phonetic Prompts				Semantic Prompts			
	L1		L2		L1		L2	
	Before	After	Before	After	Before	After	Before	After
Mandarin	18	27	102.44%	110.64%	21	15	75.00%	73.47%
Cantonese	11	11	102.44%	76.60%	22	22	70.00%	73.47%
Korean	17	24	117.07%	80.85%	19	21	75.00%	53.06%
English Avg.	-	-	20.5	23.5	-	-	20	24.5

5. Discussion

The two questions to be investigated in this study were

1. Can a shift in linguistic performance abilities be detected in the given timeframe? and
2. If there is a shift, will the speakers' first- and second- language faculties shift in a complementary manner, as the continuum theory predicts?

This study yielded data that suggest an affirmative answer to both these questions. In the following discussion, each case study will be considered individually, and then all three will be taken together in an attempt to answer each of the two initial questions.

5.1 Mandarin Discussion

The Mandarin data overall does not seem to present any coherent pattern. While the English story data, taken alone, seems to uniformly indicate some degree of attrition in English, there is no obvious explanation for phenomena like his performance in the L1 story-telling task. We will see in the Cantonese speaker that certain language use patterns might influence the way in which speakers shift through the bilingual language modes, but the Mandarin speaker reported complete shifts in language use corresponding to the dominant language of his environment; that is, he spoke only English in the United States, and used only Mandarin in China (with the exception of some television shows and music in English).

It is possible that the story-telling data is due to the influence of extra-linguistic factors on linguistic performance. One likely source of such an influence is the means by which the second set of data was gathered. The Mandarin speaker was going to be traveling with English-speaking friends for about a week; therefore, in an attempt to best capture any English attrition or Mandarin recovery effects of his stay in China, a packet of instructions and prompts was prepared for him so that he could record himself on his last day in China. One possible unintended side effect of this method, however, is that the absence of an interviewer may have reduced the pressure on the subject, enabling him to perform better than he had under the original conditions. This would explain an unexpected result like that for the phonetic prompts in English (see Table 4, above). It would still not explain the irregularities in the results from the semantic prompts, but it has already been suggested that these prompts may have been flawed.

The conclusions we can draw from the Mandarin case study are therefore limited. Some data points to the expected complementary performance shifts as the continuum theory predicts; other data contradicts this conclusion. The irregularity of the results combined with the possible interference of the different interview conditions therefore seems to justify the exclusion of the Mandarin speaker from the significance calculation of the vocabulary listing tasks.

5.2 Cantonese Discussion

In general, the results of the Cantonese case study were consistent with each other and with the predictions of the continuum theory. The only unexpected results occurred in response to the semantic list prompts, which have been addressed, and the L1

phonetically-prompted vocabulary list. The latter, rather than increasing as expected, was exactly the same both before and after the environment change. Taken together, the Cantonese results suggest that this speaker's L2 underwent the expected course of attrition, but his L1 performance exhibited very little change, either because it did not recover, or because it had never attrited much to begin with.

It is possible that language use patterns can account for this imbalance. The Cantonese speaker's English use patterns were fairly standard; that is, he used English almost all the time while in the United States, but only in a limited number of situations while in Hong Kong. The "standard" pattern therefore produces the expected "standard" result.

The subject's Cantonese usage pattern deviated from the "standard," however, in that he used Cantonese daily for about an hour on the phone to his girlfriend while he was in the United States. This usage pattern would have required him to maintain a relatively high performance ability in Cantonese; in fact he himself has observed that since he has been in this relationship, the daily L1 practice now allows him to return to Hong Kong without experiencing any linguistic transition period, as he did in his bachelor days. Note that this does not contradict Schmid's (2007) finding that frequency of L1 use does not affect rate of L1 attrition. Instead, the language modes are determined by the relevance of each language to the speaker's current environment; as Schmid puts it, "quality of contact might be more important than quantity" (2007: 150). With a Cantonese-speaking girlfriend only a phone call away, the subject's L1 therefore maintains its relevance in any environment.

The best mode to place the Cantonese speaker in, then, seems to be Type III, the fully bilingual mode, explaining why his L2 performance deteriorates into the Type I and II zones, but his L1 performance never attrites to the levels seen by other speakers at Type IV or V. The continuum theory also makes a further prediction, which is that maintaining the performance level of L1 at Type III necessarily prevents this speaker from attaining the higher levels of English fluency that would obtained at Type IV or V; it would be interesting to see if the subject's English would improve were the couple to split up.

5.3 Korean Discussion

The Korean speaker performed exactly as predicted by the continuum theory. Over the course of 24 days in Korea, her Korean story-telling shifted from “incoherent” to “coherent,” and her ability to recall Korean lexical items as tested by the vocabulary listing tasks improved. At the same time, her ability to make appropriate word choices in English suffered, as did her performance on the English vocabulary listing tasks. These complementary changes indicate clear progress from the Type V end of the language mode continuum towards the Type I end.

In terms of language use patterns, this speaker could also be considered “standard,” since she only uses Korean in the United States every few days to talk to her family, and even then she mixes in some English; while in Korea, she does not speak English – her only exposure to the language is through some reading and e-mails.

5.4 Question 1: Was any change in performance observed, given this timeframe?

Every speaker exhibited some degree of variation from the first interview to the second. While in the case of the Mandarin speaker this change was too discombobulated to draw any meaningful conclusions, the results from the Cantonese and Korean speakers seem consistent enough to conclude that these speakers did experience a shift in performance ability during this short-term change in linguistic environment.

A crucial aspect of the timing of this shift is that while it can take place quickly, it is not instantaneous. If speakers could switch modes instantly (i.e. as soon as they set foot in a new environment), there would have been no residual effects to have been observed during the second interview in the United States; the subjects themselves corroborate this, citing the need for an adjustment period upon their return to the English-speaking environment.

Compared with previous studies, which generally dealt with more long-term relocation, the changes found in this study were perhaps not quite as dramatic (for example, my subjects had no problems with the words found to be problematic by Olshtain & Barzilay (1991) – the distinction to be made here may be that the degree of attrition in my study may be enough to inhibit total recall, as in the vocabulary listing task, but not enough to prevent retrieval of the word when presented with a visual cue, as in the picture book). However, the Cantonese and Korean speakers' L1 and L2 each had a definite trend in its own direction, in some cases exactly replicating the errors produced by attriters in previous studies (such as Olshtain 1986).

The conclusion regarding this question is therefore that a short-term change in linguistic environment can effect a change in linguistic performance abilities, and that

this change will last for at least a few days after the original linguistic environment is restored.

5.5 Question 2: Does this change conform to the bilingual continuum model?

Once again excluding the Mandarin data, which showed no coherent trend, we see that the trends in the Cantonese and Korean data follow the predictions of the bilingual continuum model.

The Cantonese speaker, maintaining a Type III mode, has relatively low inhibitions in both English and Cantonese while in the United States, where both languages have a high degree of relevance to him. Upon the temporary reduction in relevance of English, however, this speaker starts to move towards Types I and II, modes where his L2 becomes more inhibited in order to maximize the fluency of his L1. The data from this case study are consistent with this transition from low inhibition to lower inhibition in Cantonese – a difference too fine to be captured by this study – and the transition from low inhibition to high inhibition in English.

The Korean speaker, on the other hand, does not have a situation in which her L1 maintains its relevance in the United States, so in that environment her L1 inhibitions are high, while her L2 ambitions are low; in other words, she is more of a Type V than a Type III. The data from this study support the expected reversal of inhibitions that would occur under a change in environment that inverted the relevance of the L1 and L2, as her L1 inhibitions decreased and her L2 inhibitions increased during her stay in Korea.

5.6 Possible Directions for Future Research

The results from this study highlight several areas in which it could be improved, and raise some issues for further research.

One area which does not seem to have been particularly successful was the semantically-prompted vocabulary listing task. As was suggested earlier, life experience can influence retrieval of semantically grouped lexical items. One possible solution to this problem could be to use the same prompt for both interviews; however, this strategy was avoided in the present study out of a concern that the task would be easier the second time, thereby skewing the results. While it may be possible to very carefully choose semantic categories such that every speaker has the potential to perform equally well on them, it seems like such a task will always be subject to the particulars of different languages and different speakers in a way that a phonetically-cued test will not.

A general principle for improving this study would simply be to increase the scale; this would apply to several areas. Using more subjects has the potential to greatly increase the significance of the findings. To circumvent the dilemma of whether or not to use the same prompts in both interviews, the number of tasks could be increased so that some stayed the same, while others changed. Collecting data from Type I native speakers for all languages, instead of just English, would allow for all comparisons to be controlled. Finally, the use of more than two interviews would allow for finer distinctions in the timeline of attrition progression, and how it might (or might not) vary from speaker to speaker.

In terms of new avenues to pursue, the Cantonese data in particular raises some interesting issues. One is the question of language relevance: what factors other than

environment allow a language to become more or less relevant to a speaker? Or, put another way, what conditions allow a given language *use* situation to become a factor in a speaker's language *environment*, for the purposes of determining language mode?

Yagmur (1997) concludes that sociolinguistic motivations contribute to, but cannot fully describe language attrition; the results of the current study seem to lead to the same conclusion, leaving the question open for exploration.

Another interesting topic raised by the Cantonese speaker is the nature of changes experienced by Type III speakers. For instance, this study has been assuming that changes are exactly complementary; that is, the "sum" of the performance levels of the two languages stays constant across all modes in the continuum. The Cantonese speaker, however, seems to have very high levels of performance in both languages at Type III; is it possible then, that speakers experience variable performance capacity, depending on the demands of their linguistic environment? On a related note, are the changes along the continuum linear, or are there drop-offs or sudden increases at any point? Only further testing can provide answers to these questions.

6. Conclusion

This study has concluded that a shift in primary language mode, in the manner predicted by the bilingual language mode continuum, can be achieved with only a short-term change in environment, and that this change has lasting – but presumably temporary – effects on the linguistic performance abilities of the subjects. These results raise at least as many questions as they answer. However, this was perhaps to be expected: given

the complexity we have come to appreciate in the structure of individual languages, it is hardly surprising to find even more complexity where two of these massive structures interface in the same mind.

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