Research Article

GOING IN AND OUT OF LANGUAGES: An Example of Bilingual Flexibility

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Abstract—*When bilinguals speak to one another, they choose a base language to interact in and then, depending on the need, code-switch to the other (guest) language for a word, a phrase, or a sentence. During the perception of a code switch, there is a momentary dominance of base-language units at the onset of the switch, but it is unknown whether this base-language effect is also present in production, that is, whether the phonetics of the base language carry over into the guest language. In this study, French-English bilinguals retold stories and read sentences monolingually in English and in French and bilingually in French with English code switches. Both the stories and the sentences contained critical words that began with unvoiced stop consonants, whose voice onset times (VOT) were measured. The results showed that the base language had no impact on the production of code switches. The shift from one language to the other was total and immediate. This manifestation of cross-linguistic flexibility is accounted for in terms of a bilingual production model.*

Bilingualism, which can be defined as the regular use of two or more languages, is a widespread phenomenon. It is present in practically every country of the world, in all classes of society, and in all age groups; in fact, it has been estimated that at least half the world's population is bilingual. One of the most interesting aspects of bilingualism at the cognitive level is the fact that two or more languages are in contact within the same person. This phenomenon, which has led to a vast body of research (Appel & Muysken, 1987; Baetens Beardsmore, 1986; Grosjean, 1982; Hakuta, 1986; Haugen, 1969; Romaine, 1989; Weinreich, 1968), can best be understood if one examines the bilingual's various language modes.

In their everyday lives, bilinguals find themselves at various points along a situational continuum. At one end of the continuum, bilinguals are in a totally monolingual mode in that they are speaking (or writing) to monolinguals of one or the other of the languages. At the other end of the continuum, they find themselves in a bilingual language mode, which means that they are communicating with bilinguals who share their two languages and with whom they normally mix languages. In this mode, bilinguals normally adopt a language to use together (the base language) and then, depending on a number of factors, mix in the other language (the guest language). One way of doing this is to borrow a lexical item from the guest language and to integrate it phonologically and morphologically into the base language (Poplack, Sankoff, & Miller, 1988; Weinreich, 1968). Thus, a French-English bilingual might say to another bilingual, "Je vais *checker* cela" (I'm going to check this). Here, English "check" is adapted to French morphology and pronounced as a French word. Another way of mixing languages, and the one that is of interest to us in this article, is to shift completely to the guest language—for a word, a phrase, or a sentence, for example. This is known as code switching. Thus, for example, a bilingual might say, "J'ai vu des *wild guys* à cheval" (I saw some wild guys on horseback), or "Va chercher Marc *and bribe him* avec un chocolat chaud *with cream on top*" (Go get Marc and bribe him with a hot chocolate with cream on top). Here "wild guys," "and bribe him," and "with cream on top" are said in English.

Although there has been a recent flurry of activity in the psycholinguistics of bilingualism (Harris, 1992; Schreuder & Weltens, 1993), less work has been done on the processing of code switches (exceptions are de Bot, 1992; Grosjean, 1988; and Myers-Scotton, 1993, among others). In the domain of perception, researchers have examined how the bilingual listener processes mixed language on-line and have studied, among other things, the base-language effect. This effect, originally proposed by Macnamara and Kushnir (1971), concerns the impact that the base language has on the guest language during the perception of code switches. It has been shown repeatedly that there is a momentary dominance of base-language units (phonemes, syllables, words) at code-switch boundaries (at the onset of "wild," "and," and "with" in the examples above). This increased activation can in turn delay slightly the perception of units in the guest language (Grosjean, 1988; Grosjean & Soares, 1986; Soares & Grosjean, 1984). This effect is influenced by a number of factors, including the acoustic makeup of the code-switched item (Bürki-Cohen, Grosjean, & Miller, 1989), its phonotactics (Grosjean, 1988), and the presence or absence of a base-language homophone (Grosjean, 1988). It is not yet clear how best to account for this effect nor at what level of processing it occurs.

The question asked in this study is whether there is also a base-language effect in production. Could it be that in speaking, the phonetic momentum of the base language carries over into the guest language and hence affects at least the beginning of code switches? How complete is a code switch, therefore? On the one hand, the results of the perception studies reported above, and the fact that 80% to 90% of linguistic units normally belong to the base language in a mixed utterance, could lead to the expectation of some base-language influence at code-switch onset (during the first phoneme or the first syllable). On the other hand, because of the inherent differences between perception and production, there could well be no clear equivalent of the base-language effect in production. Given the flexibility of the production mechanism, a switch between languages might involve a total change, not only at the lexical but also at the phonetic level. In order to test these alternatives, we mea-

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sured the onsets of code switches by means of a well-established variable, voice onset time (VOT; Lisker & Abramson, 1964), and compared the results with those obtained when the same bilinguals were speaking only one language or the other.

EXPERIMENT 1

Method

Subjects

Five French-English bilingual adults with no reported speech or hearing disorders served individually in a session lasting 45 min. Membership in a bilingual community (the European-French-speaking community in Boston), daily use of English and French, and a regular habit of code switching with other bilinguals (including the bilingual experimenter) were critical variables in choosing these subjects.[1]

Materials

Three stories in English were written for this study and another study involving the prosody of code switching. The stories ranged from 270 to 300 words long, and each contained a number of words beginning with the three unvoiced stop consonants, /p/, /t/, and /k/. Each story involved three characters, a woman, a man, and a pet, with names that could be said in English and in French (Concordia, Paul, and their dog, Tito; Pepita, Tom, and their monkey, Coco; Tatiana, Carl, and their dog, Pipo). The stories were written in such a way that the names of the characters appeared a number of times (between seven and nine times each). In addition, at least 15 words (mainly common nouns) that begin with unvoiced stops and whose French translations begin with the same consonant were included in the stories. Thus, for example, in one story, the /t/ onset was represented by the following five words (the French translations are in parentheses): *temperature* (*température*), *taxi* (*taxi*), *tourist* (*tourist*), *telephone* (*téléphone*), and *Texas* (*Texas*). The other unvoiced stops (/p/ and /k/) were represented by 10 other words in this particular story.

Once the three English stories had been written, they were translated into French. Three different "full" versions of each story were typed on separate pages: English, French with English code switches, and French. The latter two were identical except that the names of the three main characters were typed in capital letters in the version with English code switches. Three key-word versions of each story were then prepared on separate pages, one for each full version. These contained the important words of the stories (nouns, verbs, etc.) and few if any function words. The key-word version for French with English code switches was again the same as the French key-word version except that the names of the main characters appeared in capital letters.

Procedure

Before the experiment, subjects chatted in French with the bilingual experimenter, whom they knew personally, for about 15 min. Care was taken to involve code switching into English by raising appropriate topics (work, sports, etc.). Subjects were then seated in a soundproof booth with the experimenter. They were told that their task would be to read a number of stories silently and retell them to the experimenter, and that to help them during the retelling, they would be given a shortened, key-word version of each story.

The subjects were then asked to read out loud, in English, the names of the main characters in the three stories. Following this, the English stories were presented, one at a time, and after each reading, the subjects retold the story in English with the help of the English key-word version. The subjects were then presented with the three versions in French with English code switches and were asked to follow the same procedure. They were reminded that the characters were the same as in the English stories and that they would have to say the characters' names in English (i.e., code switch over to English). To help them with the task, they were given the key-word versions in French with English code switches.

Finally, the subjects were asked again to read the names of the main characters in the three stories out loud, but in French this time. They were then given the three French stories and were told that this time they were to pronounce the names of the characters in French. During this third retelling, they used the French key-word versions of the stories.

All retellings (three in English, three in French with code switches, and three in French only) were recorded with a lapel mike (Sony ECM-16T) and a cassette recorder (Marantz PMD 360).

Data analysis

The recordings were digitized (sampling rate of 20 kHz, low-pass filtering at 9.8 kHz) and analyzed by means of a computer editing program implemented on a DEC PDP 11/44. Given the differences in word stress in English and French, only monosyllabic words beginning with an unvoiced stop consonant were analyzed. These included the three monosyllabic test words (*Paul, Tom,* and *Carl,* henceforth called the stimulus words) in their three versions (English, English code switch, and French) and a number of other words in their two versions (English and French). For each word, we measured the VOT of the initial consonant, that is, the interval of time between the release of the stop and the onset of voicing (Lisker & Abramson, 1964). For each subject and each story, the first six occurrences of each stimulus word were measured, in each of their three versions, as were as many of the other monosyllabic words with initial unvoiced stop consonants as were produced.[2]

1. All subjects had the following characteristics: They were native speakers of French and had started learning English in primary or secondary school; they had moved to the United States as adults and had lived in the Boston region for at least 4 years; they spoke English with hardly any French accent; they used their two languages on a daily basis; they code-switched when speaking French to bilingual friends and family members; and they had served previously as subjects in experiments on bilingualism. No effort was made to test the subjects' proficiency in English and French nor to use "balanced" bilinguals (see Grosjean, 1982, 1985, for a discussion of the problems linked with proficiency tests and the use of balanced bilinguals).

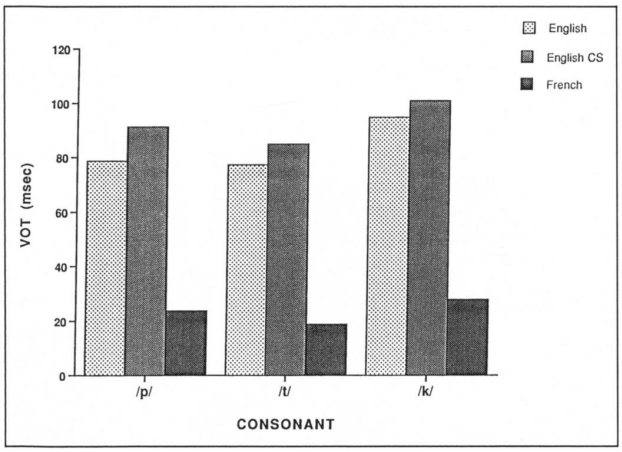

Fig. 1. Mean VOT durations for the stop consonants /p/, /t/, and /k/ at the onset of the stimulus words (*Paul, Tom,* and *Carl*) in the retelling task. Each consonant is represented by three bars depicting the values obtained in the three conditions: English monolingual (English), French with English code switches (English CS), and French monolingual (French). Each bar is the mean of 30 values (5 subjects and 6 values per subject).

Results and Discussion

Figure 1 presents the mean VOT durations for the three stop consonants /p/, /t/, and /k/ at the onset of the stimulus words. Each consonant is represented by three bars depicting the mean values obtained in the three conditions: English, French with English code switches (henceforth, English CS), and French. An examination of the English and French values reveals an expected VOT difference between the two languages (79 vs. 24 ms for /p/, 77 vs. 19 ms for /t/, and 95 vs. 28 ms for /k/). We should note that these values are not specific to proper nouns. When these VOT values were compared with those at the onsets of the other monosyllabic words in the English and French monolingual versions of the stories, no difference reached significance in the six tests conducted (two languages and three consonants).[3]

Given that the subjects showed a clear difference between English and French VOT values, we can address the question asked at the beginning of the study: Is there a base-language effect in the production of code switches and, more specifically, at their onset? As can be seen in Figure 1 (middle bar of each consonant set), the answer is clearly negative. The English CS values (91, 85, and 101 msec for /p/, /t/, and /k/, respectively) are quite different from the French values and are similar to the English values. A one-way analysis of variance based on the subject means for each consonant set shows a main effect in each case: for /p/, $F(2, 8) = 18.8$, $p < .001$; for /t/, $F(2, 8) = 17.8$, $p < .01$; for /k/, $F(2, 8) = 55.9$, $p < .001$. A Scheffé post hoc test reveals, in each case, a significant difference between English and French, and between English CS and French, but no difference between English and English CS.[4]

These results suggest that in bilingual speech production, no phonetic momentum of the base language carries over into the guest language. Switching from one language to another appears to involve a total change, not only at the lexical but also at the phonetic level. The question that remains, though, is how immediate the change is. Bilinguals might plan their code switches ahead of time and start changing over to the phonetics of the guest language before reaching the onset of the code switch; that is, the shift could take place one or two words before. As for going back to the base language, this might be done after the code switch, during the word or words that follow. In order to examine the time course of code switching, we tracked the phonetic shift from one language to another by means of a reading task.

EXPERIMENT 2

Method

Subjects

The same 5 bilingual subjects took part in this experiment, which lasted 20 min.

Materials

The three stimulus words were embedded in two versions of an English sentence. *Tom* and *Carl* were inserted in "During the first few days, we'll tell him to copy ____ constantly," and *Paul* was inserted in "During the last few days, we'll tell him to copy ____ constantly." The two versions, which differed only in the presence of *first* or *last,* were included so as to allow a bit of diversity in the reading and to make sure that subjects remained attentive throughout the study. The two versions of the sentence were then adapted into French in such a way that the number of syllables and the last part of the sentences were similar in the two languages: "Pendant les premiers (derniers) jours, il faudra qu'il copie ____ constamment."

Three reading sets were constructed from these sentences and typed on different pages. The English set contained nine tokens, three for each of the three stimulus words. The tokens were grouped by stimulus words within the set. The French set contained nine tokens of the French sentences, with the same

2. Three research assistants with good knowledge of English and French undertook the measurements. On an interjudge reliability test involving 18 measurements from the reading task in Experiment 2, the mean VOT values were 38, 39, and 39 ms, $F(2, 34) = 2.70$, $p > .05$.

3. The means over subjects for each language and each consonant, and the t values, are as follows (the first figure is for the stimulus words, the second for the other monosyllabic words): English /p/, 79 and 71, $t = 1.72$, $p = .16$; English /t/, 77 and 74, $t = 0.27$, $p = .80$; English /k/, 95 and 97, $t = 0.36$, $p = .74$; French /p/, 24 and 19, $t = 1.09$, $p = .34$; French /t/, 19 and 22, $t = 0.92$, $p = .41$; French /k/, 28 and 37, $t = 2.07$, $p = .11$. It should be noted that the results of 29 out of 30 individual tests (5 subjects, 2 languages, and 3 consonants) are also nonsignificant.

4. Individual analyses of variance for each subject and each consonant set confirm these general results. All 15 differences (5 subjects and 3 stimulus words) between English and French and between English CS and French are significant, whereas 12 out of 15 differences between English and English CS are not significant.

internal organization. Finally, the code-switching set was identical to the French set except that the stimulus words were typed in capital letters.

Procedure

As in the first experiment, subjects chatted in French and code-switched with the bilingual experimenter before undertaking the reading task. They were then seated in a soundproof booth, and the experimenter asked them to read out loud, at a normal rate, the sentences presented to them. They were instructed to read each sentence silently before reading it aloud, and they were explicitly told to code-switch for the proper nouns in the code-switching set of sentences (i.e., to pronounce *Paul, Tom,* and *Carl* in English). The order of the sets was English, English CS, and French. After a first pass through the three sets, the subjects were given a short break and were then asked to read the sets a second time. Thus, each stimulus word was read six times in each of the three conditions. The recordings were made as in Experiment 1.

Data analysis

The sentences were analyzed as in the first study. This time, however, three measures were obtained for each sentence: the VOT of /k/ at the beginning of *copy/copie*, the VOT at the onset of the stimulus words (*Paul, Tom,* and *Carl*), and, finally, the VOT of /k/ at the beginning of *constantly/constamment.*

Results and Discussion

Figure 2 presents the mean VOT durations obtained at the three measurement locations. The middle panel of the figure is the reading counterpart of the retelling data presented in Figure 1. As can be seen, the pattern of results is very similar. There are large differences between the English and French values (78 and 17 ms, respectively, for /p/; 90 and 20 ms for /t/; and 97 and 27 ms for /k/), whereas the English CS values (78, 92, and 96 ms for /p/, /t/, and /k/, respectively) are once again quite different from the French values and similar to the English values. A one-way analysis of variance based on the subject means for each consonant set shows a main effect in each case: for /p/, $F(2, 8) = 40.08$, $p < .001$; for /t/, $F(2, 8) = 41.05$, $p < .001$; for /k/, $F(2, 8) = 57.9$, $p < .001$. A Scheffé post hoc test reveals, in each case again, a significant difference between English and French, and between English CS and French, but no difference between English and English CS.[5] Thus, whether the task is retelling a story or reading a sentence, there is no apparent trace of the base language at the onset of the code switch.

In order to obtain some estimate of the time course of the code switch, that is, how early it occurs and how late it disappears, one needs to turn to the two other panels of Figure 2. In the top panel, which represents the VOT values of the /k/ of *copy/copie,* one observes an expected difference between English /k/ and French /k/, but no difference between English CS /k/ and French /k/ (the language at this point in the English CS sentence was meant to be French and clearly is French). A one-way analysis of variance based on the subject means for each consonant set confirms this finding. A main effect is found in each case: for the *Paul* sentence, $F(2, 8) = 12.2$, $p < .01$; for the *Tom* sentence, $F(2, 8) = 18.7$, $p < .001$; for the *Carl* sentence, $F(2, 8) = 19.8$, $p < .001$. A Scheffé post hoc test reveals, in each case, a significant difference between English and French, and between English and English CS, but no difference between English CS and French.[6]

An identical pattern of results is found for the /k/ in *constantly/constamment,* as can be seen in the bottom panel of

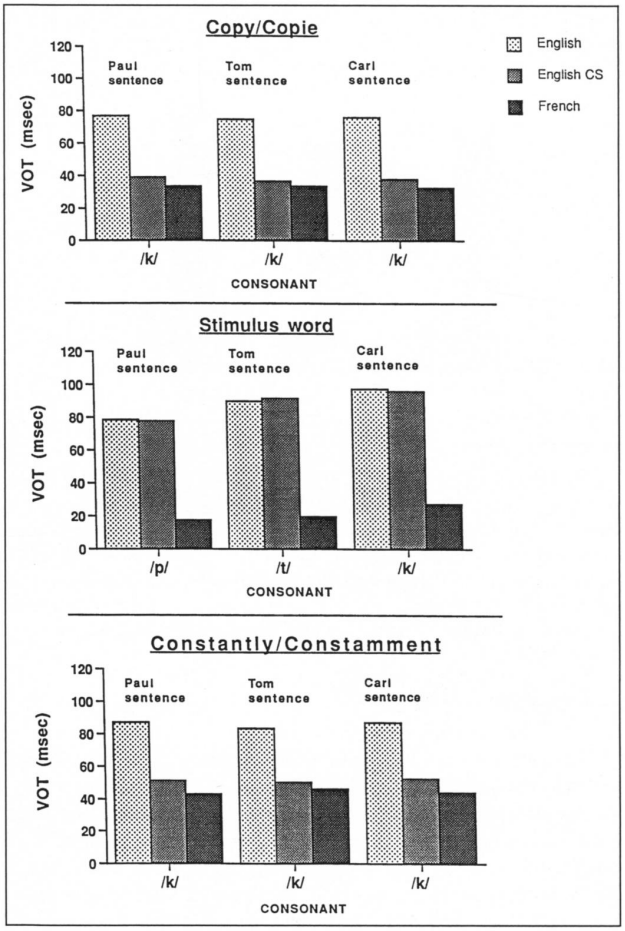

Fig. 2. Mean VOT durations at three measurement locations in the reading task: the /k/ of *copy/copie* (top panel), the onset stops (/p/, /t/, and /k/) of the three stimulus words (middle panel), and the /k/ of *constantly/constamment* (bottom panel). Each panel has three sets of bars, one for each sentence (the *Paul* sentence on the left, the *Tom* sentence in the middle, and the *Carl* sentence on the right). Each set contains three bars, depicting the values obtained in the three conditions: English monolingual (English), French with English code switches (English CS), and French monolingual (French). Each bar is the mean of 30 values (5 subjects and 6 values per subject).

5. Individual analyses of variance for each subject and each consonant produce similar results. All 15 differences (5 subjects and 3 stimulus words) between English and French and between English CS and French are significant, whereas 13 out of 15 differences between English and English CS are not significant.

Figure 2. There exists a clear difference between English /k/ and French /k/, but no difference between English CS /k/ and French /k/ (the language of the English CS sentence at this point was meant to be French and clearly is). An analysis of variance based on the subject means for each consonant set confirms this pattern: for the *Paul* sentence, $F(2, 8) = 19.1$, $p < .001$; for the *Tom* sentence, $F(2, 8) = 13.2$, $p < .01$; for the *Carl* sentence, $F(2, 8) = 22.8$, $p < .001$. A Scheffé post hoc test reveals, in each case, a significant difference between English and French, and between English and English CS, but no difference between English CS and French.[7]

Thus, to answer the question asked previously, bilinguals do not start switching one or two words before the guest word and do not switch back to the base language during the words that follow. The fact that the /k/ of *copie* in the English CS sentences is still French means that the phonetic shift to the guest language probably takes place at, or very near, the onset of the guest word, and the fact that the /k/ of *constamment* in the same English CS sentences is already in French shows that the switch back to the base language takes place extremely quickly. It appears from these results that bilinguals are both very flexible and extremely precise when going in and out of a code switch.

GENERAL DISCUSSION

The results obtained in the two experiments provide strong evidence that the phonetics of the base language has no impact on the production of code switches (in the situation studied here, at least). When bilingual speakers insert a word or phrase from the guest language into the base language, the switch usually involves a total change, not only at the lexical but also at the phonetic level. Cross-language phonetic slips may occur occasionally in spontaneous speech, especially at code-switch onset, but these are probably no more frequent than intralanguage phonetic slips. The articulatory system appears to be as flexible between languages as it is within a language.

When one considers the base-language effect in perception, the present result is a happy one for bilingual communication. Given that bilingual listeners favor the base language at the onset of code switches, it is fortunate that the phonetic information at that point is unambiguous. If the contrary were the case, the listener would be doubly handicapped—by a perceptual preference for the base language and by an ambiguous signal. A clearly marked code-switch onset undoubtedly counterbalances, at least to some extent, the perceptual base-language effect and hence reduces the duration of the ambiguity. Evidence for this was obtained in a study (Grosjean, 1988) that examined the recognition of code switches and borrowings. It was found that the language in which a guest word was pronounced affected the nature of the candidates proposed; there were more candidates from the guest language when the word was said as a code switch (i.e., pronounced in the guest language) than as a borrowing (pronounced in the base language).

A possible explanation for our findings, in terms of a model inspired in large part by de Bot (1992), Levelt (1989), and Myers-Scotton (1993), is the following. When a bilingual is speaking only one language, the surface structure of the monolingual utterance is elaborated with lemmas (the semantic and syntactic components of words that are accessed in the mental lexicon), as well as with specific grammatical rules. Once this has been done, phonological encoding can take place. This process entails retrieving from the lexicon the phonological forms of the lemmas previously chosen (i.e., the lexemes) and building a phonetic plan, that is, an internal representation of how the utterance should be articulated. Several levels of processing are involved in generating a plan: a morphological and metrical level, which retrieves a word's morphemes and metrical structure; a segmental level, which specifies the word's syllables and segments; and a phonetic level, which retrieves the stored plans of the syllables and segments in terms of sequences of phones.

When the bilingual is mixing languages, that is, speaking a base language and bringing in, from time to time, elements of the guest language, the phonological forms of the guest words are accessed in the guest lexicon (or in the guest-language part of the general lexicon, depending on one's view as to the bilingual's lexicons). The guest forms are then inserted into the utterance alongside base-language forms that are, by definition, more numerous. If there are no linguistic or psycholinguistic reasons to integrate the guest forms morphologically or phonologically into the base language and hence make them into borrowings (Myers-Scotton, 1993; Poplack et al., 1988), then each form's phonetic plan remains a string of guest-language phones (e.g., English word-initial /t/, English word-medial /a/, and English word-final /m/, for the English code switch *Tom*). These phones are transformed into articulatory commands, and production can proceed normally.

According to this view, pronouncing a code switch is no different from pronouncing another word within the same base language (a position that Paradis, 1977, 1986, has maintained for a long time). Of course, when a code switch is longer and makes up its own syntactic constituent, the planning that occurs during grammatical and phonological encoding results in differences not only at the segmental level (as in our study) but also at the prosodic level (Grosjean & Soares, 1986). Future studies are needed to examine these kinds of code switches both in reading and in more spontaneous speech as produced by different types of bilinguals.

6. Individual analyses of variance for each subject and each consonant set confirm these results. All 15 differences between English and French and the 15 between English and English CS are significant, whereas 14 out of 15 differences between English CS and French are not significant.

7. Individual analyses of variance for each subject and each consonant produce similar results. A total of 14 differences (out of 15) between English and French are significant; 12 differences between English and English CS are also significant; however, 12 differences between French and English CS are not significant.

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