# THE EFFECT OF ACQUISITION ORDER AND WORD RELATEDNESS ON CODE-SWITCHING COSTS IN BALANCED BILNGUAL SPEAKERS

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**ABSTRACT**

This paper aims to explore the effect of acquisition order and word-relatedness on code-switching costs in bilingual speakers. 38 Mandarin-Min bilinguals performed a picture-naming task, in which hand-drawn pictures were color-coded for the two languages, Mandarin and Min, and switching points were pre-determined but variable. Results showed that naming latencies of cognates were in general shorter than non-cognates, and Mandarin stimuli were also shorter than Min. Min non-cognates were especially difficult for subjects. Code-switched trials incurred longer latencies in subjects, but only in those who acquired both languages at the same time, contrary to what was predicted by the Inhibitory Control Model.

**Keywords:** code-switching, bilingual lexicon, Inhibitory Control Model, Mandarin-Southern Min

## 1. INTRODUCTION

Diglossia is a common phenomenon that exists among the bilinguals in Taiwan. Li and Lee [6] mentioned that compared with Hong Kong, individual bilingualism in Taiwan is more widespread largely as a result of the National Language Movement that promoted Mandarin as a High language, while Southern Min, Hakka, and the Aboriginal languages remained Low languages. Southern Min is the most widespread dialect and the second most widely used language variety in Taiwan. Code-switching between Mandarin and Southern Min in daily life is very common, with the matrix language being either language depending on the speaker, the context, and the genre [5, 7].

From a psycholinguistic perspective, Green [3] proposed the Inhibitory Control Model (ICM) to account for problems that bilingual speakers encounter when selectively attending to only one of two languages. Time costs incur when speakers switch between two languages as a result of the change of task schema. Furthermore, processing costs in code-switched materials differ according to various degrees of activation and suppression in L1 and L2 respectively. When one speaks L1, L1 would be activated and L2 inhibited. Since L2 is presumably a weaker language, it is less activated and is thus easier to be suppressed. Therefore, when one is switching from L1 to L2, the suppression of L2 in the first language schema when speaking L1 does not incur a large carryover effect on the next language schema (L2). However, when L2 is switched to L1, in which more suppression of L1 is required, greater switch costs would occur. Using a picture-naming paradigm, Meuter and Allport [9] found that the response latencies of language switching trials were longer than nonswitching trials in unbalanced bilinguals. More importantly, switching to a more dominant L1 took more time than switching to a weaker L2.

## 2. AIMS OF THE STUDY

There are three specific aims in this study. The first is to examine whether the imbalanced switching cost could also be shown in Mandarin-Min bilinguals. Based on Meuter and Allport [9] and the ICM [3], it would be reasonable to predict that switching from Min to Mandarin is slower than switching from Mandarin to Min since Mandarin is a relatively more dominant language. However, the special linguistic ecology in Taiwan tends to create bilinguals that are more balanced than the ones in Meuter and Allport's study [9]. It is thus unclear whether similar results could be replicated on balanced bilinguals of Mandarin-Min.

Secondly, we would also like to see whether the order of acquisition would affect code-switching costs. Due to the diglossic situation in Taiwan, most Mandarin-Min bilinguals acquired Min earlier than Mandarin, the former being acquired at home while the latter at school. However, as Mandarin is the official language, some parents tend to use both languages at home so as to give children a “head start”. As a consequence, there are also bilinguals that acquire the two languages simultaneously. Therefore, the second purpose of this study is to tease apart the effects caused by order of acquisition and those by language dominancy. If the status of being an L1 is special, even for nondominant languages, then one should find lower costs for code-switching in bilinguals that acquired both languages simultaneously. Finally, we would also like to examine the effect of word-relatedness. Meuter and Allport [9] used numbers in English and other European languages as their stimuli, which are composed of cognates sharing phonological similarities. However, it is unclear whether the same pattern could be replicated in non-cognate words. Hence, the third purpose is to explore the difference in code-switching between cognate and noncognate words. If the incurred switching cost is due mainly to words that are phonologically and morphologically similar, then one should find a lower switching cost for cognate than noncognate words.

## 3. METHODS

### 3.1. Participants

38 Mandarin-Min bilinguals (mean age = 23.3) took part in the study. Half acquired both languages simultaneously (the “Simultaneously-Acquired Group”) and half acquired Min prior to Mandarin (the “Min-First Group”). No speaker in the two groups was exposed to Catonese or other dialects at their earlier age. Participants self-evaluated their language proficiency using a Likert scale ranging from 1 (very disfluent) to 7 (very fluent) .The average rating for Mandarin was 6.64 while that for Min was 5.38. The relative proficiency of participants in the two languages in both groups was similar. Though participants viewed themselves as highly-proficient bilinguals, for all participants, the proficiency level of Mandarin was respectively greater than that of Min. Participants spoke Mandarin more often than Min, which was reflected by language usage frequency survey filled up by participants. We are aware of that the level of proficiency will be more reliable if separate language proficiency raters are provided for two groups. However, since the stimuli in the experiment are names of pictures, it is difficult to determine the language proficiency objectively via single words uttered by participants. To sum up, as for the dominance of two languages, based on participants’ level of relative proficiency and the frequency of language use, both groups of speakers spoke Mandarin as their more dominant language. Although there are inter-subject differences for each group, the general trend of the language dominancy is similar. Data from two speakers in the Min-First Group was deleted. One was due to an unpredictable technical problem. The other was because that a subject registered in the Min-first group but his language background mismatched the requirement of “acquiring Min prior to Mandarin” of the group. Data from one speaker in the Simultaneously-acquired Group was deleted because of self-report stutter in the language background questionnaire. Finally, there were 18 participants in the Siumultaneously-acquired Group and 17 in the Min-first Group.

### 3.2. Stimuli

40 target stimuli of everyday objects were chosen and were presented in cartoons. Half of the stimuli formed cognates in Mandarin and Min (e.g., [Mandarin] *jing*$^3$*-cha*$^2$ *vs.* [Min] *keng*$^3$*-chhat*$^4$ ‘police’) and the other half were noncognates (e.g., [Mandarin] *sha*$^1$*-fa*$^1$ *vs.* [Min] *phong*$^3$*-i*$^2$ ‘sofa’). An additional 40 stimuli were also chosen to serve as primes. All of the line drawings were color-coded in light blue and white, the former representing Min, and the latter representing Mandarin. All drawings were pre-tested using a naming task to make sure they are representative enough of the stimuli in both languages. In total, there were 40 (targets) × 2 (colors) + 40 (stimuli) × 2 (colors) = 160 stimuli.

### 3.3. Equipment

E-prime 1.1 and its accompanying PST button box Model #200a were used to collect the reaction time data. A SONY MRD 7520 head-mounted microphone and a BurnIt CDR830 CD-ROM Burner were used for recording.

### 3.4. Procedure

Participants were seated in a quiet room before a computer monitor, and were asked to name the presented line drawings in the designated language. Instructions were provided by Mandarin. Each trial consisted of a prime and a target. In total, there were 40 (pairs) × 4 (color combinations: WW, WB, BW, BB) = 160 trials. WW and BB were the "non-switching" trials, in which the prime and the target were coded in the same color (Figure 1), while WB and BW were the "switching trials", in which the prime and the target were coded in different colors (Figure 2). The 160 trials were further divided into four equal groups, which contained 10 trials of each color combination. Participants were randomly assigned into four groups so that each person only saw each prime-target pair once. The order of presentation was randomized by E-prime for each participant.

**Figure 1:** An example of the structure of a non code-switching list (Prime: white, Mandarin; Target: white, Southern Min). Both fixation periods were 2 sec long and both the prime and the target were 4 sec long. The response window was also 4 sec long.

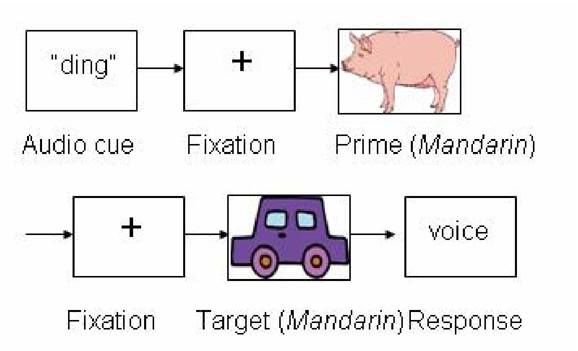
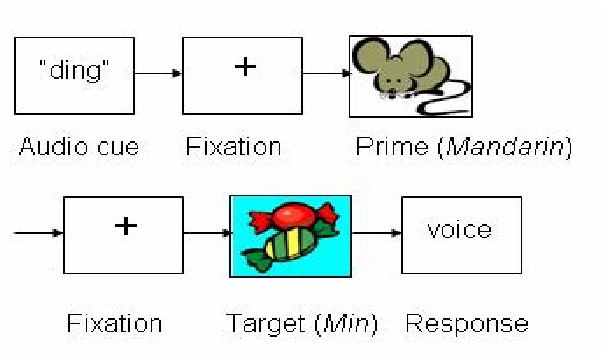



**Figure 2:** An example of the structure of a code-switching list (Prime: white, Mandarin; Target: blue, Southern Min). Fixation time and response window were the same as Figure 1.




### 3.5. Measurement

Reaction time was measured from the onset of stimuli by E-prime. Data collected by voice key was double-checked and hand-corrected based on the additionally recorded soundfiles using Praat. Responses were counted as correct only when the pictures were named correctly in the target language. The average correct rate was 92.23%. Latencies that were more than three standard deviations away from the mean were planned to be excluded. However, no data was deleted according to this criterion.

## 4. RESULTS

A Switch (2) × Language (2) × Cognate (2) × Order (2) four-way ANOVA was performed. Results showed that three of the main effects were significant [Language: $F(1,1277)= 75.34$, $p < 0.0001$, $\hat{\eta}^2 = .06$; Cognate: $F(1,1277)= 76.99$, $p < 0.0001$, $\hat{\eta}^2 = .06$; Order: $F(1,1277)= 4.50$, $p < 0.05$, $\hat{\eta}^2 = .004$]. The effect of Switch was also near significant [$F(1,1277)= 2.91$, $p = 0.09$, $\hat{\eta}^2 = .002$]. Two of the two-way interactions were also significant [Language × Cognate: $F(1,1277)= 15.15$, $p < 0.001$, $\hat{\eta}^2 = .01$; Switch × Order: $F(1,1277)= 5.47$, $p < 0.05$, $\hat{\eta}^2 = .004$]. No other higher-level interactions were found.

Post hoc independent $t$ tests regarding the Language × Cognate interaction showed that cognates were in general faster than non-cognates [Mandarin: $t(644.66) = -4.45$, $p < .0001$; Min: $t(453.73) = -7.19$, $p < .0001$], and Mandarin stimuli were always faster than Min [Cognate: $t(598.45) = -4.22$, $p < .0001$; Non-cognates: $t(452.98) = -7.10$, $p < .0001$]. However, as shown in Figure 3, Min non-cognates were much slower than other types of stimuli.

As for the interaction of Switch × Order, post hoc independent $t$ tests showed that RT for code-switched items were longer for subjects who acquired both languages simultaneously, as shown in Figure 4 [$t(633.24) = 3.46$, $p < .001$]. For non-switched items, there was no difference in acquisition order. Comparing across items, it was also interesting to find that code-switching incurred a cost only in subjects who acquired both languages at the same time [$t(660) = 2.91$, $p < .01$]. No difference was found in the Min-first subjects.

**Figure 3:** Overall RTs (in ms) for Mandarin and Min stimuli for cognates and non-cognates.

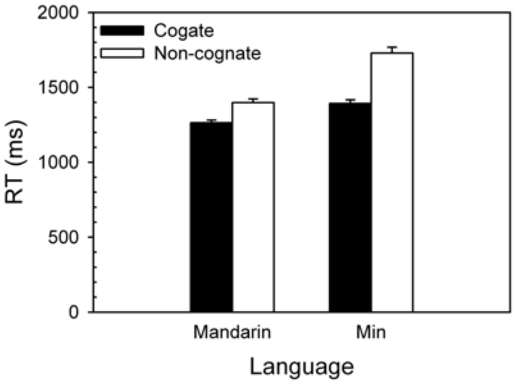
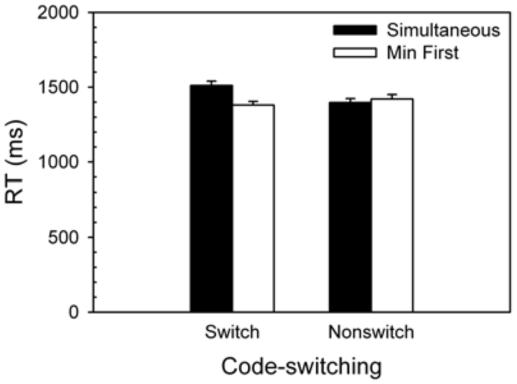



**Figure 4:** Overall RTs (in ms) regarding switching pattern and acquisition order.




## 5. DISCUSSION

The Inhibitory Control Model [3] predicts that time costs are incurred when bilinguals code-switch. However, this was only supported in our study for subjects who acquired both languages simultaneously. Code-switching time costs were not found for speakers acquiring Min prior to Mandarin. This interaction was interesting, as the two groups of subjects did not differ in their self-rated language proficiency. In other words, the order of acquisition might also affect the efficiency of lexical encoding, and thus code-switching latency. More studies would be needed in order to understand this effect.

The unequal switching costs found in Meuter and Allport [9] was not replicated in this study. Mandarin stimuli were in general responded faster than Min ones. This may have to do with the special language ecology in Taiwan. As Min is a language dominant in private domains and Mandarin a dominant language in public domains, the distinction of L1 and L2 in Taiwan might not have the same implication as that in Europe (e.g., English and French [8]). In other words, a later-acquired language is not necessarily a weaker language in Taiwan. Another possible underlying cause for the discrepancy might lie in the design. Meuter and Allport [9] used a within-subjects design while we used a between-subject one. Further studies will be needed in order to gain a clearer understanding of this matter.

The effect on word-relatedness is interesting. Cognates in general better facilitated code-switching than non-cognates. One possible reason is that the activation of phonological information affects the process of lexical selection [1], which causes the relationship between lexical items and phonological forms become bidirectional and interactive. The cognate status of word not only activates lexical representations in one language, but also spreads some activation to its corresponding segments, making the retrieval of the lexical item much easier. Non-cognates that were coded in Min were especially in disadvantage.

## 6. REFERENCES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