The role of lexico-syntactic features in noun phrase production and comprehension: insights from Spanish and Chinese in unilingual and bilingual contexts

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Chapter 6

Adjective-noun Order in Spanish–Chinese Code-switching: Resolving Syntactic Conflict

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Abstract

This study investigates adjective-noun placement in Spanish–Chinese code-switched constructions, addressing how bilinguals resolve syntactic differences between Spanish (postnominal adjectives, e.g., *manzana roja* "apple red") and Chinese (prenominal adjectives, e.g., *红色的苹果* "red apple"). Two models offer predictions for navigating this conflict: the Matrix Language Frame (MLF) model suggests that adjective-noun order follows the matrix language (ML), while Minimalist Program (MP)-based approaches arrive at the descriptive generalization that word order aligns with the language of adjectives. To test these predictions, thirty early Spanish–Chinese bilinguals completed a director-matcher task and a forced-choice acceptability judgment task in four contexts: unilingual Spanish and Chinese, and mixed language contexts with either Spanish or Chinese as the matrix language. Production data were analyzed descriptively, and comprehension data using Thurstone's law (case V) and one-way ANOVA. Results showed consistent expected default word order in unilingual contexts, which referred to prenominal adjectives in Chinese and postnominal adjectives in Spanish. In Spanish matrix contexts, while the matrix language, as predicted by the MLF, accounted for word order of adjective-noun patterns in production, the language of adjectives, as predicted by the MP, explained more patterns in both production and comprehension, suggesting better prediction by the MP overall. In Chinese matrix contexts, both the matrix language and the adjective languages explained adjective-noun patterns, aligning with both models. Additionally, noun insertions were preferred over adjective insertions, consistent with trends in other bilingual communities. This study is the first to empirically examine how grammatical constraints, derived from the MLF and MP, interact with Spanish–Chinese CS patterns, complementing existing research on adjective placement in bilingual speech. Moreover, our finding challenges the idea that a single theoretical model fully explains code-switching patterns; instead, it strongly suggests that both matrix language structure (MLF) and the features of individual

lexical items (MP) interact and contribute to mixed constructions, leading to a more fine-grained understanding of syntactic integration.

Keywords: code-switching (CS), bilingualism, adjective-noun order, matrix-language frame (MLF), minimalist program (MP), Chinese, Spanish

6.1 Introduction

In multilingual communities, a phenomenon known as code-switching (CS) occurs when speakers integrate elements from two or more languages in a single discourse (Poplack, 1980; Deuchar, 2012). Research has established that CS is not random; instead, it follows specific patterns and rules (e.g., Bullock & Toribio, 2009). One area of particular interest in CS research is how bilinguals manage the "conflict sites" between two languages (Poplack & Meechan, 1998), where the grammatical rules of the two languages differ. These sites serve as key indicators of linguistic integration in bilingual speech, providing valuable insights into how bilinguals resolve syntactic differences. One such syntactic difference for Spanish–Chinese bilinguals arises in adjective-noun constructions. In Spanish, the typical word order is noun-adjective (e.g., *manzana roja*, [apple red], "red apple"), whereas Chinese features a reversed order with adjectives preceding nouns (e.g., *红色的苹果*, [red apple], "red apple"). Consequently, Spanish–Chinese bilinguals in code-switching may produce four possible mixed patterns: *苹果 roja* "apple$_{N.CN}$ red$_{ADJ.SP}$", *roja 苹果* "red$_{ADJ.SP}$ apple$_{N.CN}$", *manzana 红色的* "apple$_{N.SP}$ red$_{ADJ.CN}$", and *红色的 manzana* "red$_{ADJ.CN}$ apple$_{N.SP}$". Thus, the question arises whether bilinguals favor all these patterns or reject some combinations in their production and comprehension.

In Mandarin Chinese, there are two common adjective-noun structures: adjective *de*[9] noun (A *de* N) and adjective plus noun (A N) (Li & Thompson, 1981; Paul, 2010). In the "A *de* N" structure, the nominalizing particle *de* functions as an intermediary between the adjective and the head noun, and the adjective has the function of further clarifying features or

[9] In adjective *de* noun (A *de* N) constructions, *de* is the Pinyin transcription of Chinese character *"的"*.

references of the noun (e.g., *红色的花,* /hong2se4de0hua1[10]/ [red flower], "red flower") (Li & Thompson, 1981). Regarding the "A N" structure, the adjective and the noun are simply juxtaposed, and this structure is frequently used in a way that makes the adjective a name for a category of the noun (e.g., *黄豆* /huang2dou4/ [yellow bean], "soybean" (Li & Thompson, 1981; Paul, 2010). While certain adjectives can modify nouns with or without the particle *de*, most cases of adjectives require the nominalizing particle *de* when modifying a noun (Li & Thompson, 1981). In other words, the "A *de* N" structure occurs more frequently than the "A N" structure in Mandarin Chinese. Note that adjectives always precede nouns in both "A *de* N" and "A N" structures.

In contrast, Spanish predominantly adheres to a postnominal adjective order in the nominal constructions, in which the adjective is positioned after the noun. Nevertheless, a small number of exceptions exist where certain adjectives may appear before nouns with a change in meaning (Terker, 1985). In Spanish adjective-noun constructions, the postnominal adjective tends to convey a basic, attributive meaning to specify the noun (see 1a), whereas the prenominal adjective indicates a restricted and inherent characteristic of the noun (see 1b) (Terker, 1985). Notably, adjectives that relate to defining the kind of objects, such as color, nationality, shape, and religion, consistently follow nouns they modify and do not change position (Bull, 1950).

1. a. un hombre grande
   a man tall
   "a tall man"

   b. un gran hombre
   a great man
   "a great man"

(Stadthagen-González et al., 2019)

[10] In this paper, the number paired with the pinyin represents a specific tone. In Mandarin Chinese, there are four distinct phonemic tones. Tone 1 has a high-level pitch, Tone 2 has a high-rising pitch, Tone 3 has a low-dipping pitch, and Tone 4 has a high-falling pitch (Chao, 1948).

Given the differing word order in Chinese (2a) and Spanish (2b), whereby in Mandarin Chinese, adjectives precede nouns, and in Spanish, adjectives follow nouns, the adjective-noun constructions in Spanish–Chinese speech are therefore "conflict sites".

2. a. 绿色的 裙子 [Chinese: prenominal adjectives]
   green skirt
   "green skirt"

   b. falda verde [Spanish: postnominal adjectives]
   skirt green
   "green skirt"

Theoretical models have attempted to explain how the "conflict site" is managed in CS speech. On the one hand, Poplack (1980) proposed the Equivalence Constraint stating that code-switching only occurs where the syntactic rules of both languages align, implying that adjective-noun "conflict site" should block switching. Building on this, Torres Cacoullos and Vélez Avilés (2024) introduced the Variable Equivalence Hypothesis, suggesting that CS favors shared grammatical boundaries without privileging the syntax of one language. Like the Equivalence Constraint, it predicts that switching at the "conflict site" (e.g., between adjectives and nouns) will be disfavored, with switches more likely before, after, or at phrase boundaries (see Table 6.1.1, 3a–4b). However, since this study specifically focuses on code-switching between nouns and adjectives, rather than broader patterns across shared grammatical boundaries, the Variable Equivalence Hypothesis will not be examined further.

Table 6.1.1. Example CS sentences align with the Variable Equivalence Hypothesis.

CS contexts			
Chinese as matrix language		**Spanish as matrix language**	
Examples	Switch boundaries	Examples	Switch boundaries
3a.我妈妈有一只 **gato travieso**. My mom has a **cat naughty**.	before the phrase/at the phrase boundaries	3b. Mi mamá tiene un **淘气的猫**. My mom has.3S a_{Masc} **naughty cat**.	before the phrase/at the phrase boundaries
4a.我妈妈有一只**淘气的猫**, Muy lindo. My mom has a **naughty cat**, very cute.	after the phrase	4b. Mi mamá tiene un **gato travieso**, 很可爱. My mom has.3S a_{Masc} **cat naughty**, very cute.	after the phrase
Translation [English]			
My mom has a naughty cat, (very cute).			

For this specific conflict site, the placement of adjectives and nouns in code-switching, the Matrix Language Framework (MLF; Myers-Scotton, 1993, 2002) and Minimalist Program (MP)-based approaches (MacSwan, 1999) offer targeted predictions (see Section 6.2.1 for detailed information). According to the MLF (Myers-Scotton, 1993, 2002), code-switching involves a matrix language (ML) that provides the morphosyntactic frame and an embedded language (EL) that supplies lexical items. As such, in code-switched adjective-noun constructions, the MLF (Myers-Scotton, 1993, 2002) posits that the adjective position should be compatible with the word order of the matrix language. Another approach (Cantone & MacSwan, 2009), rooted in the MP (MacSwan, 1999), argues that code-switching should be governed by the same grammatical principles as monolingual syntax, with grammatical features determined by the properties of individual lexical items. Thus, following Cinque's (1994, 1999, 2005) proposal that adjectives are universally placed before nouns, Cantone and MacSwan (2009) reached the descriptive generalization that in adjective-noun switching, the adjective placement should be determined by the language of adjectives. A key aspect to mention is that, although these two models capture different aspects of adjective-noun patterns and differ in

assumptions, their predictions in explaining these patterns sometimes converge or diverge. Specifically, certain sentences may be explained by both models (MLF+/MP+), by only one of them (e.g., MLF+/MP− or MLF−/MP+), or by neither (MLF−/MP−).

Several studies examining predictions of these two models in fully explaining grammatical patterns in adjective-noun code-switching have failed to find compelling evidence in support of either model (see Section 6.2.2 for detailed descriptions). For example, studies using naturalistic conversations and/or elicitation tasks, such as those in English–Welsh (Parafita Couto et al., 2015), Welsh–English, Spanish–English (Miami), and Papiamento–Dutch (Parafita Couto & Gullberg, 2019), Spanish–English (Balam & Parafita Couto, 2019) and Spanish–Dutch/Papiamento–Dutch (Van Osch et al., 2023), provided support for predictions of both models. While other studies, such as those in French–Dutch (Vanden Wyngaerd, 2017), Welsh–English (Parafita Couto et al., 2017; Vaughan-Evans et al., 2020), Spanish–English (Stadthagen-González et al., 2019) and Papiamento–Dutch (Pablos et al., 2019), showed that CS adjective-noun patterns could be explained by either the MLF or MP, or neither of them. These findings suggest that while each model captures different aspects of adjective-noun patterns in CS, neither fully accounts for the complexity observed. This underscores the need for further research, particularly with understudied language combinations, to more thoroughly evaluate these theoretical frameworks and refine our understanding of adjective-noun switching.

With this in mind, in this study, we investigate adjective-noun CS patterns in mixed nominal constructions with an underexplored language pair and bilingual community. Specifically, we examine Spanish–Chinese mixed constructions produced by early Spanish–Chinese bilinguals in Barcelona, Spain, to evaluate the MLF and MP predictions regarding adjective-noun order. Using a multitask approach, we aim to not only test these models but also uncover new insights into CS behaviors in this unique linguistic context.

6.2 Theoretical background

6.2.1 Theoretical models

6.2.1.1 The Matrix Language Frame (MLF) model

According to the Matrix Language Frame (MLF) model (Myers-Scotton, 1993, 2002), code-switching is structurally asymmetrical: one language, the Matrix Language (ML), provides the morphosyntactic frame, while the Embedded Language (EL) contributes content elements (see Table 6.2.1). A fundamental concept in the MLF is the distinction between content and system morphemes. Content morphemes, such as nouns, verbs, adjectives, and prepositions, carry semantic and pragmatic meaning and receive thematic roles (Myers-Scotton, 2002). On the other hand, system morphemes, including function words and inflections, relate to constituent structure and indicate relations between content morphemes. Typically, system morphemes come from the ML, while content morphemes can be sourced from both the ML and EL (Myers-Scotton, 2002). To determine the ML, Myers-Scotton (1993) proposed two principles based on distinctions of content and system morphemes:

The System Morpheme Principle: "In ML+EL constituents, all system morphemes which have grammatical relations external to their head constituent (i.e., which participate in the sentence's thematic role grid) will come from the ML."

The Morpheme Order Principle: "In ML+EL constituents consisting of singly occurring EL lexemes and any number of ML morphemes, surface morpheme order (reflecting surface syntactic relations) will be that of the ML."

(Myers-Scotton, 1993:83)

In code-switched clauses, both principles apply simultaneously, with the ML determining word order and providing inflections and function words (Myers-Scotton, 2002). The model predicts that finite verb morph-

ology and clause word order will follow the ML. If the bound morphology of the finite verb is from language A, then the noun phrase word order, including adjective placement, should also match language A. For instance, with Chinese as the ML, adjectives should precede nouns, whether in Chinese or Spanish; with Spanish as the ML, adjectives should follow nouns, regardless of their language (see examples 5a–6b in Table 6.2.1).

Table 6.2.1. Example CS sentences align with the MLF predictions.

CS contexts			
Chinese as matrix language		**Spanish as matrix language**	
Examples	Predicted acceptability	Examples	Predicted acceptability
5a. 我妈妈有一只**淘气的 gato**. My mom has a **naughty cat**.	**MLF+**/MP+	6a. Mi mamá tiene un **猫 travieso**. My mom has.3S a$_{Masc}$ **cat naughty.**	**MLF+**/MP+
5b. 我妈妈有一只 **travieso 猫**. My mom has a **naughty cat**.	**MLF+**/MP–	6b. Mi mamá tiene un **gato 淘气的**. My mom has.3S a$_{Masc}$ **cat naughty.**	**MLF+**/MP–
Translation [English]			
My mom has a naughty cat.			

Note: MLF+/MP+: sentences accepted by both MLF and MP; MLF+/MP–: sentences accepted by only MLF.

6.2.1.2 The Minimalist Program (MP)

MacSwan (1999) applied the Minimalist Program (MP) (Chomsky, 1995) to explain CS grammars. Rather than proposing constraints specific to code-switching, MacSwan (2005) suggested that the phenomenon is constraint-free and can be explained by general grammatical principles, as "Nothing constrains code-switching apart from the requirements of the mixed grammars" (MacSwan, 1999:146). Regarding adjective-noun order, Cantone and MacSwan (2009) follow Cinque's (1994, 1999, 2005) proposal that the adjective placement follows a Universal Base, where all adjectives are universally placed before nouns. According to Cantone and MacSwan (2009), in languages with strong morphological features such as

case or φ features (e.g., number, person, and gender), nouns may undergo overt movement across the adjectives to check strong agreement features. In this framework, such overt movements are triggered when strong case or φ features must be evaluated before pronunciation, resulting in visible word order changes within the determiner phrase (DP; Cantone & MacSwan, 2009). Accordingly, postnominal placements in Romance languages such as Spanish likely arise from overt noun movement preceding adjectives triggered by strong φ features. In Cantone and MacSwan's (2009) proposal, the adjective placement in code-switched NPs aligns with the syntactic constraints of its source language. By analysing Italian–German naturalistic data, they observed that adjectives from Italian are consistently positioned after nouns due to the noun movement, regardless of the ML, while German adjectives are placed prenominally. Thus, they reach the descriptive generalization that in the NP-internal code-switching, adjective language determines word order. Accordingly, adjectives should be placed before nouns when they are Chinese (see 7a and 7b with the highlighted code-switched constructions in Table 6.2.2) and after nouns when they are Spanish (see 8a and 8b), regardless of the ML in the clause.

Table 6.2.2. Example CS sentences align with the MP predictions.

CS contexts			
Chinese as matrix language		**Spanish as matrix language**	
Examples	Predicted acceptability	Examples	Predicted acceptability
7a. 我妈妈有一只**淘气的 gato**. My mom has a **naughty cat**.	MLF+/**MP+**	7b. Mi mamá tiene un **淘气的 gato**. My mom has.3S a_{Masc} **naughty cat**.	MLF–/**MP+**
8a. 我妈妈有一只**猫 travieso**. My mom has a **cat naughty**.	MLF–/**MP+**	8b. Mi mamá tiene un **猫 travieso**. My mom has.3S a_{Masc} **cat naughty**.	MLF+/**MP+**
Translation [English]			
My mom has a naughty cat.			

Note: MLF+/MP+: sentences accepted by both MLF and MP; MLF–/MP+: sentences accepted by only MP.

6.2.2 Previous studies in testing MLF and MP predictions in mixed adjective-noun patterns

Several attempts have been made to evaluate these two theoretical frameworks in accounting for adjective-noun code-switching across bilingual communities with different language pairs (see an overview in Appendix 6.A). However, findings of these studies posed challenges for both models. On the one hand, studies based on (semi-)naturalistic data generally reported preferences for noun insertion, a pattern that is commonly aligned with both models, although there remain cases that cannot be adequately explained by either model. For instance, Parafita Couto et al. (2015) used corpora and elicitation data to examine English–Welsh adjective-noun switches and found a preference for noun insertions, which align with both the matrix language (MLF) and the language of adjectives (MP). Similarly, Parafita Couto and Gullberg (2019) analyzed three corpora, Welsh–English, Spanish–English (Miami), and Papiamento–Dutch, and observed that adjective-noun patterns conformed to both models. Balam and Parafita Couto (2019) also found that most cases of Spanish–English adjective-noun constructions in the Northern Belize corpus aligned with both models. Additionally, Van Osch et al. (2023) examined adjective-noun switches in Spanish–Dutch and Papiamento–Dutch in an elicitation task and found a clear preference for noun insertion, which aligned with both models, although they pointed out that either the ML or the adjective language, or both, play roles in determining word order. However, Bierings et al. (2019), in an elicitation study of Kaqchikel–Spanish adjective-noun switches, found that these patterns could not be explained by either model, although they attributed these results to task effects and methodological issues.

On the other hand, studies with other methodologies revealed different CS patterns in adjective-noun switching. For example, French–Dutch adjective-noun code-switching in Vanden Wyngaerd (2017), which used a 3-point grammatical judgment task, found the MP better explained adjective-noun patterns, although the potential role of ML and noun

insertions was also observed. However, Stadthagen-González et al. (2019) employed a 2-Alternative Forced Choice (2AFC) judgment task to examine the acceptability of adjective-noun order in Mexican Spanish–American English and found neither the MLF nor MP alone could fully explain adjective-noun patterns. Instead, their results revealed an additive effect, suggesting that both the ML and the language of adjectives influence word order acceptability. Further, Olson (2024) replicated the study of Stadthagen-González et al. (2019) in a 2AFC judgment task and found comparable findings. Additionally, Parafita Couto et al. (2017) used event-related brain potentials (ERPs) to investigate Welsh–English adjective-noun switches and observed the left anterior negativity (LAN), an ERP component sensitive to early grammatical processing, in conditions predicted by the MLF to induce a violation of adjective position. They argued that these findings may support the MLF over MP, though they refrained from making definitive conclusions. Similarly, Vaughan-Evans et al. (2020) examined Welsh–English adjective-noun switches with behavioral and ERPs measures based on Parafita Couto et al. (2017). Their behavioral results indicated that sentences adhering to the MLF assumptions were more likely to be acceptable. While electrophysiological data revealed a greater LAN elicited by MP violations, significant LAN and P600, an ERP component associated with global grammatical findings, were elicited by MLF violations, providing support for the MLF over the MP at a global sentence processing level. Conversely, Pablos et al. (2019) investigated Papiamento–Dutch adjective-noun switches using ERPs measures to detect LAN, and found no LAN modulation elicited by the adjectives in sentences that include MLF or MP violations. Their null results may suggest either that both noun-adjective orders are acceptable in modification contexts or that all tested code-switched patterns were generally dispreferred.

Overall, these findings suggest that bilinguals may not only integrate information from the clausal structure but also be sensitive to the morphosyntactic properties of individual lexical items when processing and producing mixed NPs. In other words, these studies did not provide

compelling evidence for either model in fully explaining adjective-noun patterns. Additionally, preferences for noun insertion over adjective insertion were identified across these studies. Moreover, these findings primarily stem from well-established bilingual or multilingual communities (e.g., Spanish–English in Miami or Papiamento–Dutch in the Netherlands), while research on adjective-noun order in relatively young bilingual communities remains absent. Building on this, the present study explores how bilinguals in a relatively young yet stable bilingual community process grammatical constraints proposed by two theoretical models in constructing mixed adjective-noun nominal constructions, aiming to contribute to a more comprehensive understanding of bilingual syntactic integration.

6.2.3 Spanish–Chinese bilingual community in Spain

The most representative young yet stable bilingual community is the Spanish–Chinese bilingual community in Barcelona, Spain, which offers a unique and valuable context for exploring CS habits and patterns. As a relatively young community, it brings together rich cross-linguistic input, consistent heritage language maintenance, and diverse multilingual interactions, which ensure the vibrant use of Chinese and Spanish in this community and make it especially suitable for investigating how bilinguals manage and switch between typologically distinct language systems. The Chinese community, as the second-largest non-EU immigrant group in Spain (Robles-Llana, 2018), has its roots in the largest wave of Chinese migration to Spain in the 1980s (Beltrán Antolín & López, 2013), which was primarily driven by economic and political reasons. Since then, the Chinese population, 70% of whom migrated from Qingtian, Zhejiang province, has grown steadily and reached the second-largest non-EU immigrant group by 2016 (Robles-Llana, 2018; Beltrán Antolín, 2006). In Barcelona, the Chinese population increased from 13,416 in 2003 to 56,017 in 2020, with children under 16 (second generations) rising from 2,412 to 12,285 (He, 2024), fostering the emergence and growth of Spanish–Chinese bilingual communities. Most first-generation immigrants in this community came from the same region, worked in similar jobs (i.e.,

family-run restaurants), and preserved Chinese cultural values, creating a stable and homogenous environment for Chinese heritage language transmission to second generations.

Additionally, these second generations often act as linguistic and cultural mediators due to their parents' limited integration into broader Spanish society (Robles-Llana, 2018), and their upbringing in a multilingual environment has also led them to routinely interact with Chinese and Spanish monolinguals, Spanish–Catalan bilinguals, and other bi/multilinguals. This exposure has resulted in their high proficiency in Chinese, Spanish, and other languages (e.g., Catalan), fostering rich cross-linguistic interactions and adaptive language practices, such as CS, and the ability to manage typologically different language systems. Despite the community being relatively young (with a second-generation average age of 21 years), second-generation bilinguals share a relatively homogeneous linguistic and educational background, ensuring a valuable context for exploring how bilinguals navigate CS patterns.

6.3 Research questions

In this study, we investigate how early Spanish–Chinese bilinguals, heritage speakers who use Chinese at home and Spanish in the broader society (Barcelona, Spain), navigate the syntactic conflict in adjective-noun placement in mixed Spanish (postnominal adjectives)–Chinese (prenominal adjectives) constructions. Based on this, we further examine how grammatical constraints derived from the two theoretical models, the MLF and MP, influence the construction of mixed adjective-noun patterns. Additionally, given that previous studies have found a preference for noun insertions, we explore whether bilinguals similarly favor the insertion of nouns over adjectives. Building on these objectives, our research questions are as follows:

1. What code-switching patterns between nouns and adjectives will early Spanish–Chinese bilinguals favor in production and

comprehension? Specifically, is there a stronger preference for noun insertions compared to adjective insertions?

2. What insights do the MLF and the MP offer for understanding adjective placement in mixed adjective-noun constructions among early Spanish–Chinese bilinguals, and how can these insights help refine our understanding of CS patterns?

6.4 Materials and methods

6.4.1 Participants

Thirty early Spanish–Chinese bilinguals (age_{mean}= 20.5 years, age_{SD} = 1.66 years; 20 females) were recruited from Pompeu Fabra University in Barcelona, Spain (see Table 6.4.1). Participants completed a sequence of tasks, beginning with a production task and a comprehension task, followed by a questionnaire based on the Bilingual Code-Switching Profile (BCSP; Olson, 2022). The questionnaire assessed participants' language proficiency, experience, and language use. Based on the results of BCSP, participants reported being born either in Spain (n = 18) or China (n = 10), with two exceptions: one participant was born in France but moved to Spain immediately after birth, and another was born in Italy, spent four years in China shortly after birth, and has since lived in Spain. All participants are Chinese heritage speakers raised in Chinese-speaking families, acquiring Chinese after birth, while growing up in a Spanish-speaking society (i.e., learning/speaking Spanish outside home and at schools) with an average age of acquiring Spanish of 3.47 years old (SD = 3.42). Moreover, they reported their daily use of Spanish ($M_{frequency}$ = 41.9%, $SD_{frequency}$ = 0.156), Chinese ($M_{frequency}$ = 40.7%, $SD_{frequency}$ = 0.170), Catalan ($M_{frequency}$ = 9.12%, $SD_{frequency}$ = 0.059), and English ($M_{frequency}$ = 6.18%, $SD_{frequency}$ = 0.053). The study was approved by the Ethics Committee of the Faculty of Humanities at Leiden University, and all participants provided informed consent before taking part in the experiments. Upon completing all tasks, participants received monetary compensation for their participation.

Table 6.4.1. Participant characteristics for production and comprehension tasks.

	Experiments 1 and 2
Number of Female/Male participants	20/10
Mean age in years (SD; range)	20.5 (1.66;18–24)
Number of participants born in Spain/Italy/France	18/1/1
Number of participants born in China	10
Age of Chinese acquisition	After birth
Age of Spanish acquisition	3.47 years (*SD* = 3.42)
Daily use of Chinese (frequency)	40.7% (*SD* = 0.170)
Daily use of Spanish (frequency)	41.9% (*SD* = 0.156)
Daily use of Catalan (frequency)	9.12% (*SD* = 0.059)
Daily use of English (frequency)	6.18% (*SD* = 0.053)
Participants without living experience in China (i.e., more than one year)	8

6.4.2 Production task: Director-Matcher task

6.4.2.1 Materials

Twenty-one target-colored line drawings were obtained from the Multipic database (Duñabeitia et al., 2018) based on the following procedures: first, we selected nine colored pictures that are related to familiar, concrete, and easily recognizable features as basic objects; second, each picture was modified by altering properties such as color, size, or condition, resulting in one or two new variants per original picture. This process generated a final set of 21 distinct target pictures with different properties (see Table 6.4.2). For detailed materials, including target pictures, sentences, task results, and questionnaires, please refer to the supplementary materials available at OSF.

Table 6.4.2. Objects used in the director-matcher task.

Target objects		
Grey cat 	Pink pig 	Yellow glove 
Orange cat 	Black pig 	Black glove 
White cat 	Brown pig 	Brown glove 
Orange balloon 	Whole egg 	Big potato 
Blue balloon 	Broken egg 	Small potato 
Green skirt 	Red strawberry 	Red apple 
Black skirt 	White strawberry 	Green apple 

6.4.2.2 Procedure

The experiment involved two sessions, i.e., a familiarization and an experimental session. During familiarization, participants were introduced to the Spanish and Chinese names of nine basic pictures. This step ensured that all participants were equally familiar with the visual stimuli and their corresponding labels before proceeding to the experimental tasks.

The experimental session consisted of four director-matcher tasks (Gullberg et al., 2009), administered across two language contexts: code-switching (i.e., Chinese matrix language and Spanish matrix language) and unilingual (i.e., Chinese and Spanish). In CS contexts, participants completed two tasks where mixed constructions occurred (i.e., adjectives from

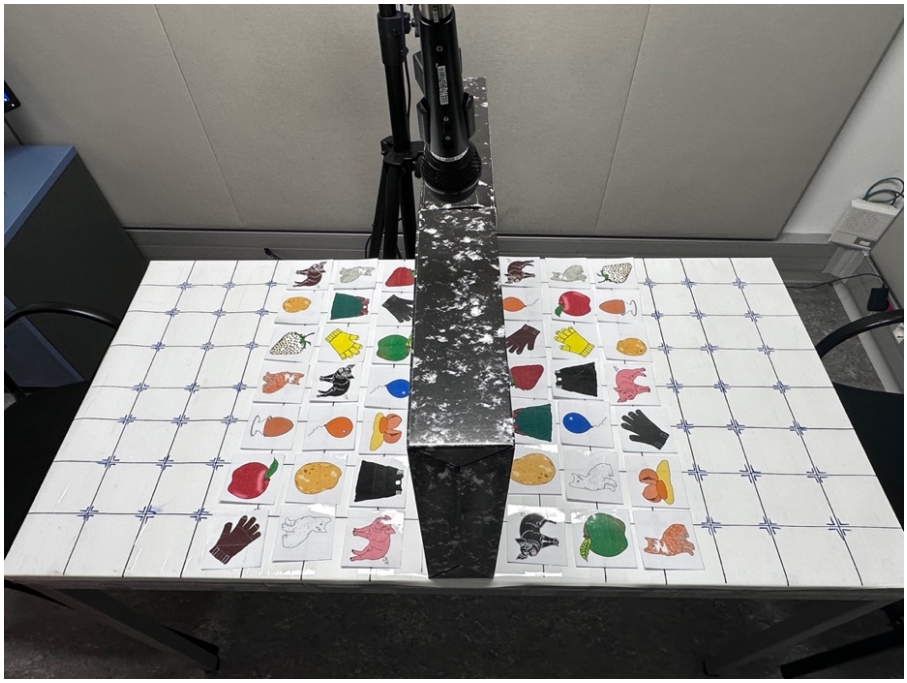
one language and nouns from another). They were instructed to name objects in a language different from the matrix language, which was either Chinese or Spanish. Specifically, when Chinese served as the matrix language, objects were named in Spanish, and vice versa. In unilingual contexts, participants performed two tasks exclusively in Spanish or Chinese. The order of tasks within each context was randomized, and participants completed four toy tasks sequentially, with CS contexts always preceding unilingual contexts.

In each language context, two participants were randomly assigned the roles of "director" and "matcher". They sat opposite each other at a table separated by a hardboard and were presented with a grid of 21 target objects that were identical but arranged differently on each side (see Figure 6.4.1). In general, "directors" instructed "matchers" to rearrange objects to match their grid by describing details of each object (e.g., position, color, size, or condition). After completion, "matchers" described the grid with detailed features for verification.

CS contexts: CS instructions were played at the beginning of tasks to elicit participants to communicate in CS mode. Participants were instructed to communicate in Spanish and name objects in Chinese or vice versa, eliciting mixed adjective-noun constructions (i.e., Spanish adjectives with Chinese nouns in Spanish ML or Chinese adjectives with Spanish nouns in Chinese ML).

Unilingual contexts: Participants communicated and named objects in either Spanish or Chinese to assess unilingual adjective-noun word order.

Figure 6.4.1. Illustration of the setup of the director-matcher task.



6.4.3 Comprehension task: Acceptability judgment using a two-alternative forced-choice task

6.4.3.1 Materials

Critical sentences

Seventy-two CS sentences (i.e., thirty-six each for Spanish ML and Chinese ML) and thirty-six unilingual sentences (i.e., eighteen each for unilingual Spanish and Chinese) were generated. Nine base sentences were first created in Spanish, each featuring an unilingual adjective-noun construction. These were then translated into Chinese, resulting in nine equivalent Chinese sentences. In both languages, nouns referred to the nine target pictures from the production task, while adjectives described a

single property of each picture (color, size, or condition). Each construction included only one adjective.

***CS contexts*:** In CS contexts, target nouns in the nine Spanish base sentences were replaced with their Chinese equivalents, and vice versa for the Chinese base sentences. This resulted in nine Spanish sentences with inserted Chinese nouns (i.e., Chinese noun insertion) and nine Chinese sentences with inserted Spanish nouns (i.e., Spanish noun insertion). Similarly, adjectives in the nine Spanish base sentences were replaced with their Chinese equivalents, and vice versa for the Chinese base sentences. This process resulted in nine Spanish sentences with inserted Chinese adjectives (i.e., Chinese adjective insertion) and nine Chinese sentences with inserted Spanish adjectives(i.e., Spanish adjective insertion). These CS sentences, featuring noun and adjective insertions, were then modified according to four possible code-switching patterns based on the MLF (Myers-Scotton, 1993, 2002) and MP (MacSwan, 1999), namely:

MLF+/MP+: the CS pattern was predicted by both the MLF and the MP
MLF+/MP–: the CS pattern was predicted by the MLF (but not by the MP)
MLF–/MP+: the CS pattern was predicted by the MP (but not by the MLF)
MLF–/MP–: the CS pattern was predicted by neither the MLF nor the MP

This yielded a total of 72 CS sentences, i.e., 36 for the Spanish ML and 36 for the Chinese ML (see Appendix 6.B for a full list of the sentences). Each sentence featured only one instance of code-switching: either a noun or an adjective inserted from the non-matrix language (i.e., Chinese in Spanish ML sentences, or Spanish in Chinese ML sentences; see Table 6.4.3). Sentences representing different CS patterns were compared pairwise in all possible combinations, with the number of pairwise comparisons for each CS base sentence calculated using the formula n*(n-1)/2 (i.e., n is the number of CS patterns for each CS base sentence) (Stadthagen-González et al., 2018). Thus, each CS base sentence generated 6 pairwise comparisons and then generated 108 pair compari-

sons for all 18 CS base sentences (i.e., 54 each for Chinese ML and Spanish ML).

***Unilingual contexts*:** In unilingual contexts, the nine base sentences in both Spanish and Chinese were further modified to reflect adjective positions within adjective-noun constructions.

This yielded a total of 36 unilingual sentences, i.e., 18 in Spanish and 18 in Chinese. These sentences were compared in pairs, with the contrast in the placement of adjectives either before or after nouns. All comparisons only occurred within the same language, yielding a total of 18 pair comparisons, i.e., nine in Spanish and nine in Chinese.

Table 6.4.3. Example critical sentence in different language contexts.

CS contexts			
Chinese as matrix language		**Spanish as matrix language**	
Examples	Predicted acceptability	Examples	Predicted acceptability
我妈妈有一只**淘气的 gato**.	MLF+/MP+ (Pattern A)	Mi mamá tiene un **猫 travieso**.	MLF+/MP+ (Pattern A)
我妈妈有一只 **travieso 猫**.	MLF+/MP– (Pattern B)	Mi mamá tiene un **gato 淘气的**.	MLF+/MP– (Pattern B)
我妈妈有一只**猫 travieso**.	MLF–/MP+ (Pattern C)	Mi mamá tiene un **淘气的 gato**.	MLF–/MP+ (Pattern C)
我妈妈有一只 **gato 淘气的**.	MLF–/MP– (Pattern D)	Mi mamá tiene un **travieso 猫**.	MLF–/MP– (Pattern D)
Unilingual contexts			
Chinese unilingual sentences		**Spanish unilingual sentences**	
我妈妈有一只**淘气的**猫.	Pre-nominal	Mi mamá tiene un gato **travieso**.	Post-nominal
我妈妈有一只猫**淘气的**.	Post-nominal	Mi mamá tiene un **travieso** gato.	Pre-nominal
Translation [English]			
My mom has a naughty cat.			

Filler sentences

Sixty-four CS filler sentences and sixty-four unilingual Chinese filler sentences were included, focusing on classifier contrasts in mixed and unilingual NPs. The outcomes of these filler items fall outside the scope of the present study and will be reported in other studies. Sentences in each mode were compared pairwise, generating 64 comparisons, i.e., 32 for CS mode and 32 for unilingual mode.

6.4.3.2 Procedure

This experiment was administered online using Qualtrics (Qualtrics, LLC, Provo, UT, USA). Participants completed tasks sequentially in CS and unilingual contexts. In CS contexts, they were presented with 108 pair comparisons (i.e., 54 for Chinese ML and 54 for Spanish ML) and instructed to choose the sentence that felt more natural when speaking to other bilinguals, even if both sentences seemed equally natural or unnatural. In unilingual contexts, they were instructed to choose one sentence based on the same criterion as in CS contexts. In each context, participants had to make a choice for each comparison before proceeding to the next, without the option to revisit previous pairs. The experiment followed a by-subject order design, with the order of sentence pairs and sentences within each pair randomized across participants.

6.5 Results and analyses

6.5.1 Production task: director-matcher task

The recorded target constructions from both unilingual and CS contexts were transcribed. Unilingual and mixed adjective-noun constructions displaying identified word order were extracted for further analysis. In CS contexts, a total of 1,260 trials were initially collected, with 630 trials from each matrix language. Of these, 244 trials, i.e., 242 from Spanish ML and 2 from Chinese ML, were excluded due to: (1) unexpected adjective-

noun structures, i.e., N + de + prepositional phrases (PP), which differ in underlying syntactic structures and constraints from N + Adj (Bosque & Picallo, 1996), and do not directly represent a syntactic conflict of adjective placements in Spanish and Chinese; (2) or single noun production. This resulted in 1,016 valid trials for analysis: 388 for Spanish ML and 628 for Chinese ML. In unilingual contexts, a total of 1,260 unilingual trials were collected (630 per language), of which 126 Spanish trials (10%) were excluded due to the same reason, yielding 1,134 valid trials, i.e., 504 in Spanish and 630 in Chinese.

6.5.1.1 Unilingual contexts: unilingual sentences

Spanish unilingual sentences: Participants produced a total of 504 trials with Spanish unilingual sentences, featuring Spanish constructions (i.e., Spanish nouns paired with Spanish adjectives). A consistent pattern was observed in these Spanish unilingual sentences:

1. Spanish nouns + Spanish adjectives (postnominal) (504 of 504, 100%)

(1) el gato naranja
the cat orange
DET N ADJ

(from speaker 22M)

Chinese unilingual sentences: A total of 630 unilingual Chinese constructions (i.e., Chinese nouns paired with Chinese adjectives) were obtained. Two distinct patterns were identified:

2. Chinese adjectives + Chinese nouns (prenominal) (627 of 630; 99.52%)

(2) 黑色的 裙子
black skirt
ADJ N

(from speaker 21D)

3. Chinese nouns + Chinese adjectives (postnominal) (3 of 630; 0.48%)

(3) 裙子 绿色的
skirt green
N ADJ

(from speaker 27D)

The majority of adjective-noun constructions in unilingual Spanish and Chinese aligned with the default word order of each language: postnominal adjectives in Spanish and prenominal adjectives in Chinese. However, an exception was observed in unilingual Chinese, where 3 trials (0.48%) deviated from this pattern, all produced by the same participant (Speaker 27D).

6.5.1.2 CS contexts: CS sentences in Spanish matrix language and Chinese matrix language

Spanish matrix language: For Spanish ML with mixed adjective-noun constructions (i.e., Spanish adjectives with Chinese nouns), participants produced a total of 388 trials with identifiable word order. Four main patterns were observed:

4. Chinese nouns + Spanish adjectives (MLF+/MP+) (361 of 388; 93.04%)

(4) una 苹果 verde
an apple green
ART N ADJ

(e.g., speaker 29D/30M)

5. Spanish adjectives + Chinese nouns (MLF−/MP−) (25 of 388; 6.44%)

(5) un rosa 猪
a pink pig
ART ADJ N

(from speaker 20M)

6. Spanish nouns + Spanish adjectives (no CS-postnominal) (1 of 388; 0.26%)

(6) una patata pequeña
a potato small
ART N ADJ

(from speaker 01D)

7. Spanish adjectives + Spanish nouns (no CS-prenominal) (1 of 388; 0.26%)

(7) un negro cerdo
a black pig
ART ADJ N

(from speaker 09D)

Chinese matrix language: For Chinese ML with mixed adjective-noun constructions (i.e., Chinese adjectives with Spanish nouns), a total of 628 trials were yielded. Three patterns were observed:

8. Chinese adjectives + Spanish nouns (MLF+/MP+) (560 of 628; 89.17%)

(8) 红色的 fresa
red strawberry
ADJ N

(e.g., speaker 07D)

9. Spanish nouns + Chinese adjectives (MLF−/MP−) (63 of 628; 10.03%)

(9) globo 蓝色的
balloon blue
N ADJ

(from speaker 27D)

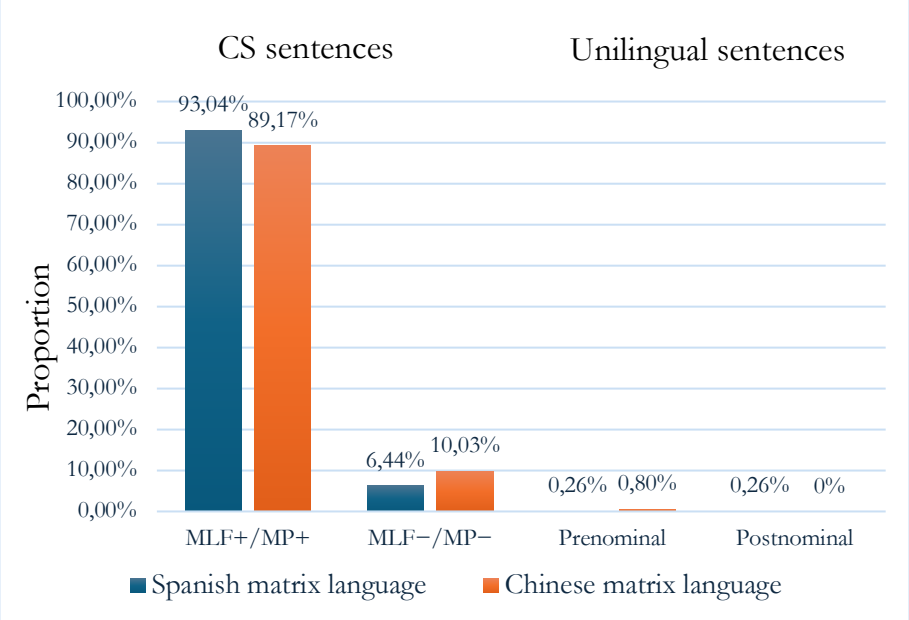
10. Chinese adjectives + Chinese nouns (no CS-prenominal) (5 of 628; 0.8%)

(10) 裂开的　鸡蛋
broken　egg
ADJ　N

(from speaker 28M)

For both Chinese and Spanish matrix language sentences, the majority of the mixed adjective-noun constructions involved Chinese or Spanish noun insertions, which can be predicted by both the MP and MLF (see Figure 6.5.1). However, neither the MP nor MLF model can account for the occurrence of pattern (5), in which Spanish adjectives were used prenominally, or pattern (9), where Chinese adjectives were used postnominally. Notably, two unilingual Spanish and five unilingual Chinese constructions were produced in CS contexts.

Figure 6.5.1. Distribution of nominal constructions in Spanish and Chinese matrix languages within CS contexts.



6.5.2 Comprehension task: acceptability judgment using a two-alternative forced-choice task and Thurstone's law

6.5.2.1 Unilingual contexts: unilingual sentences

Spanish unilingual sentences: Participants chose postnominal adjectives, which is the natural word order in Spanish, in 93.7% of the trials (253 out of 270 trials). The remaining 6.3% of the trials featured prenominal adjectives, and these occurrences were dispersed across participants and target objects, rather than being concentrated in a single speaker or construction.

Chinese unilingual sentences: Participants showed a strong preference for prenominal adjectives, consistent with the default word order in Chinese, in 98.89% of the trials (267 out of 270 trials). A very small proportion (1.11%, 3 trials) featured postnominal adjectives, produced by three different speakers and involving three different target objects.

6.5.2.2 CS contexts: CS sentences

Participants' responses in CS contexts were first analyzed using Thurstone's law of Comparative Judgment, Case V (Thurstone, 1994). This analysis examines the pairwise comparisons made by participants to generate a ranking of preferences among conditions and a measure of their relative comparison. The measure values are relative to the lowest acceptable pattern, conventionally set to zero (Stadthagen-González et al., 2018). For detailed explanations, refer to Thurstone (1994) and Stadthagen-González et al. (2018). Additionally, confidence intervals (CIs) were calculated using Montag's (2006) method for analyzing paired comparison data. Notably, participants' responses in the Spanish matrix language task and the Chinese matrix language task were analyzed separately.

Spanish matrix language

Table 6.5.1 summarizes the results of Thurstone's measure for each condition in the Spanish matrix language task. Notably, condition B (MLF+/MP–) with a score of 0 indicates that it is the least favored option compared to other conditions. The 95% confidence interval for the Spanish matrix language data was 0.07. For detailed calculation steps of Thurstone's law and confidence interval, please refer to the supplementary materials.

Table 6.5.1. Ranking and Thurstone measures for sentences presented in Spanish as matrix language.

Rank	Pattern	Construction	Type of insertions	Example	Thurstone measure
1	C. MLF–/MP+	$ADJ_{CN}+N_{SP}$	Adjective insertion	Barry dibujó una 绿色的 fresa.	2.28
2	A. MLF+/MP+	$N_{CN}+ADJ_{SP}$	Noun insertion	Barry dibujó una 草莓 verde.	2.03
3	D. MLF–/MP–	$ADJ_{SP}+N_{CN}$	Noun insertion	Barry dibujó una verde 草莓.	0.13
4	B. MLF+/MP–	$N_{SP}+ADJ_{CN}$	Adjective insertion	Barry dibujó una fresa 绿色的.	0.00

A within-subjects ANOVA was then conducted to statistically analyze the preference for each code-switching pattern. The result revealed a significant effect of different patterns on participants' responses in the Spanish matrix language, $F(3, 87) = 75.50$, $p < .001$, $\eta^2 = .72$. Post-hoc pairwise comparisons using Bonferroni correction indicated all comparisons were significantly different (all p values < .001), except for the contrast between pattern C (i.e., adjective insertion, $ADJ_{CN}+N_{SP}$) and pattern A (i.e., noun insertion, $N_{CN}+ADJ_{SP}$), as well as the contrast between patterns D ($ADJ_{SP}+N_{CN}$) and B ($N_{SP}+ADJ_{CN}$).

As shown in Table 6.5.1, although Spanish–Chinese bilinguals showed the strongest preference for condition C ($ADJ_{CN}+N_{SP}$), where adjective insertion is predicted only by the MP, followed by condition A

(N_{CN}+ADJ_{SP}), where noun insertion aligns with both the MLF and MP, post-hoc pairwise comparisons revealed no significant difference between them ($p = 1$, $t = 1.2$). Similarly, the least preferred constructions, condition D (ADJ_{SP}+N_{CN}) and B (N_{SP}+ADJ_{CN}), also showed no significant difference ($p = 1$, $t = 0.64$). Overall, participants showed preferences for patterns involving noun insertions (Condition A, N_{CN}+ADJ_{SP}), where adjectives follow both the matrix language (MLF) and the language of adjectives (MP), as well as adjective insertions (Condition C, ADJ_{CN}+N_{SP}), where adjectives align only with the adjective language.

Chinese matrix language

Following the same procedures, we calculated Thurstone's measure (see Table 6.5.2) and a within-subjects ANOVA for comparing patterns in the Chinese matrix language. The 95% confidence interval in Thurstone's measure was 0.07. A within-subjects ANOVA showed a significant effect of code-switching patterns, $F(3, 87) = 115.50$, $p < .001$, $\eta^2 = .80$, indicating that the different conditions significantly influenced participants' acceptability of adjective-noun constructions in the Chinese matrix language. Post-hoc Bonferroni corrections indicated all comparisons were highly significantly different (all p values < .001), except for the contrasts between patterns B (i.e., MLF+/MP–, ADJ_{SP}+N_{CN}) and D (i.e., MLF–/MP–, N_{SP}+ADJ_{CN}), as well as between patterns B (i.e., MLF+/MP–, ADJ_{SP}+N_{CN}) and C (i.e., MLF–/MP+, N_{CN}+ADJ_{SP}).

Table 6.5.2. Ranking and Thurstone measure for sentences presented in Chinese as matrix language.

Rank	Pattern	Construction	Type of insertion	Example	Thurstone measure
1	A. MLF+/MP+	ADJ_{CN}+N_{SP}	Noun insertion	巴瑞画了一颗绿色的 fresa.	4.20
2	C. MLF–/MP+	N_{CN}+ADJ_{SP}	Adjective insertion	巴瑞画了一颗草莓 verde.	1.24
3	B. MLF+/MP–	ADJ_{SP}+N_{CN}	Adjective insertion	巴瑞画了一颗 verde 草莓.	0.64
4	D. MLF–/MP–	N_{SP}+ADJ_{CN}	Noun insertion	巴瑞画了一颗 fresa 绿色的.	0.00

Table 6.5.2 shows that Spanish–Chinese bilinguals differed in their acceptability of adjective-noun constructions across four conditions. They showed a marked preference for Condition A, which involved noun insertions (prenominal Chinese adjectives with Spanish nouns) and is predicted by both the MLF and MP, compared to all other conditions (all p values < .001). Regarding condition C, which features adjective insertions (Chinese nouns with postnominal Spanish adjectives), results suggest comparable acceptability to condition B (p = 0.184, t = 2.27). Note that condition C is predicted only by MP, whereas condition B is predicted only by MLF. Additionally, bilinguals rejected condition D, which contains Spanish nouns with postnominal Chinese adjectives (noun insertions) and is predicted by neither MLF nor MP. Overall, there was a clear preference for pattern A (i.e., MLF+/MP+, ADJ_{CN}+N_{SP}, noun insertion) over all other patterns in the Chinese matrix language.

6.6 Discussion

In this study, we examined how early Spanish–Chinese bilinguals resolved the syntactic difference in adjective-noun placements between Spanish (postnominal adjectives) and Chinese (prenominal adjectives) in mixed constructions. Rather than solely evaluating the predictions of the MLF and MP, we used these models as starting points to examine how well they account for observed code-switching patterns. Our aim was to assess whether the adjective-noun structures produced in Spanish–Chinese code-switching align with either model's predictions, and to consider how the findings might inform or refine our understanding of code-switching patterns.

Regarding the first research question, our findings revealed distinct adjective-noun code-switching patterns in production and comprehension, varying by matrix languages. In the Spanish matrix language, participants predominantly produced noun insertions (N_{CN}+ADJ_{SP}) in production, while they favored both such noun insertions and adjective insertions (ADJ_{CN}+N_{SP}) in comprehension. In the Chinese matrix language, they

consistently preferred prenominal Chinese adjectives with Spanish nouns (ADJ_{CN}+N_{SP}) in both tasks, also reflecting noun insertion patterns. Overall, bilinguals favored noun insertions across both matrix languages, aligning with previous findings (e.g., Parafita Couto et al., 2015; Van Osch et al., 2023; Vaughan-Evans et al.,2020).

For the second research question, we evaluated the extent to which the MLF and MP offer explanations for adjective placement in adjective-noun constructions among early Spanish–Chinese bilinguals, and how these explanations refine our understanding of code-switching patterns. In production, most constructions aligned with both models in Spanish (93.04%) and Chinese (89.17%) matrix languages, likely due to the dominance of noun insertions. In comprehension, MP predictions could explain more constructions in the Spanish matrix language, in line with the findings observed in Vanden Wyngaerd (2017) in French–Dutch constructions. In the Chinese matrix language, both the MLF and MP are favored, mirroring observations from Balam and Parafita Couto (2019) with Spanish–English bilinguals in Northern Belize. In sum, participants favored noun insertions aligning with both the matrix language (MLF) and the language of adjectives (MP) in the Chinese matrix language, while they preferred noun insertions aligned with both models and adjective insertions that follow the order of the adjective languages (MP) in the Spanish matrix language. Overall, these findings provide insights into how mixed adjective-noun constructions were structured by Spanish–Chinese bilinguals across languages and tasks. However, from a broader perspective, these findings also suggest that, although the two competing theoretical frameworks, the MLF and MP, make partially different predictions regarding preferred CS adjective-noun patterns, both clausal structure and morphosyntactic properties of individual lexical items play roles in constructing mixed adjective-noun constructions among bilinguals. This also implies that no single grammatical constraint from these theoretical frameworks can fully and solely account for observed patterns. Rather, a more comprehensive understanding of the constructions of CS patterns

requires considering the combined influence of both clausal structures and morphosyntactic properties of individual lexical items.

Taking a closer look at our data, matrix language and language of adjectives play a crucial role in adjective-noun order within mixed nominal constructions. In both production and comprehension, when adjectives aligned with matrix languages, participants consistently preferred the adjective-noun order of matrix languages. Conversely, when adjectives were inconsistent with matrix languages, participants tended to follow the adjective-order of the language of adjectives. A more detailed inspection of production tasks revealed that the adjective language overwhelmingly matched the matrix language (623/628 in Chinese ML; 386/388 in Spanish ML). This is likely due to the task design, which explicitly instructed participants to name *only* the object in the other language and likely promoted a high occurrence of noun insertions. This aligned with findings in previous studies (e.g., Van Osch et al., 2023). Additionally, the judgment data revealed a sole preference for inserting Spanish nouns in Chinese contexts, whereas both Chinese nouns and adjectives were more acceptable in Spanish contexts. This suggests that Spanish attributive adjectives are less favored than Chinese adjectives in code-switching nominal constructions. One possible explanation for this asymmetry may be attributed to Spanish attributive adjectives functioning as gender carriers, given that Spanish requires gender agreement between nouns and adjectives at both syntactic and morphological levels (Balam & Parafita Couto, 2019). This finding aligns with prior studies showing gender-marked adjectives are infrequently produced in mixed noun-adjective constructions during CS (Parafita Couto & Gullberg, 2019).

A particularly notable finding from the production tasks is that participants employed two types of nominal constructions with postnominal adjectives in Spanish ML in both unilingual and CS contexts: (1) N + Adj (see example 11) and (2) N + *de*-PP (see example 12). The use of both constructions may stem from the fact that both structures function similarly for classificatory adjectives (i.e., those denote a property of nouns,

such as color, size, shape, etc.; see Bosque & Picallo, 1996) to modify head nouns. Another plausible explanation for high occurrences of *N + de-PP* constructions may be attributed to structural priming during production, where one speaker's use of constructions would increase the likelihood that another speaker would repeat or prime them to produce similar constructions (see detailed descriptions below).

11. Chinese nouns + Spanish adjectives

(11) un	猫	gris
the_{MASC}	cat	grey
Det	N	Adj

12. Chinese nouns + Spanish prepositional phrases

(12) un	猫	de color blanco
the_{MASC}	cat	of color white
Det	N	de-PP

As mentioned above, one issue that needs to be mentioned in production tasks is structural priming in code-switching, where one speaker's code-switching behavior would facilitate similar patterns in another (Fricke & Kootstra, 2016). Analyzing spontaneous English–Spanish code-switching dialogues, Fricke and Kootstra (2016) found that bilinguals' behavior would prime each other regarding the tendency and grammatical frame of code-switching (Fricke & Kootstra, 2016). Similarly, Berghoff et al. (2023) showed that lexical repetition enhances code-switching at points of non-shared word order in Afrikaans–English bilinguals, highlighting the interaction between internal (word order) and external (e.g., priming) factors in code-switching. In our study, we observed comparable structure priming in code-switching between "directors" and "matchers" in paired production tasks, as illustrated in Appendix 6.C. During production, "directors" always described object details (e.g., position, color, size, or condition) to guide "matchers" in re-arranging objects, and "matchers" described the same details to verify the match, eliciting mixed adjective-noun constructions from both sides. This interaction seems to facilitate "matchers" to repeat or produce similar

code-switching structures as "directors", potentially reducing the opportunity to observe their spontaneous code-switching patterns.

While our study did not fully capture spontaneous speech or naturally occurring code-switching, previous research has demonstrated that experimental data often reflect patterns similar to those found in corpus-based studies. For instance, in well-established bilingual communities like Papiamento–Dutch communities in the Netherlands, bilinguals often favor the minority language (Papiamento) as the matrix language, with insertions from the majority or societal language (Dutch), while the reverse pattern is less frequently accepted (e.g., see corpora data in Parafita Couto & Gullberg, 2019 and semi-experimental data in Van Osch et al., 2023). Although the Spanish–Chinese bilingual community in Barcelona is still relatively young, bilinguals share a relatively stable and homogeneous linguistic background that supports the regular use of Chinese and Spanish. This may contribute to the emergence of shared community norms and promote more widespread and systematic code-switching behavior. Thus, although our data do not offer definitive evidence regarding the directionality of code-switching, we anticipate that bilinguals in this community may exhibit similar patterns to those observed in more established bilingual communities. This hypothesis would have to be investigated in future research.

6.7 Conclusion

This study is the first to empirically examine how mixed adjective-noun constructions are structured in light of syntactic differences in adjective placement among Spanish–Chinese bilinguals. Our findings provide preliminary evidence that the language of adjectives (as predicted by the MP) plays a crucial role in adjective placement within Spanish matrix language sentences, while bilinguals are sensitive to both clausal structure (as predicted by the MLF) and the languages of adjectives (MP) when constructing mixed adjective-noun patterns in Chinese matrix language sentences. Parallel to trends observed in other bilingual

communities, we also found a general preference for noun insertions across ML contexts. Additionally, our results highlight the potential influences of syntactic priming and emerging community norms on bilinguals' adjective-noun CS patterns. Together, these results offer new insights into how bilinguals navigate syntactic differences, particularly the interplay between matrix language and adjective language in shaping adjective-noun order in relatively young bilingual communities. This study contributes valuable data from an understudied bilingual population, advancing our understanding of how syntactic constraints shape adjective-noun CS patterns and laying the groundwork for future research on the directionality and constraints of code-switching in this language pair and community.

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Data Availability Statement

Supplementary materials supporting the experimental design, stimuli pictures and sentences, and findings of this study are openly available in Open Science Framework at https://osf.io/vpbcw/?view_only=556566ad901248c98e75c3e160857846 (view-only link).

Appendix

Appendix 6.A Overview of studies comparing the MLF and MP models regarding mixed adjective-noun nominal constructions (i.e., this form was built based on Bierings et al., 2019).

Studies	Language pairs	Tasks	Findings regarding MP	Findings regarding MLF
Parafita Couto et al. (2015)	Welsh–English (Wales, UK)	• Naturalistic data (corpora) • Elicitation task	• No convincing evidence for supporting the MP	• Support for the MLF (compared to MP)
		• Auditory judgment task	• Inconclusive	• Need more evidence to draw conclusions
Parafita Couto & Gullberg (2019)	Welsh–English (Wales, UK) Spanish–English (Miami, USA) Papiamento–Dutch (The Netherlands)	• Naturalistic data (three corpora)	• Partly support the MP in all language pairs (less than MLF)	• Support for the MLF in all language pairs
Balam & Parafita Couto (2019)	Spanish–English (Northern Belize)	• Naturalistic data (Sociolinguistic interviews)	• Evidence for supporting the MP (less than the MLF)	• Highly support for the MLF
Van Osch et al. (2023)	Spanish–Dutch (The Netherlands) Papiamento–Dutch (The Netherlands)	• Elicitation task	• Support for the MP (most common patterns are noun insertions)	• Support for the MLF (most common patterns are noun insertions)
Bierings et al. (2019)	Kaqchikel–Spanish (Patzún, Guatemala)	• Elicitation task	• The adjective positions contra the prediction of the MP (may due to task-effect, and need more evidence)	• The adjective positions contra the prediction of the MLF (may due to task-effect, and need more evidence)
Vanden Wyngaerd (2017)	French–Dutch (Brussels, Belgium)	• 3-points grammatical judgment task	• Highly support for the MP (more than the MLF)	• Supported for the MLF, less than the MP
Stadthagen-González et al. (2019)	Spanish–English (Mexicans in the U.S.A)	• 5-point Likert judgment task • 2-Alternative forced choice judgment task	• No particular support for the MP, but combined explanation with the MLF	• No particular support for the MLF, but combined explanation with the MP

Olson (2024)	Spanish–English (Online platform)	• 2-Alternative forced choice judgment task	• Replicated the result of Stadthagen-González et al. (2019)	• Replicated the result of Stadthagen-González et al. (2019)
Parafita Couto et al. (2017)	Welsh–English (Wales, UK)	• EEG study (ERPs data, a sentence verification task)	• No convincing support for the MP	• Support for the MLF (more than MP), need complementary evidence
Vaughan-Evans et al. (2020)	Welsh–English (Wales, UK)	• EEG study (Behavioral and ERPs data)	• No convincing support for the MP	• Clear support for the MLF (noun insertions are common patterns)
Pablos et al. (2019)	Papiamento–Dutch (The Netherlands)	• EEG study (ERPs data, comprehension srudy)	• No particular support for the MP	• No particular support for the MLF (no preference between noun-adjective switches)

Appendix 6.B Sample sentences used in the comprehension task in Chapter 6.

Unilingual base sentences			
Target objects	**Spanish**	**Chinese**	**Translation [English]**
gato/猫 [Cat]	Mi mamá tiene un **gato** travieso.	我妈妈有一只淘气的**猫**.	My mom has a naughty **cat**.
globo/气球[balloon]	Hay un **globo** rosa flotando en el cielo.	天空中飘着一个粉色的**气球**.	There is a pink **balloon** floating in the sky.
cerdo/猪 [pig]	En los cuentos de hadas, Wilbur es un **cerdo** inteligente.	在童话里，威尔伯是一只聪明的**猪**。	In fairy tales, Wilbur is a smart **pig**.
guante/手套[glove]	Mary perdió un **guante** verde.	玛丽丢了一只绿色的**手套**.	Mary lost a green **glove**.
huevo/鸡蛋 [egg]	Tom le dio a su hermana un **huevo** cocido.	汤姆给了他妹妹一个煮熟的**鸡蛋**.	Tom gave his sister a cooked **egg**.
patata/土豆[potato)	Jack vio una **patata** estropeada en la cocina.	杰克在厨房里看到了一个变质的**土豆**.	Jack saw a spoiled **potato** in the kitchen.
falda/裙子 [skirt]	Lisa tiene una **falda** hermosa.	丽莎有一条漂亮的**裙子**.	Lisa has a beautiful **skirt**.
fresa/草莓 [strawberry]	Barry dibujó una **fresa** verde.	巴瑞画了一颗绿色的**草莓**.	Barry drew a green **strawberry**.
manzana/苹果[apple]	Blancanieves se comió una **manzana** venenosa.	白雪公主吃了一个有毒的**苹果**.	Snow White ate a poisonous **apple**.
Code-switched sentences [CS contexts]			
Target objects	**Spanish as matrix language**	**Chinese as matrix language**	**Predicted acceptability**
	Mi mamá tiene un 猫 travieso.	我妈妈有一只淘气的 gato.	MLF+/MP+
	Mi mamá tiene un gato 淘气的.	我妈妈有一只 travieso 猫.	MLF+/MP–

gato/猫 [Cat]	Mi mamá tiene un 淘气的 gato.	我妈妈有一只猫 travieso.	MLF–/MP+
	Mi mamá tiene un travieso 猫.	我妈妈有一只 gato 淘气的.	MLF–/MP–
globo/气球[balloon]	Hay un 气球 rosa flotando en el cielo.	天空中飘着一个粉色的 globo.	MLF+/MP+
	Hay un globo 粉色的 flotando en el cielo.	天空中飘着一个 rosa 气球.	MLF+/MP–
	Hay un 粉色的 globo flotando en el cielo.	天空中飘着一个气球 rosa.	MLF–/MP+
	Hay un rosa 气球 flotando en el cielo.	天空中飘着一个 globo 粉色的.	MLF–/MP–
cerdo/猪 [pig]	En los cuentos de hadas, Wilbur es un 猪 inteligente.	在童话里，威尔伯是一只聪明的 cerdo.	MLF+/MP+
	En los cuentos de hadas, Wilbur es un cerdo 聪明的.	在童话里，威尔伯是一只 inteligente 猪.	MLF+/MP–
	En los cuentos de hadas, Wilbur es un 聪明的 cerdo.	在童话里，威尔伯是一只猪 inteligente.	MLF–/MP+
	En los cuentos de hadas, Wilbur es un inteligente 猪.	在童话里，威尔伯是一只 cerdo 聪明的.	MLF–/MP–
guante/手套[glove]	Mary perdió un 手套 verde.	玛丽丢了一只绿色的 guante.	MLF+/MP+
	Mary perdió un guante 绿色的.	玛丽丢了一只 verde 手套.	MLF+/MP–
	Mary perdió un 绿色的 guante.	玛丽丢了一只手套 verde.	MLF–/MP+
	Mary perdió un verde 手套.	玛丽丢了一只 guante 绿色的.	MLF–/MP–
huevo/鸡蛋 [egg]	Tom le dio a su hermana un 鸡蛋 cocido.	汤姆给了他妹妹一个煮熟的 huevo.	MLF+/MP+
	Tom le dio a su hermana un huevo 煮熟的.	汤姆给了他妹妹一个 cocido 鸡蛋.	MLF+/MP–
	Tom le dio a su hermana un 煮熟的 huevo.	汤姆给了他妹妹一个鸡蛋 cocido.	MLF–/MP+
	Tom le dio a su hermana un cocido 鸡蛋.	汤姆给了他妹妹一个 huevo 煮熟的.	MLF–/MP–

patata/土豆[potato)	Jack vio una 土豆 estropeada en la cocina.	杰克在厨房里看到了一个变质的 patata.	MLF+/MP+
	Jack vio una patata 变质的 en la cocina.	杰克在厨房里看到了一个 estropeada 土豆.	MLF+/MP–
	Jack vio una 变质的 patata en la cocina.	杰克在厨房里看到了一个土豆 estropeada.	MLF–/MP+
	Jack vio una estropeada 土豆 en la cocina.	杰克在厨房里看到了一个 patata 变质的.	MLF–/MP–
falda/裙子[skirt]	Lisa tiene una 裙子 hermosa.	丽莎有一条漂亮的 falda.	MLF+/MP+
	Lisa tiene una falda 漂亮的.	丽莎有一条 hermosa 裙子.	MLF+/MP–
	Lisa tiene una 漂亮的 falda.	丽莎有一条裙子 hermosa.	MLF–/MP+
	Lisa tiene una hermosa 裙子.	丽莎有一条 falda 漂亮的.	MLF–/MP–
fresa/草莓[strawberry]	Barry dibujó una 草莓 verde.	巴瑞画了一颗绿色的 fresa.	MLF+/MP+
	Barry dibujó una fresa 绿色的.	巴瑞画了一颗 verde 草莓.	MLF+/MP–
	Barry dibujó una 绿色的 fresa.	巴瑞画了一颗草莓 verde.	MLF–/MP+
	Barry dibujó una verde 草莓.	巴瑞画了一颗 fresa 绿色的.	MLF–/MP–
manzana/苹果[apple]	Blancanieves se comió una 苹果 venenosa.	白雪公主吃了一个有毒的 manzana.	MLF+/MP+
	Blancanieves se comió una manzana 有毒的.	白雪公主吃了一个 venenosa 苹果.	MLF+/MP–
	Blancanieves se comió una 有毒的 manzana.	白雪公主吃了一个苹果 venenosa.	MLF–/MP+
	Blancanieves se comió una venenosa 苹果.	白雪公主吃了一个 manzana 有毒的.	MLF–/MP–
Unilingual sentences [Unilingual mode]			
Target objects	**Spanish**	**Chinese**	**Predicted acceptability**
	我妈妈有一只**猫**淘气的.	Mi mamá tiene un **gato** travieso.	Post-nominal

gato/猫 [Cat]	我妈妈有一只淘气的**猫**.	Mi mamá tiene un travieso **gato**.	Pre-nominal
globo/气球[balloon]	天空中飘着一个**气球**粉色的.	Hay un **globo** rosa flotando en el cielo.	Post-nominal
	天空中飘着一个粉色的**气球**.	Hay un rosa **globo** flotando en el cielo.	Pre-nominal
cerdo/猪 [pig]	在童话里，威尔伯是一只**猪**聪明的.	En los cuentos de hadas, Wilbur es un **cerdo** inteligente.	Post-nominal
	在童话里，威尔伯是一只聪明的**猪**.	En los cuentos de hadas, Wilbur es un inteligente **cerdo**.	Pre-nominal
guante/手套[glove]	玛丽丢了一只**手套**绿色的.	Mary perdió un **guante** verde.	Post-nominal
	玛丽丢了一只绿色的**手套**.	Mary perdió un verde **guante**.	Pre-nominal
huevo/鸡蛋 [egg]	汤姆给了他妹妹一个**鸡蛋**煮熟的.	Tom le dio a su hermana un **huevo** cocido.	Post-nominal
	汤姆给了他妹妹一个煮熟的**鸡蛋**.	Tom le dio a su hermana un cocido **huevo**.	Pre-nominal
patata/土豆[potato)	杰克在厨房里看到了一个**土豆**变质的.	Jack vio una **patata** estropeada en la cocina.	Post-nominal
	杰克在厨房里看到了一个变质的**土豆**.	Jack vio una estropeada **patata** en la cocina.	Pre-nominal
falda/裙子 [skirt]	丽莎有一条**裙子**漂亮的.	Lisa tiene una **falda** hermosa.	Post-nominal
	丽莎有一条漂亮的**裙子**.	Lisa tiene una hermosa **falda**.	Pre-nominal
fresa/草莓 [strawberry]	巴瑞画了一颗**草莓**绿色的.	Barry dibujó una **fresa** verde.	Post-nominal
	巴瑞画了一颗绿色的**草莓**.	Barry dibujó una verde **fresa**.	Pre-nominal
manzana/苹果[apple]	白雪公主吃了一个**苹果**有毒的.	Blancanieves se comió una **manzana** venenosa.	Post-nominal
	白雪公主吃了一个有毒的**苹果**.	Blancanieves se comió una venenosa **manzana**.	Pre-nominal

Appendix 6.C Examples of code-switching patterns produced by a paired "director" and "matcher".

Paired director and matcher in the production task in Chinese matrix contexts		
Director (Speaker 19)	Matcher (Spaker 20)	Comparison of two patterns
1. N + de-PP un 手套 de color amarillo Det glove of color yellow	1. N + de-PP un 手套 de color amarillo Det glove of color yellow	same
2. N + de-PP una 裙子 de color negro Det skirt of color black	2. N + Adj una 裙子 negra Det skirt black	different
3. N + de-PP una 草莓 de color blanco Det sreawberry of color white	3. N + de-PP una 草莓 de color blanco Det sreawberry of color white	same
4. N + de-PP un 猫 de color gris Det cat of color grey	4. N + de-PP un 猫 de color gris Det cat of color grey	same
5. N + Adj un 气球 azul Det balloon blue	5. N + de-PP un 气球 de color azul Det balloon of color blue	different
6. N + Adj un 鸡蛋 completo Det egg complete	6. N + Adj un 鸡蛋 completo Det egg complete	same
7. Adj + N un pequeño 土豆 Det small potato	7. Adj + N un pequeño 土豆 Det small potato	same