Does prosody constrain code-switching? Stress, tone and speech rate in Papiamento-Dutch spontaneous speech

Penning, Nina

Does prosody constrain code-switching?

Stress, tone and speech rate in Papiamento-Dutch spontaneous speech

by

Nina Penning

s1697447

A Research Master thesis

Submitted to the Leiden University Centre for Linguistics

Leiden University

In partial fulfilment of the requirements

for the degree of Master of Arts

July, 2021

Supervisors: dr. M. C. Parafita Couto & prof. dr. Y. Chen

Second reader: dr. L. Pablos Robles

Universiteit Leiden

Word count: 21974

Abstract

Research has shown that code-switching (CS) is morpho-syntactically constrained (e.g. Poplack, 1980; Myers-Scotton, 1993; MacSwan, 1999; Lipski, 2019). The fact that phonology and syntax interface in bilingual performance (Bullock, 2009) has been largely neglected in CS research. It is likely that the interface between prosody and morphosyntax, and not merely morphosyntax alone, may play a role in constraining CS. However, the phonetic and phonological reflexes of CS remain relatively unexplored. This thesis aims to improve our understanding of prosodic constraints on CS by examining the speech from a Papiamento-Dutch conversation corpus (Gullberg, Indefrey & Muysken, 2004; 2009). This language pair is eminently suitable for a prosodic analysis because Papiamento has a tonal system with two level tones that interacts with lexical stress, and Dutch a different lexical system: with stress, without tone. I examined whether stress constrains CS in the nominal domain (Akinremi, 2016), and whether Papiamento tone constrains Dutch insertions (Zheng, 1997; Tuc, 2003). Furthermore, I examined whether speech rate in bilingual vs. unilingual utterances differ to add to the research on speech planning in CS (Johns & Steuck, 2021). My findings are that the stress of switched nouns does not constrain CS, but the stress of adjacent words might; Dutch insertions occur mostly in a context where the prosodic systems of Papiamento and Dutch coincide; and speech rate in bilingual vs. unilingual utterances does not significantly differ. I conclude that congruency in prosody facilitates CS and that CS does not inhibit speech planning. Taken together, my findings are compatible with the view that CS may be an opportunistic strategy that bilinguals use to aid speech planning as prosody in both languages openly contributes to production (Beatty-Martinez, Navarro-Torres & Dussias, 2020).

Keywords: Code-switching, constraints, prosody, Papiamento, Dutch

Acknowledgements

This thesis could not have been made possible without the help of several people. I would like to begin with thanking dr. Maria Carmen Parafita Couto and prof. dr. Yiya Chen for being great supervisors, for all their support, patience, and continuous helpful input. I want to specifically thank Maricarmen for teaching me about code-switching, and Yiya for making me excited about prosody and for being my supervisor a second time. I thank prof. Marianne Gullberg for the access to the data in the Papiamento-Dutch conversation corpus. I thank Nihayra, Bibian, Nicole and Kjelld for their native Papiamento insights. I thank Ben Bonfil for helping me with my Praat script. I thank my family and friends – in particular Suze, Danique, Emmi, Suk Sum, Lorenzo, and Daya – for their company and support throughout the entire thesis writing process. Finally, I thank dr. Leticia Pablos Robles for being my second reader, and her patience.

Table of Contents

List of tables and figures

List of abbreviations

2	second person
3	third person
BNF	benefactive
DET	determiner
FUT	future
INF	infinitive
NEG	negative
PART	participial
PL	plural
PROG	progressive
PRT	particle
SG	singular

1. Introduction

In many multilingual communities, speakers commonly practice CS, which can be broadly defined as the ability of a multilingual speaker to alternate effortlessly between two or more languages (Bullock & Toribio, 2009). Muysken (2000) differentiates between ‘code-switching’ and ‘code-mixing’. He uses the term code-mixing “to refer to all cases where lexical items and grammatical features from two languages appear in one sentence” and CS “for the rapid succession of several languages in a single speech event” (p. 1). In this thesis I will use the term CS to mean any use of two or more languages in one clause, sentence or discourse (Parafita Couto, Bellamy & Ameka, forthcoming).

Structurally, CS can be divided into *intersentential* and *intrasentential* CS (Poplack, 1980). Intersentential CS, as in (1), is a change of language between sentences; one sentence is in one language and the next is in the other. Intrasentential CS, as in (2) and (3), is the use of two languages within the same sentence: a switch of language between words or clauses. The distinction between inter- and intrasentential can be further refined to differentiate between the less commonly used term *interclausal*, as in (2) – a change of language between two clauses – and *intraclausal*, as in (3) – a change of language before the end of a clause – CS (Deuchar, 2012). I adopt the latter terminology because it avoids the ambiguity of intrasentential meaning either interclausal (when referring to switching between two clauses in the same sentence) or intraclausal.

Intersentential:

(1) (Papiamento-**Dutch**[1]; Gullberg, Indefrey & Muysken, 2004; conv. 5, rec. 267, 268-9)

…**in**	**de**	**gemeenschappelijk**	**keuken**	**te**	**blowen.**
…in	the	communal	kitchen	INF	smoke weed

unico	cos	cu	e	ta	haci	ta	blow
only	thing	that	he	is	do	is	smoke weed

'… smoking weed in the communal kitchen. [The] only thing he does is smoke weed.'

Intrasentential/ interclausal:

(2) (Papiamento-**Dutch**; conv. 5, rec. 924-5)

bo	por	siña	-nan	pero	**het**	**dring**	**-t**	**gewoon**	**niet**	**door**
you	could	teach	-3PL	but	it	get	-2/3SG	just	not	through

'You could teach them, but it just doesn't get through [to them].'

Intrasentential/ intraclausal:

(3) (Papiamento-**Dutch**; conv. 3, rec. 140-1)

nan	no	tin	manera	un	**elftal**	mixto
they	not	have	like	a	football team	mixed

---

[1] I use 'Papiamento' (Aruban orthography) instead of 'Papiamentu' (Bonaire and Curaçao orthography) throughout my thesis to stay close to the corpus I worked, in which Aruban orthography for the transcription was used. Participants in the corpus recordings originated from different islands, so both varieties are represented in my data.

‘They don’t have a mixed football team.’

Researchers generally agree that CS is not the random use of multiple languages, but that it is governed by rules and that it signifies high proficiency in all languages (e.g. Poplack, 1980; Deuchar, 2012). The focus of previous CS literature has mainly been the morphosyntactic and social constraints on CS (e.g. Poplack, 1980; Myers-Scotton, 1993; Muysken, 2000; Deuchar, 2005; Lipski, 2019). The prosodic properties of CS remain relatively unexplored (Henriksen, Coetzee, García-Amaya & Fischer, 2021; Johns & Steuck, 2021; Torres Cacoullos, 2020; Akinremi, 2016; Fricke, Kroll & Dussias, 2016; Bullock, 2009; Tuc, 2003; Zheng, 1997). So far, research has often assumed that codeswitched utterances, as opposed to *borrowings*, embody an abrupt transition between the sound systems of two languages. Borrowing is used to describe a word that is established in a language to which it is not native. For example, Vick’s® VapoRub® has been adapted into Spanish as *vivaporú* [biβaporú] in the Caribbean. It is thought that borrowings may undergo a degree of phonological integration that code-switches do not. This is the view of linguists who argue that CS and borrowing are two separate phenomena (e.g. Poplack & Meechan, 1998). Others agree that there is no distinction between the two processes because there is only one lexicon (e.g. López, 2020), and yet others contend that the two processes fall on a continuum based on the phonological and semantic integration of lexical items (e.g. Myers-Scotton, 1993; Backus & Dorelijn, 2009). The phonological adaptation of borrowings has received considerable attention in CS research, but the relationship between CS and the sound system of a language has not (cf. Stammers & Deuchar, 2012). If borrowing and CS fall on a continuum though, then CS utterances – like borrowings – may display some degree of integration or convergence (Bullock, 2009, p. 163).

This thesis presents a study of the phonetic reflexes of Papiamento-Dutch bilingual speech in order to shed more light on the underexplored area of prosody in CS, and to contribute to a more complete understanding of CS in general. This language pair is particularly suitable to investigate the prosodic domain within CS because the sound systems of the languages differ: the Papiamento system includes both distinctive stress and lexically contrastive tone (see Section 4.1); the Dutch system includes stress but lacks tone (see Section 4.2). I analyzed stress, tone and speech rate in data from a corpus of spontaneous bilingual Papiamento-Dutch speech (Gullberg, Indefrey & Muysken, 2004; 2009) to examine whether these specific prosodic features contribute to the constraints on CS. Differences in the prosodic systems of the two languages may restrict the occurrence of switches, which is why stress and tone are the crucial variables to investigate. That is where the Papiamento-Dutch language pair differs in prosodic systems, which could inform us on the constraints that this might impose. Unlike stress and tone, speech rate will not inform us on the topic of prosodic constraints on CS. Including a speech rate analysis allows me to find support for or evidence against the existing findings in the literature that CS facilitates speech rates, and thus speech planning. Overall, this thesis reinforces Bullock's (2009, p. 179) tentatively affirmative answer to the question "can phonological/phonetic [prosodic] properties be observed to constrain CS production?".

1.1 Structure of this thesis

The question at the end of the previous section serves as the umbrella under which my more specific research questions fall. These questions and my hypotheses are presented in Chapter 4, Section 4.3. This section is preceded by specifics on the prosodic features of Papiamento (Section 4.1) and Dutch (Section 4.2). Chapter 2 provides an overview of some of the leading literature on the constraints on CS. Section 2.1 discusses the structural constraints, and Section

2.2 presents the extant research on the prosodic constraints on CS. Chapter 3 focusses on the existing research on Papiamento-Dutch CS. Section 3.1 introduces the Papiamento-speaking community in the Netherlands and Section 3.2 discusses some of the studies on the Papiamento-Dutch language pair. Chapter 5 explains the methodological approach I used to answer my research questions. It includes the details of the corpus I worked with (Section 5.1), an overview of the data I extracted and how I coded it (Section 5.2), and finally the statistical analyses I ran on my data (Section 5.3). Chapter 6 presents the results of the statistical analyses for each of the phonetic aspects I investigated: stress (Section 6.1), tone (Section 6.2) and speech rate (Section 6.3). Chapter 7 discusses and explains the results in light of the existing literature. This chapter also recognizes the limitations of my study and presents ideas for future research. Chapter 8 presents the conclusion of my thesis by giving a brief summary of the whole study and providing an answer to my main research question.

2. Constraints on code-switching

Researches agree that CS is not a random process of combining words from two languages into sentences, as mentioned in Chapter 1. As a result of the observation that CS is constrained, they have been trying to describe what those constraints are. This chapter describes some of the literature that has advanced our knowledge of constraints on CS. Early analyses of CS mostly concerned themselves with the concept of grammatical surface equivalence. Section 2.1 discusses the work of Poplack (1980, 1981), following Pfaff (1979), on two of the most well-known constraints. This section also elaborates on the null theory approach, specifically MacSwan's (1999) generativist approach, following the Minimalist Program (Chomsky, 1995), and Myers-Scotton's (1993, 2002) psycholinguistically based *Matrix Language Frame* (MLF) model that assumes an asymmetry between a *Matrix Language* (ML) and an *Embedded Language* (EL). Section 2.1.1 also discusses Muysken's (2000; 2013) taxonomy of bilingual speech to help me define a switch, because definitions have differed a lot across the CS literature. Section 2.2 is devoted to the literature most relevant to the topic of this thesis: studies on the prosodic constraints on CS. I bridge Section 2.1 and 2.2 by discussing Torres Cacoullos' (2020) study on the syntax-prosody interface. The remainder of the section features the topics stress (Akinremi, 2016), tone (Zheng, 1997; Tuc, 2003), and speech rate (Fricke, Kroll & Dussias, 2016; Johns & Steuck, 2021).

Additional to morphosyntactic and prosodic constraints, social factors play an important role in the linguistic outcome of CS (e.g. Blokzijl, Deuchar & Parafita Couto, 2017; Balam, Parafita Couto & Stadthagen-González, 2020). An in-depth discussion of these factors is beyond the scope of this thesis. However, I will address them briefly in the introduction of this chapter because these factors are equally as, if not more important than, the linguistic characteristics of the languages involved (Gardner-Chloros, 2009, p. 42). Garden-Chloros (2009, p. 42-43) describes three types of social factors:

(i) Factors that affect all speakers of the relevant varieties in a particular community, e.g. prestige and power relations.

(ii) Factors specific to the speakers, as individuals and as a member of sub-communities, e.g. their competence, attitudes and social networks.

(iii) Factors specific to the conversation in which CS takes place, where CS can be used as a conversational resource, e.g. to bring structure to discourse or to accommodate to interlocutor's preferences.

The factors in these three sets often overlap and interact in the emergence of CS patterns. The way these factors may affect CS covers a wide range of phenomena. For example, (i) different bilingual communities may settle for specific CS patterns (Balam, Parafita Couto & Stadthagen-González, 2020); and (ii) order of acquisition may have an effect in gender strategies (how a bilingual handles sites where gender conflicts in the grammars of their languages; Munarriz-Ibarrola, Ezeizabarrena, Arrazola & Parafita Couto, 2021). They all contribute to the form these patterns may take, together with the constraints that I will discuss in the following two sections.

2.1 Grammatical constraints

Interclausal CS has mostly been studied within the field of sociolinguistics, but it is not very relevant to the study of the structure of CS because the separate clauses have separate structures. That is why this section focuses on constraints within intraclausal CS.

Based on her work with a Puerto Rican community in the United States, Poplack (1980, 1981) proposed two famous constraints. The *free morpheme constraint* describes that CS cannot occur between roots and bound morphemes. This means that constructions like in (4) below, where a switch occurs between the English root ‘eat’ and the affixed Spanish bound morpheme *-iendo* ‘-ing’ (in boldface), are not allowed. Although we now know that switches like the one in (4) are in fact possible.

(4) *eat - **iendo**

‘eating’ (Poplack, 1980, p. 586)

The *Equivalence Constraint* states that switches are most likely to occur at points in discourse where the surface structures of the two languages match each other. According to this constraint, switching does not occur within a constituent when the rules of both languages differ on how to construct this constituent. Poplack (1980, p. 587) demonstrates the constraint with an example from Gingràs’ (1974) acceptability judgments study, shown in (5) with Spanish in boldface.

(5) a. **El** man **que** came **ayer** wants John **comprar** a car **nuevo**.

‘The man who came yesterday wants John to buy a new car’.

b. Tell Larry **que se calle la boca**.

‘Tell Larry to shut his mouth’.

The sentence in (5a) violates the Equivalence Constraint but the sentence in (5b) does not. The English verbs ‘wants’ and ‘tell’ require an infinitive in the verb phrase complement, whereas

Spanish uses a subjunctive in these constructions. Because a switch did take place in the invented sentence in (5a), the English infinitive position was lexicalized with the Spanish infinitive verb *comprar* 'to buy', resulting in a construction that is ungrammatical in Spanish. (5b) on the other hand does not violate the Equivalence Constraint: the verb phrase complement was fully lexicalized in Spanish.

In response to Poplack's (1980, 1981) constraints, many studies reported counterexamples (e.g. Myers-Scotton, 1997; Cantone & Müller, 2008), and other types of explanations were proposed. Within the null theory approach, researchers have claimed that the constraints on CS are not based on the surface level structures but on the underlying grammar of the languages involved. Along these lines, MacSwan (1999; 2005), following the Minimalist Program (Chomsky, 1995), argues the following:

(6) Nothing constrains CS apart from the requirements of the mixed grammars (p. 69).

This means that the Minimalist approach allows lexical items to be drawn from the lexicon of either language to introduce features (e.g. morphological: case) to the derivation of the phrase structure. These features then need to be checked (i.e. allow for interpretation) just like features need to be checked in unilingual syntax. A representation of MacSwan's (1999) model can be found in Figure 1 below. The two lexicons are denoted as Lex(L_x) and Lex(L_y), the lexicon of language *x* and language *y* respectively.

López (2020) counters MacSwan's (1999) approach by claiming a bilingual only makes use of one lexicon. Combining Minimalism and Distributed Morphology into his MDM model (p. 16), López posits that the lexicon is split into two lists, the first of which contains abstract roots and grammatical features that feed into syntax (List 1), and the second takes care of assigning a phonetic form to the syntactic terminals (List 2). A representation of the MDM model can be found in Figure 2 below.

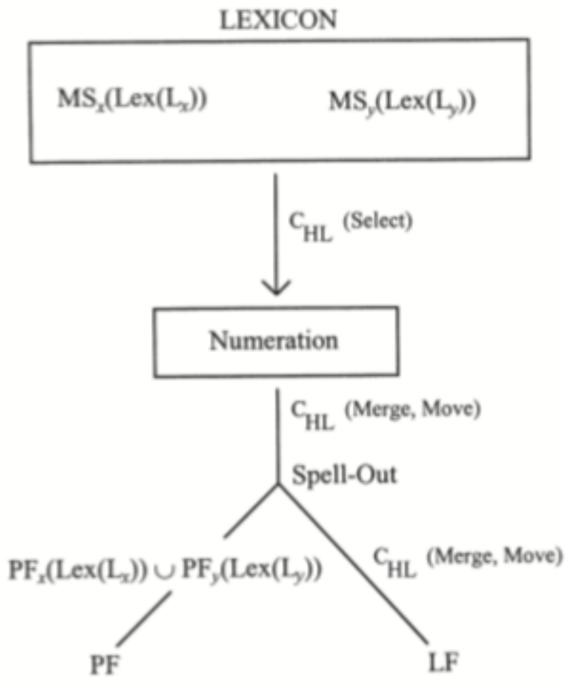

Figure 1 Bilingual Minimalist grammar (MacSwan, 1999, p. 75)

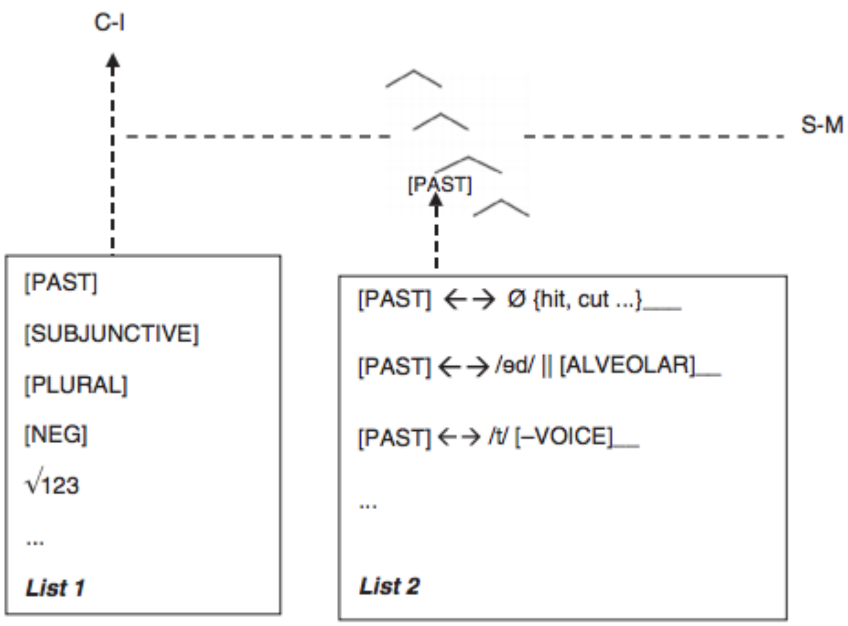

Figure 2 MDM model (López, 2020, p. 16)

The next approach to grammatical constraints on CS I discuss is the MLF model (Myers-Scotton, 1993, 2002). The key characteristic of the MLF model is asymmetry, meaning that one of the two participating languages plays a dominant role in the bilingual clause, the ML. The ML, according to the *System Morpheme Principle* (SMP), is the language that provides the bilingual clause with the morphosyntactic frame (i.e. the system morphemes or functional elements), and the other language – the EL – provides the content morphemes (or lexical elements). The other main principle of the MLF model is the *Morpheme Order Principle* (MOP). The MOP states that the order of the morphemes in a bilingual clause follow the order of only of the participating languages. How these principles assign the ML of an utterance is illustrated with the examples in (7) and (8) below (examples come from the Bangor Miami corpus, available at bangortalk.org.uk; Parafita Couto, Bellamy & Ameka, forthcoming). English (in bold) is the ML in (7) and Spanish (in italics) is the ML in (8).

(7) **My mom got the** *manguera*

hosepipe

'My mom got the hosepipe.'

(8)	*Eso*	*fue*	*en el*	**front desk**	*en el*	**reception**
	that	was	at the		at the	

'That was at the front desk, at the reception.'

The SMP can identify the ML in (7) and (8) as English and Spanish by the finite verbs 'got' and *fue* 'was' respectively. The MOP is not able to identify the ML in these examples, because Spanish and English share a subject-verb-object constituent order in these utterances.

Under the MLF model, CS is thus constrained in the way that not all morpheme types in a bilingual clause can come equally from the ML and EL, and the SMP limits the occurrence of system morphemes that make up the clausal structure of the ML.

2.1.1 What is a switch?

It is important to identify how I define the term *switch*, because the term has been used rather inconsistently throughout the codeswitching literature (Deuchar, 2020). Sometimes a switch refers to the point where the language changes, in other cases it concerns the inserted other-language material, and it may even be defined as the location of the point where the language changes.

Muysken (2000) describes three main codeswitching patterns that may be found in bilingual speech communities: *insertion*, *alternation* and *congruent lexicalization*. He later adds *backflagging* (2013). Usually there is one dominant pattern within a community, but this does not necessarily mean that the patterns cannot cooccur.

The first pattern concerns the *insertion* of material (lexical items or entire constituents) from one language into the structure of the other language. In (9) the English prepositional phrase is inserted into the overall Spanish structure. Figure 3 shows a schematic representation of the structural interpretation of the insertion pattern. This is also the pattern that is assumed by Myers-Scotton's (1993) MLF.

(9) **Yo anduve** in a state of shock **por dos días**.

‘I walked in a state of shock for two days.’

(Muysken, 2000, p. 5, citing Pfaff, 1979, p. 296)

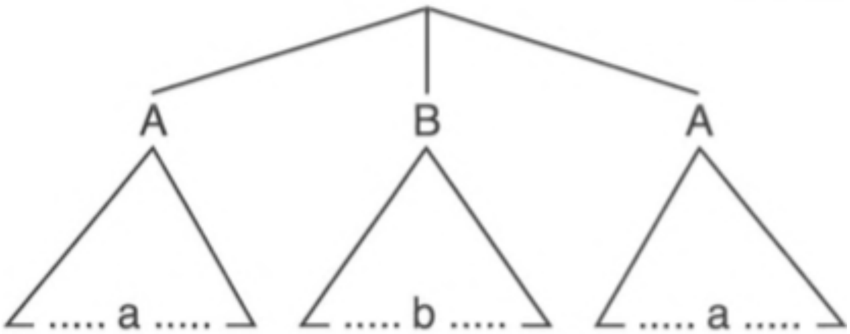

Figure 3 Insertion pattern (Muysken, 2000, p. 7)

The second codeswitching pattern is the *alternation* between structures of languages; each language occurs with their own structure. In (10) there is a true change from Spanish to English, involving both grammar and lexicon. Figure 4 shows a schematic representation of the structural interpretation of the alternation pattern.

(10) **Andale pues** and do come again.

‘That’s all right then, and do come again.’

(Muysken, 2000, p. 5, citing Gumperz & Hernández-Chavez, 1971, p. 118)

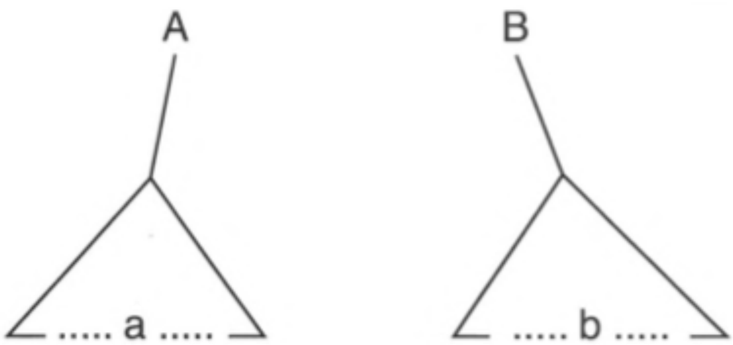

Figure 4 Alternation pattern (Muysken, 2000, p. 7)

The third pattern is the *congruent lexicalization* of material from different lexical inventories into a shared grammatical structure. The lexical items are more or less randomly inserted into the structure. In (11) the constituent in brackets contains both Spanish and English lexical items inserted into a structure that could be shared by both languages. Figure 5 shows a schematic representation of the structural interpretation of the congruent lexicalization pattern.

(11) **Bueno**, in other words, **el** flight [**que sale de** *Chicago* around three o'clock].

Good, in other words, the flight that leaves from Chicago around three o'clock.

(Muysken, 2000, p. 6 citing Pfaff, 1976, p. 250)

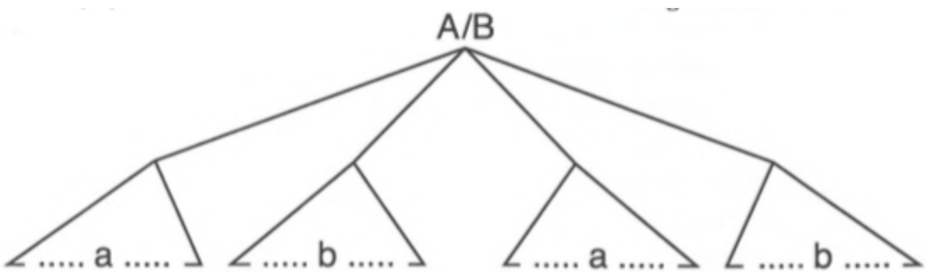

Figure 5 Congruent lexicalization pattern (Muysken, 2000, p. 8)

The fourth and final pattern is *backflagging*, exemplified in (12): the insertion of heritage language discourse markers (the Moroccan Arabic 'wella') in L2 discourse (Dutch). Speakers select this strategy to signal their ethnic identity even when they have shifted to a non-ethnic language.

(12) Q: What will you be when you grow up?

A: Ik	ben	dokter	**wella**	ik	ben	ingenieur.
I	am	doctor	or	I	am	engineer

"I will become a doctor or an engineer."

(Muysken, 2013, p. 713 citing Nortier, 1990, p. 142)

Muysken's approach takes into account the location of the switch but also the characteristics of the switched material. The latter is important because my definition of a switch is precisely that: the switched material. However, it is not always clear what is meant by switched material either. Deuchar, Muysken & Wang (2007, p. 309) give an example with a bilingual sequence consisting of ABABAB, where A and B represent two different languages. Given a linear approach, the first occurrence of B could be seen as a switch because it involves a change from language A to language B. Along the same line of thought, the second occurrence of A could also be considered a switch, unless A-elements do not count because the bilingual sequence started with A. Then only all B-elements could be seen as switches. Unlike the approach in this example, however, language is not only sequential but also hierarchical (i.e. involving constituency). Sequentially, all language changes in bilingual discourse could be treated as switches or – like in the example – the decision to treat some elements as a switch but not others could be made on the basis of arbitrary rules. Therefore, a completely linear approach would not be able to capture accurately what a switch is. Taking hierarchy into account, I identified the switched material with the help of the MLF model (see Section 5.2).

The next section will discuss the extant literature on prosody in CS. Having just considered some of the many approaches to the morpho-syntactical structure of CS, I introduce the next section by presenting a study that ties in with the topic of this section: CS strategies at the intersection of prosody and syntax.

2.2 Prosodic constraints

In recent years, the research on the phonetic and phonological reflexes of CS has gained an increasing amount of interest. The current literature addresses various topics within the prosodic domain, of which I will discuss stress, tone and speech rate because these are the variables under investigation in this thesis.

Torres Cacoullos (2020) considered prosodic and syntactic variables in spontaneous Spanish-English bilingual speech to examine CS strategies. She describes CS strategies as quantitative preferences and structural adjustments for switching at particular junctures of two languages. These strategies become apparent by extending the Equivalence Constraint (Poplack, 1980) to study points where syntactic difficulty may arise. These sites of *variable equivalence* are junctures where the word sequences of the two languages are only equal sometimes due to differences in language-internal structures. For Spanish-English bilinguals, the boundary between the main and complement clause is a site of variable equivalence because the complementizer *that* is often absent in English, whereas *que* needs to be present almost always in Spanish. (13) and (14) below illustrate the unilingual situations, and (15) and (16) give examples of codeswitched sentences of a switch from English to Spanish and Spanish to English respectively (Torres Cacoullos, 2020, p. 4).

(13) English main clause (MC) and complement clause (CC):

…I thought$_{(MC)}$ Ø it was a pretty big town back then.$_{(CC)}$

(14) Spanish MC and CC:

yo pensé$_{(MC)}$ **que estaba muy alto**.$_{(CC)}$

‘I thought$_{(MC)}$ that it was very high.$_{(CC)}$’

(15) English to Spanish codeswitched sentence:

…and you were surprised$_{(MC)}$ **que era el Rudy**? $_{(CC)}$

'…and you were surprised$_{(MC)}$ that it was Rudy? $_{(CC)}$'

(16) Spanish to English codeswitched sentence:

se me hace$_{(MC)}$ **que** they're better. $_{(CC)}$

'I think$_{(MC)}$ that they're better. $_{(CC)}$'

Torres Cacoullos (2020) hypothesized that bilinguals utilize the *prosodic distancing strategy* and the *syntactic selection strategy* at the site of variable equivalence. The prosodic distancing strategy involves "mitigating the variable equivalence by prosodically separating the juncture of two languages" (p. 5). It predicts that the main and complement clause appear in different Intonation Units (IUs; Du Bois, Schuetze-Coburn, Cumming & Paolino, 1993, p. 47: "a stretch of speech uttered under a single, coherent intonation contour") in codeswitched utterances, while these clauses are usually prosodically integrated in the same IU. The syntactic selection strategy involves "constructing consistent equivalence by opting for the more readily available syntactic variant" (p. 5). It predicts that a complementizer is always present, and that Spanish *que* is preferred over English *that*. These strategy predictions are both confirmed by data from the New Mexico Spanish-English Bilingual (NMSEB) corpus (Torres Cacoullos & Travis, 2018). The discovery of such community CS strategies may prompt researchers to reconsider the processing cost of CS as a matter of cognitive difficulty because these strategies aid the solution of sites of variable equivlence. Crucially, this study shows how prosody can play a key role in the realization of switches at specific syntactic sites. The findings could even be reinterpreted to say that switches at the main and complement clause boundary in Spanish-English CS are essentially constrained so that the clauses may not be uttered in the same IU.

2.2.1 Stress

Lexical, or word stress is the accentuation of syllables within words. The phonetic correlates often associated with stress are duration, amplitude and pitch (Cutler, 2008). There is extremely little research on lexical stress within the domain of CS (see below). Though, in language pairs that have different suprasegmental systems (i.e. systems operating over a unit greater than a single phoneme), it is an interesting and very suitable aspect to examine in order to learn more about the way CS might be constrained. A mismatch in suprasegmental systems prompts a question on how bilinguals resolve this divergence when mixing languages and how the languages' systems contribute to this.

Akinremi (2016) describes morphosyntactic integration of English verbs into Igbo in the speech of Igbo-English bilinguals. This African-European language pair has major phonological differences, both segmentally and suprasegmentally. The Igbo sound system includes vowel harmony[2] and tone, and the English sound system lacks both of these features and includes stress. Tone and vowel harmony play a large role in determining the phonological features of affixes that attach to Igbo root verbs. One morpho-phonological rule in Igbo requires the tone on the participial prefix to differ from the tone of the (first syllable of the) verb root, as illustrated in (17).

---

[2] However interesting, I do not include vowel harmony in my overview of the article here, since it is not a prosodic characteristic that is featured in my thesis.

(17) a. Chinwè nà- è-nwe nsògbu.

Chinwe PROG PART-have problems

'Chinwe is having problems.' (Akinremi, 2016, p. 61)

b. Ọ̀ ga-ghị e-zù-ru anyị.

it FUT-NEG PART-suffice-BNF us

'It will not be sufficient for us.' (Akinremi, 2016, p. 62)

The high tone on the verb *nwe* 'have' in (9a) selects for a participial prefix with a low tone *è-*. Similarly, the low tone on the verb *zù* 'suffice' in (9b) selects for a high tone prefix *a-*.

When English verbs are inserted in the Igbo morphosyntactic structure in bilingual speech, the tonal feature that would select the Igbo affix is absent. However, Akinremi (2016) found that the inherent stress feature of English verbs is adapted into the Igbo tonal system by treating primary stress as a high tone. This allows the English verb to select the tonal Igbo affixes after all. An example of the insertion of an English verb in an Igbo participial construction is presented in (18).

(18) Ọ̀ bụ̀ nnà gị nà- à-**run system** à?

it be father your PROG PART-run system this

'Is it your father that runs this system?' (Akinremi, 2016, p. 64)

Given that the participial prefix requires tonal dissimilation with the root verb and that the prefix *à-* in (10) has a low tone, the data suggests that the stress on the monosyllabic English verb 'run' is adapted into the Igbo structure as a high tone. This finding also applied to data with multisyllabic verbs with differing stress patterns. When primary stress was not on the first syllable of the verb, the participial prefix would be realized with a high tone because the non-stressed syllable of the English verb would be seen as having a low tone.

The above study on Igbo-English CS shows how two sound systems may coincide to make CS possible. Moreover, the insertion of English verbs into an Igbo morphosyntactic structure in Igbo-English CS is constrained by the need for the adaptation of English stress to Igbo tone.

2.2.2 Tone

This section highlights the extant CS literature on the prosodic feature of tone. A tone language can be defined as "one in which an indication of pitch enters into the lexical realization of at least some morphemes" (Yip, 2007, p. 230, citing Hyman, 2001). In other words, the pitch of a word can change the meaning of that word – not just its nuances, but its core meaning. The previous section already presents some findings of CS research where stress is integrated into a tonal system. This section presents two studies that focus on tone in CS specifically.

Zheng (1997) investigates tone in the speech of Chinese-Australian bilingual children. The tonal system of Mandarin Chinese consists of four contour tones and a neutral tone (see (19) below; Ross & Ma, 2006). English intonation is similar to Chinese falling tone, so Zheng hypothesizes that switching from Chinese to English may be facilitated at words with such falling tones.

	Tone	Description of pitch movement	Example	
(19)	a. 1	Level (high)	mā	'mother'
	b. 2	Rising (mid to high)	má	'numb'
	c. 3	Falling-rising (mid-low to low to mid-high)	mǎ	'horse'

d. 4	Falling (high to low)	mà	'scold'
e. Neutral	Falling	ma	question particle

When a third tone (19c) is immediately followed by a first, second, fourth, or most neutral tones, it usually becomes a *half* third tone: the tone falls but does not rise (Zheng, 1997, p. 54).

The findings of this study are that (i) single switches to an English word or phrase within a sentence, (ii) switches to English with a switch back to Chinese, (iii) responses to Chinese questions in English with a switch back to Chinese, and (iv) frequent switching in and out of English are all facilitated by falling tones (i.e. the half third tone, the fourth tone and the neutral tone). These findings could again be interpreted in the form of constraints on CS because Zheng (1997, p. 59) reports that switching to English occurs at falling tones 96.96% of the total 1033 data points. This suggests that switches to English are unlikely to occur after words with rising tone and are therefore constrained to an environment with falling tones. More generally, CS may thus be constrained to sites where the prosodic features of two languages coincide – which could be seen as an extension of the Equivalence Constraint (Poplack, 1980), even though – at the morphosyntactic level – there is counterevidence for this constraint.

Similar to the Chinese-English CS study, Tuc (2003) examined the speech of Vietnamese-Australian English bilinguals. The tonal system of Vietnamese includes six tones (1= high rising, 2= mid-level, 3= mid trailing, 4= mid-high falling rising contour, 5= mid-low rising falling contour, 6= low falling). The first three tones (1, 2 and 3) can be referred to as the 'high tone group' because they generally share a higher pitch than the 'low tone group' (4, 5 and 6). Tuc mentions that an English stressed syllable is perceived to have a higher pitch than an unstressed one (p. 103). The pitch of an English stressed syllable is comparable to the pitch of the first tone and an English unstressed syllable is perceived to be similar to the second and third tones. These perceptual similarities provide prosodic common ground for the two differing languages. An analysis of pre-switch tones showed that most switches take place after these high and mid-level pitch tones, which is compatible with English stressed/ unstressed syllables. These findings again led to a faciliatory interpretation of tone.

Using an example from Tuc (2003, p. 107), Bullock (2009) also argues that switching is actually constrained by tone. In the sentence in (20), the determiner *đó* 'that' has been inserted, without it having a syntactic function. The codeswitched sentence would be grammatical without the determiner. Moreover, in monolingual Vietnamese the sentence would be ungrammatical if the determiner preceded the Vietnamese verb for 'recall'.

(20)	Nhū'ng	gì	nó	nói	mày	phi	đó	**recall**	lại	hềt
	PL	what	he	say	you	must	DET	recall	again	PRT

"You have to recall whatever he said."

The insertion of the determiner could be seen as to prevent ill-formedness by providing a high tone context instead of a contour tone for the switch to English. This would imply that the determiner creates the environment that allows CS.

2.2.3 Speech rate

In the context of CS, speech rate is often considered as a measure of speech planning or processing cost (e.g., Fricke, Kroll & Dussias, 2016; Johns & Steuck, 2021). Unlike stress and tone, this prosodic property does not inform us on the topic of constraints on CS. It will provide a link to the also important cognitive aspects of CS, providing this thesis with a broad description of prosody in Papiamento-Dutch bilingual speech.

Existing research has found contradicting answers to the question whether CS is cognitively costly or difficult. On the one hand, studies have shown that switching languages is difficult and costly when bilinguals are cued to switch (e.g., Meuter & Allport, 1999; see also Van Hell, Litcofsky & Ting, 2015; Costa & Santesteban, 2004). On the other hand, researchers have shown that cognitive costs may diminish (e.g., Gollan & Ferreira, 2009) or disappear (e.g., Blanco-Elorrieta, Emmorey & Pylkkänen, 2018; Beatty-Martinez, Navarro-Torres & Dussias, 2020). This dichotomy also exists in studies that examined the cost of CS with speech rate. I discuss two of those studies in this section.

Fricke, Kroll & Dussias (2016) examined speech rate in the Bangor Miami Corpus of spontaneous CS (Deuchar, Davies, Herring, Parafita Couto & Carter, 2014). The utterances in the corpus were categorized as unilingual English, unilingual Spanish or codeswitched (here: containing at least one word in both Spanish and English). They used the average syllable duration of the part of the utterance that leads up to the switch point (or matched non-switch point in unilingual utterances) as the measure for speech rate, or rather articulation rate. The findings are that mean syllable durations preceding a switch were on average 16 ms longer than in matched unilingual utterances. This is indicative of a processing cost when speakers switch languages in spontaneous speech. Interestingly, they found that articulation rates before proper nouns were slightly faster than articulation rates leading up to common nouns. This could be evidence to support the *Triggering Hypothesis* (Clyne, 2003; Broersma & De Bot, 2006) which states that spontaneous CS can be triggered by cross-language phonological overlap. In other words, switches are more likely to occur within clauses that contain phonological trigger words: words that are phonologically similar across a bilingual's two languages. Fricke, Kroll & Dussias suggest that their findings are a possible extension of the Triggering Hypothesis:

articulation rate leading up to trigger words (proper nouns) is faster than speech rate leading up to common nouns. Moreover, articulation rates before codeswitched trigger words were not slower than speech rates before non-codeswitched common nouns, implying that cross-language phonological overlap may facilitate the production of trigger words in general.

Unlike the findings from Fricke, Kroll & Dussias (2016), Johns & Steuck (2021) find that "speech rates while codeswitching is associated with overall *faster* speech rates" (p. 4). They make use of the New Mexico Spanish-English Bilingual corpus (NMSEB; Torres Cacoullos & Travis, 2018, chs. 2-3) that consists of speech from 40 Hispanic New Mexicans from a community where Spanish and English are used regularly in daily interactions. The NMSEB corpus is also prosodically transcribed: the speech is broken down into IUs and Prosodic Sentences (PSs). Again, an IU is defined as "a stretch of speech uttered under a single, coherent intonation contour" (Du Bois, Schuetze-Coburn, Cumming & Paolino, 1993). IUs can be organized into PSs, which end with a final or appeal intonation contour (Chafe, 1994, p. 139-140). These prosodic units are claimed to have a cognitive basis and reflect speech planning and production. So, in order to assess speech planning in the production of CS, Johns & Steuck (2021) analyzed a sample of 111 bilingual PSs (614 IUs) containing at least one multi-word codeswitch, a sample of 71 unilingual Spanish PSs (305 IUs), and a sample of 61 unilingual English PSs (286 IUs). Speech rate was calculated by dividing the number of syllables in each IU by the duration of the IU in seconds. The speech rates were normalized by language to account for differences in the average unilingual speech rates. The findings of the comparison of speech rates between unilingual and bilingual PSs were that normalized speech rate was significantly faster in bilingual PSs compared to unilingual PSs. These results suggest that CS is associated with a global facilitation in speech rates. This argues for the idea that CS is a strategy used by bilinguals to aid speech planning and production.

It appears from the studies presented above that speech rate is not a constraining factor in CS. Rather, it is a prosodic measure of planning and production costs in CS. By also examining speech rate, I intend to utilize the data from the Papiamento-Dutch bilingual speech corpus (Gullberg, Indefrey & Muysken, 2004) to the fullest. Including a speech rate analysis allows me to find support for or evidence against the existing findings in the literature that CS facilitates speech rates, and thus speech planning.

3. Papiamento-Dutch code-switching

This chapter describes some of the literature on the Papiamento-Dutch language pair (Section 3.2) and it delves into the relevant prosodic features of each of the languages (see Section 3.3 for Papiamento and Section 3.4 for Dutch). Section 3.1 first gives an impression of the Papiamento-speaking community in the Netherlands.

3.1 Papiamento-Dutch bilingualism

Papiamento, an Iberian-based creole, and Dutch, a Germanic language, are two of the official languages – alongside English – of Aruba, Bonaire and Curaçao (also known as the ABC Islands). Papiamento received its official status in Aruba in 2003, and on Bonaire and Curaçao in 2007. It has an estimated number of 270.000 speakers on the islands, 120.000 living on Curaçao, 60.000 on Aruba and 10.000 on Bonaire. It is also spoken by approximately 100.000 Antillean immigrants who live in the Netherlands (Jacobs & Muysken, 2019).

The Antillean community in the Netherlands has a diverse sociological profile, varying from long-term residents to students, most of whom all speak Papiamento at home. Even though the extent to which speakers use the language in everyday life may differ greatly, there is a lot of appreciation for Papiamento among Antilleans (Jacobs & Muysken, 2019). Interestingly, Kootstra & Sahin (2018) suggest that the Papiamento of speakers in the Netherlands is undergoing a contact-induced language change as a result of contact with Dutch, unlike the Papiamento of speakers on the ABC Islands.

3.2 The Papiamento-Dutch language pair

The Papiamento-Dutch language pair is relatively understudied within the domain of CS. Thus far, there is no research that examines the prosodic aspects of CS in this language pair. This section presents some of the research that has already explored some other aspects of Papiamento-Dutch CS. The studies I present are mostly concerned with structural characteristics and (contact-induced) language change.

Kootstra & Şahin (2018) investigate crosslinguistic structural priming as a potential mechanism of language change by examining the syntactic choices of Papiamento-Dutch bilinguals in Aruba and the Netherlands. They hypothesize that the Papiamento of the bilinguals in the Netherlands – because of their exposure to and use of Dutch – is influenced by Dutch more than that of the Papiamento speakers in Aruba. The study design consisted of two experiments in which Papiamento speakers in Aruba and the Netherlands described movie clips of ditransitive events. The first experiment served as a baseline, and in the second experiment speakers were primed by Dutch prime sentences to test whether these could influence syntactic choices in the Papiamento movie-clip descriptions. The results provided multiple forms of evidence of contact-induced differences between speakers from Aruba and the Netherlands. The first experiment showed that speakers of Papiamento in the Netherlands produce more Dutch-like dative structures than speakers of Papiamento in Aruba. This difference is probably caused by Dutch syntactic preferences influencing Papiamento syntactic choices in the speakers from the Netherlands. The second experiment showed the indisputable influence of Dutch prime sentences on syntactic choices in Papiamento. The conclusion of this study is that crosslinguistic syntactic priming is likely to be a mechanism of contact-induced language change.

Another study that includes an examination of language change is Muysken, Kook & Vedder (1996), who investigated Papiamento-Dutch CS in bilingual parent-child reading sessions in Antillean migrant families in the Netherlands. They asked caregivers to read three picture books to their child: one in Papiamento, one in Dutch, and one without text. The CS in the data allowed them to study the implications for language change through lexical borrowing, bilingual competence, and the structural properties of Papiamento-Dutch CS. Their findings confirm claims made in earlier studies. Poplack (1980) and Nortier (1990) pointed out that there is a relation between the degree of bilingual competence and the type of switching that occurs, so that a higher competence in both languages means a higher occurrence of intrasentential switching. This relation was reflected in Muysken, Kook & Vedder's (1996) data, but the effect was stronger for Papiamento than for Dutch competence: Papiamento often functioned as the ML in which Dutch nouns and numerals were inserted. The fact that the structure of the CS patterns of the caregivers generally involved a Papiamento matrix with Dutch insertions, makes it conceivable for the children to interpret these words as being Papiamento. This could result in these words becoming borrowings in the next generation.

In the Papiamento-Dutch CS data from the study by Parafita Couto & Gullberg (2017) – who made use of the bilingual Papiamento-Dutch conversation corpus too (Gullberg, Indefrey & Muysken, 2004), they also found that the ML was exclusively Papiamento (p. 6). This study explored how different theoretical traditions, namely generativist accounts (Cantone & MacSwan, 2009; Liceras, Fuertes, Perales, Pérez-Tattam & Spradlin, 2008) and the MLF model approach (Myers-Scotton, 1993), can account for the relationship between determiners, adjectives and nouns in codeswitched Noun Phrases (NPs). They examined the nominal switching domain as a conflict site in three language pairs[3] whose languages differ with regard to gender and noun-adjective word order. In the Papiamento-Dutch language pair, Dutch has gender, whereas Papiamento does not, and Papiamento prefers post-nominal adjectives, whereas Dutch prefers prenominal adjectives. These language properties thus allowed for the assessment of predictions about CS in the nominal domain in cases where there are asymmetries with regard to gender marking and word order. For the language of the determiner, the generativist approach predicts that the language with more grammaticalized (or *phi*) features provides the determiner. The MLF model predicts that the ML provides the determiner, which is indirectly determined by finite verb morphology (SMP; see Section 2.1). For noun-adjective word order, generativism predicts that the language of the adjective determines word order. The MLF model predicts that the adjective occurs in the position that follows the order of the ML (MOP; see Section 2.1). For Papiamento-Dutch mixed NPs[4], this means that generativists predict the determiner to always be Dutch (because the Papiamento determiner lacks phi features, specifically gender) and the MLF model predicts the ML to provide the determiner. In (21) below, the example shows how the generativist predictions are not borne out, because the determiner is in fact Papiamento. Given that the ML of the clause is Papiamento, the predictions made by the MLF model are confirmed by this example.

---

[3] Parafita Couto & Gullberg (2017) examined three language pairs: Welsh-English, Spanish-English and Papiamento-Dutch. For the sake of relevance – since this thesis is concerned with Papiamento-Dutch CS – I only discuss the Papiamento-Dutch language pair. The example from the data follows the predictions of one of the approaches, which serves to highlight the differences between them.

(21) e **voetganger**

DET^{P} pedestrian^{D}

'the pedestrian' (Parafita Couto & Gullberg, 2017, p. 7)

The study by Parafita Couto & Gullberg (2017) has made an effort to evaluate the predictions of different structural approaches to CS (see also e.g. Eppler, Luescher & Deuchar, 2017; Fairchild & Van Hell, 2017). The findings could not, however, conclusively distinguish between the two different approaches.

A follow-up to the above analysis of spontaneous CS in the nominal domain used event-related brain potentials (ERPs) to measure online comprehension of Papiamento-Dutch code-switched utterances (Pablos, Parafita Couto, Boutonnet, De Jong, Perquin, De Haan, & Schiller, 2018). This study also assessed the predictions of structural accounts concerning the underlying mechanisms of adjective-noun word order, including a third: (i) the adjective determines word order (Cantone & MacSwan, 2009), (ii) the ML determines word order (Myers-Scotton, 1993), or (iii) either order is possible (Di Sciullo, 2014). In an ERP experiment, they tested bilinguals' comprehensions of less frequent switch patterns. The phrase in (22) is an example of a very common CS pattern in the production data. The less frequent patterns would, for instance, include a switch between the adjective and the noun, or a Dutch adjective in postnominal position.

(22) e **simpele** **voetganger**

DET^{P} simple^{D} pedestrian^{D}

'the simple pedestrian' (Pablos et al., 2018, p. 7)

The ERP component *left anterior negativity* (LAN) can flag a syntactic violation (i.e. the adjective-noun conflict). If a LAN component would be observed, the predictions in (i) or (ii) would be correct, because they predict a specific type of switch pattern bound by syntactic rules. On the other hand, if CS follows the prediction in (iii) and is allowed either way, no LAN component would be observed. The results from the comprehension experiment reject the predictions from the MLF and the minimalist approach because there was no components indicative of a syntactic violation were found. This could either be interpreted as support for Di Sciullo's (2014) account or reject all CS patterns presented in the experiment. Again, no conclusive distinction could be made between the accounts. The overall conclusion of both studies is that CS research needs more convergent data from different methodologies and populations. To this point, Valdés Kroff (2016) argues that CS is a learned behaviour and that different patterns may be learned in different bilingual communities. Future research could tap into this by examining Papiamento-Dutch CS in the Antilles, where Papiamento is more dominant than in the Netherlands. These studies thus highlight that sociolinguistic factors require more attention, but also – given that none of the research in this section mentions prosody – a lot can still be learned about CS by investigating the Papiamento-Dutch language pair even more.

4. The current study

The previous section has shown that what we know about Papiamento-Dutch CS is mostly about the morpho-syntax. To add to the research on this language pair, specifically its phonetic reflexes, the next two sections present the relevant prosodic features of Papiamento (Section 4.1) and Dutch (Section 4.2). These features are mainly tone and stress, as these are crucial to the analyses in my thesis.

4.1 Papiamento prosodic features

The prosodic system of Papiamento includes both distinctive stress and lexically contrastive tone. I present these features parallel to each other because they can interact within a word. Both stress and tone distinguish minimal pairs, contribute to morphological distinctions, and exhibit the typical characteristics of stress and tonal systems.[5] Papiamento's stress system is like other stress systems in the sense that it is hierarchical, rhythmic and demarcative of the word domain (Rivera-Castillo & Pickering, 2004 referencing Kager, 1995). These characteristics of the stress system are illustrated using (23) below (a single quotation mark indicates primary stress, double quotation marks secondary stress, an acute accent a H tone, and unstressed syllables and L tones are unmarked[6]).

---

[5] It needs to be noted that this section presents characteristics of the prosodic system of Papiamento from sources that describe the language variety spoken in Aruba (i.e. Papiamento) and on Curaçao (i.e. Papiamentu). According to Remijsen & van Heuven (2005) there are some differences between the dialects of Papiamento, one of which is speech melody. However, the characteristics of stress and tone that I discuss here seem to apply to both varieties.

[6] These conventions for stress and tone are applied to all examples, where relevant.

(23) “kumin’sá

‘begun’ (Rivera-Castillo & Pickering, 2004, p. 264)

Each word has a primary stress placement (*‘sa*) that has a fixed default penultimate position (demarcative property). Only one position with primary stress is allowed within each word (hierarchical property). Secondary stress (*“ku*) is applied in polysyllabic words. The primary stress is not in its default position in (23) because of the rhythmic property: an unstressed syllable (*min*) is required to occur between a primary and a secondary stress position. Remijsen & Van Heuven (2005) further describe stress assignment in verbs. The location of primary stress in verbs is predictable from the number of syllables and the morphological category. Most base forms of disyllabic verbs have the default penultimate stress (24a), whereas the final syllable is stressed in the corresponding participle forms (24b). The derivation of the participle is thus marked by a shift of stress.

(24) a. ‘subí ‘to climb’

b. su’bí ‘climbed’ (Remijsen & Van Heuven, 2005, p. 207)

As mentioned before, Papiamento has a tone system alongside its stress system. Tonal distinctions are determined paradigmatically, whereas stress patterns are determined syntagmatically: (i) stress is relational because the degree of stress in a syllable (primary vs. secondary) depends on the relative stress of adjacent syllables; and (ii) stress is culminative because the degree of stress in a particular syllable depends on its prominence (i.e. pitch, duration, amplitude). The interpretation of tone height is possible without referring to the tone of an adjacent syllable. Several adjacent syllables may have the same tone height; tone can spread over multiple syllables, but stress cannot (Rivera-Castillo & Pickering, 2004, p. 264, Footnote 1; see also Footnote 7 below). Similar to how stress can distinguish two forms of the same verb as in (24), there are tonal patterns that can distinguish lexical categories, as exemplified in (25).[7] The tonal system consists of a level H tone and a level L tone.

(25) a. ‘lóra ‘parrot’ (noun)

b. ‘lorá ‘to turn’ (infinitive)

c. lo’rá ‘turned’ (participle) (Remijsen & Van Heuven, 2005, p. 210)

The H tone in (25a) on the penultimate syllable distinguishes the noun *lóra* ‘parrot’ from the verb *lorá* ‘to turn’ in (25b), which also has an H tone on the penultimate syllable. Interestingly, (25) also shows how the combination of the stress and tonal systems can make a three-way distinction between disyllabic nouns, infinitives and participles. Where tone can distinguish between nouns and infinitives, stress can distinguish between infinitives and participles. Finally, the realisation of tone is not affected by the location of stress.

Papiamento exemplifies a system in which stress and tone are lexically distinctive. This makes it quite optimal for the study of prosody. The Papiamento creole prosodic system includes the tonal features of West African languages and stress from Indo-European languages

---

[7] The Papiamento tonal system also exhibits some typical features such as tone spreading, polarization, contour tones, tone preservation, floating tones, and downdrift, but I refrain from discussing these here since my consideration of tone is on a purely lexical level. For more detail on these features see e.g. Rivera-Castillo & Pickering, 2004; Römer, 1991.

(Rivera-Castillo & Pickering, 2004). The next section will discuss the prosodic features of such an Indo-European language, namely Dutch.

4.2 Dutch prosodic features

Dutch is an Indo-European, specifically Germanic, language with approximately 23 million speakers, of which 16 million reside in the Netherlands (Eberhard, Simons & Fennig, 2019). The prosodic system of Dutch does not use pitch – the phonetic correlate of tone – to differentiate between lexical categories or items, but pitch variation takes the form of intonation. Intonation operates on larger structures than a single word, usually over clauses or complete sentences (Collins, 2003). It can have several functions: (i) focus (it can highlight certain words), (ii) attitude (it can reflect a speaker's attitude), (iii) grammatical (it can add grammatical information to what is provided by the bare words), and (iv) discourse (it can help organize conversations, e.g. by indicating speakers' turn-taking). The prosodic structure of Dutch consists of the elements in (26). It is a hierarchical system, in which intonations patterns are determined at the highest level, and pitch movements at the lowest ('t Hart, 1998).

(26) Utterance
Intonational Phrase
Phonological Phrase
Prosodic Word
Foot
Syllable (adapted from Gussenhoven, 2006)

The foot is the association site for the Dutch pitch accents and stress (Gussenhoven, 2006). Pitch movements can be divided into gradual (i.e. spread across several consecutive syllables) and abrupt (i.e. shorter than duration of the syllable) patterns. The most relevant feature within the domain of intonation for the current study is the process of *declination*. This is the tapering off of pitch throughout an utterance. Usually the utterance-final pitch of a speaker varies very little, whereas the pitch at the beginning of an utterance depends on the length of the utterance. 'T Hart (1998) found that longer utterances start higher than short utterances. Individual declination slopes may thus vary considerably. This does, however, not depend on sentence type.

The other relevant prosodic feature – besides declination – I discuss in this section is of course stress. As is typical for stress systems, Dutch stress is culminative (there is a single syllable with primary stress), and obligatory (all words have at least one stressed syllables). Polysyllabic words may have secondary stress, occurring either before or after the primary stress, as in *"admi'raal* 'admiral', and *'mara"thon* 'marathon', respectively (Gussenhoven, 2014). Intonational pitch accent usually only associates with primary stressed syllables, and syllables with secondary stress tend to be shorter than syllables with primary stress in words with more than one stressed syllable. Dutch default stress assignment is on the penultimate syllable, like in Papiamento, but Dutch is *quantity sensitive*: closed syllables, diphthongs, and long vowels attract primary stress. Moreover, the Dutch system belongs to the more complex word prosodic systems that have been reported because of its many exceptions (Gussenhoven, 2014. For the sake of my thesis though, the features I have presented above are sufficient to allow for a good understanding of my analysis of stress in Papiamento-Dutch CS.

4.3 Research questions and hypotheses

The overarching research question I intend to answer is 'does prosody constrain CS?'. I do so by analyzing stress and tone in spontaneous Papiamento-Dutch CS corpus data. In turn, I intend to answer the questions ‘does stress constrain Papiamento-Dutch CS?’ and ‘does tone constrain Papiamento-Dutch CS?’. Additionally, I analyze speech rate in order to provide insight into speech planning processes in CS. The prosodic properties of stress and tone provide a solid foundation for an analysis because the prosodic systems of Papiamento and Dutch differ in their use of the properties. Speech rate adds to my study because it provides a link from a prosodic feature to a cognitive aspect of CS, namely speech planning. I designed a more specific research question for each of the phonetic variables. I present each question in (a) and my hypothesis in (b) in (27, 31, 32) below. After presenting each question-answer pair, I provide the motivation for my hypothesis.

Stress:

(27) a. Is Papiamento-Dutch CS in the nominal domain constrained by stress?

b. Yes, stress constrains the likelihood of switching in Papiamento-Dutch CS in the nominal domain.

The way I approach this question is by comparing the likelihood of a stress match between a noun and its translation equivalent (TE) in codeswitched vs. unilingual Papiamento NPs. So, my research question in (27a) can be stipulated even more specifically as in (28a).

(28) a. Is it more likely for the stress pattern of a noun in a codeswitched NP to match the stress pattern of its TE than for a noun in a unilingual NP?

b. Yes, the stress pattern of a noun in a codeswitched NP is more likely to match the stress pattern of its TE than the stress pattern of a noun in a unilingual NP.

To illustrate my research question in (28a), I present an example of a noun in a codeswitched NP and its TE in (29) and a noun in a unilingual NP and its TE in (30).

(29)	CS NP		CS NP (Papiamento TE)	
	un **par'tij**	(conv. 3, rec. 1014)	un par'tido	'a (political) party'

(30)	unilingual NP		unilingual NP (Dutch TE)	
	e pa'labranan	(conv. 1, rec. 0144)	**de 'woorden**	'the words'

The examples in (29) and (30) match my hypothesis. The stress pattern of the noun in the codeswitched NP in (29) matches that of its TE: both are stressed on the second syllable. The stress pattern of the noun in the unilingual NP in (30), however, does not match that of its TE: the Papiamento noun is stressed on the second syllable, the Dutch noun carries stress on the first. I predict that this is the most prevalent pattern in CS because it follows the *Equivalence Constraint*: switches are most likely to occur at points in discourse where the surface structures of the two languages match each other (Poplack, 1980; see Section 2.1). It is also important to note that Papiamento and Dutch both have default stress on the penultimate syllable (Rivera-Castillo & Pickering, 2004 for Papiamento; Gussenhoven, 2014 for Dutch; see Sections 4.1 and 4.2). In my analysis, I consider stress in the surface level structure – making the Equivalence Constraint a relevant parameter – because underlyingly the languages have the same stress pattern.

Additionally, Akinremi (2016) reports the integration of English stress into the Igbo tone paradigm in CS as a form of convergence between the two differing sound systems. This integration is constrained by the adaptation of stress in English verbs to the required alternation of tone in Igbo affixes (see Section 2.2.1 for more details). In the codeswitched Papiamento-Dutch NPs, it therefore seems plausible that the switch of a noun is constrained to (or at least more likely to occur at) a site where stress patterns match.

Tone:

(31) a. Is the position and/ or the form of switches constrained by the tone of the surrounding Papiamento words?

b. Yes, in short, Dutch insertions are constrained by the tone of the surrounding Papiamento words.

By the position of a switch, I mean the syntactic position (e.g. in relation to a phrasal boundary) and by the form of a switch I mean its syntactic makeup (e.g. the phrase it occurs in). All of these structural aspects I take into account are illustrated in Section 5.3. The research question in (31a) is purposefully exploratory because there has not been a lot of research on tone in CS. Zheng (1997) and Tuc (2003) found a facilitative function of prosody on switches at sites where the prosodic features of the two languages coincide.

Based on the analysis of (20) in Section 2.2.2, I adopt Bullock's (2009) constraining interpretation of tone. Similarly, I hypothesize that the position of the switches in the Papiamento-Dutch corpus is constrained by the tone of the surrounding Papiamento words. My analysis is focused on the switch site because the sound quality of the corpus data did not allow for an in-depth phonetic analysis on the realization of the tones. One result I might expect to find is that Dutch insertions are more likely to occur after falling Papiamento tones, because Dutch prosody involves *declination*. This is the tapering off of pitch throughout an utterance ('T Hart, 1998; see Section 4.2 for more details). I approach the question in (31a) with three different analyses (see Section 5.2.2), that each tap into a different structural aspect that tone could constrain:

(i) In which phrase does the switch occur?

(ii) What is the syntactic category of inserted material?

(iii) Does the switch occur before or after the finite verb in the utterance?

Speech rate:

(32) a. Is the speech rate in bilingual utterances faster than the speech rate in unilingual utterances?

b. Yes, the speech rate in bilingual utterances is faster than in unilingual utterances.

The research question in (32a) and hypothesis in (32b) are motivated by the work of Johns & Steuck (2021). They found that speech rates during CS (or, while in a bilingual mode) are faster than unilingual speech rates (see Section 2.2.3 for more details). I therefore also expect to find faster speech rates in bilingual utterances compared to those in unilingual Papiamento and unilingual Dutch utterances.

5. Methodology

The goal of this research is to determine whether prosody constrains CS, and to learn about speech planning in Papiamento-Dutch CS. This chapter explains the methods I employed to analyze stress, tone and speech rate. I used CS data from the Papiamento-Dutch conversation corpus (Gullberg, Indefrey & Muysken, 2004; 2009). I discuss the corpus in Section 5.1, the data I extracted from the corpus and its coding in Section 5.2, and the statistics I used to analyze the data in Section 5.3.

5.1 Corpus

The Papiamento-Dutch corpus consists of six four-party free conversations (Gullberg, Indefrey & Muysken, 2004; 2009).[8] The participants were approached, greeted and instructed in Papiamento-Dutch mixed speech in order for participants to feel comfortable in a CS context, so that they would not inhibit their own use of mixed speech. The conversations lasted approximately 45 minutes each. Participants were seated in a circular arrangement in a room. The conversations were video recorded by 2 cameras (2 speakers/camera angle). They were instructed to talk freely about any topic of their choice. To get them started they were encouraged to talk about life in the Netherlands vs. life in the Antilles.

---

[8] For access to all the data in the conversation corpus, go to:

https://archive.mpi.nl/islandora/object/lat%3A1839_00_0000_0000_0001_289F_4.

5.1.1 Participants

25 Papiamento-Dutch bilinguals (18 female), ages ranging between 18 and 61 years (mean= 27.00, SD= 8.57) participated in the recordings. Their educational backgrounds range from vocational training to university education. Most of them were born in Aruba (*n*= 10) and Curaçao (*n*= 9), but they were all resident in the Netherlands at the time of the recordings. The length of their stay in the Netherlands ranged from 4 months to 32 years (mean= 6.89 yrs., SD= 6.82 yrs.). The participants are all early functional bilinguals, who reported using both languages to the same extent daily in various situations (Parafita Couto & Gullberg, 2017, p. 5). They also habitually code-switch with other bilinguals. Nevertheless, 24 of the 25 speakers reported that Papiamento was their 'best language'.

5.1.2 Transcriptions

The conversations are transcribed using standard Dutch and Aruban orthography. Transcriptions cover the middle 30 minutes of the conversations. A team of native bilingual Papiamento-Dutch bilinguals transcribed the audio files, marking phonetic modification, hesitations and overlapping speech. The transcripts were further glossed and tagged for language and word class adopting the coding scheme from Muysken, Kook & Vedder (1996). Transcriptions and annotations were checked and corrected twice by native speakers. The annotations, audio and video files were merged in ELAN (https://archive.mpi.nl/tla/elan). The transcriptions were divided into utterances determined by grammatical completion (clause) and/or pauses. An example utterance from the corpus is presented in (33).

(33)

1-0009\id	1-0009 0014.401 0015.553 subject #2			
1-0009\tr	No,	nami		bisa
1-0009\mo	no	na	-mi	bisa
1-0009\gl	no	let	-1SG	say
1-0009\la	P	P	-P	P
1-0009\gr	6	3	-3	2

The **\id line** is a unique number to identify the utterance and the conversation (here 1-0009 means conversation 1, utterance 0009). It also contains a time stamp of that utterance and which participant is speaking (here #2). #0 is always one of the experimental assistants (a native bilingual Papiamento-Dutch speaker)[9]. The **\tr line** contains the word-by-word transcription. The **\mo line** shows the morphemes corresponding to the words in the \tr line. The **\gl line** contains the English gloss, following the Leipzig Glossing Rules (http://www.eva.mpg.de/lingua/resources/glossing-rules.php). The **\la line** contains the language tagging (see Muysken et al., 1996):

N Dutch.

X Dutch loans with Papiamento morphology: the Dutch word is recognized, but adapted to a Papiamento context.

Y Unadapted but established Dutch loans. These words are used in Papiamento and have a Dutch origin; their pronunciation does not strongly deviate from Dutch.

Z Papiamento words of Dutch origin, but completely adapted to Papiamento pronunciation.

---

[9] The speech of the experimental assistants was also included in the compilation of my data sets in order to include as many CS items as possible.

P Papiamento.

Q Unclassifiable (onomatopoeic elements, English words, exclamations, names).

The **\gr line** contains the word class tagging (see Muysken et al., 1996):

0 prepositions.

1 nouns, names.

2 verbs.

3 tense/ mood/ aspect particles, auxiliaries, copula.

4 personal/ possessive/ demonstrative/ reflexive pronouns, question words, determiners.

5 exclamatives, interjections.

6 negation, adverbs.

7 coordinating and subordinating conjunctions.

8 numerals, quantifiers.

9 adjectives.

5.2 Data and coding

This section describes the data sets I extracted from the corpus.[10] I discuss how I compiled the data, what the criteria for inclusion/exclusion were and how I coded the data. Section 5.2.1 presents the data for my analysis of stress, Section 5.2.2 for my analysis of tone and Section 5.2.3 presents the data for my analysis of speech rate.

Across all data sets, I adopted Deuchar, Muysken & Wang's (2007) hierarchical approach to the analysis of switches. I worked on a clause-by-clause basis to identify the switches in the

[10] My data sets are available as supplementary materials on the Open Science Framework: https://osf.io/rtdx4/?view_only=8c2a0917ca374d5aaf1eefdb4da7ad54.

corpus. Bilingual clauses are identified by whether the clause contains material from both Papiamento and Dutch. Next, I identified the ML of the utterance on the basis of word order and subject-verb agreement (where possible). All continuous other language material in the clause was counted as a switch (i.e. B in an ABA sequence). The switches were then grouped based on Muysken's (2000; 2013) taxonomy of codeswitching patterns. The next steps of the coding process for each of the prosodic features are explained in the following three sections.

5.2.1 Stress

The origin of the stress data was a list of all CS NPs (n= 84) from the Papiamento-Dutch CS conversation corpus (Gullberg, Indefrey & Muysken, 2004; 2009), extracted in the interest of a study of switching patterns between determiners and nouns (Parafita Couto & Gullberg, 2017). I selected all the CS NPs with a Papiamento determiner and a Dutch noun (n= 47) for the current analysis because this structure was the most common in the data. The NPs with adjectives or other language configurations were excluded from the current analysis.[11] This decision was made in the interest of a homogenous data set. Thus, the determiner-noun (Det-N) NPs and their Papiamento TE were included in the analysis of stress. In order to assess whether the stress pattern of Dutch nouns in CS NPs is more likely to match the stress pattern of their Papiamento TE than it is for nouns in unilingual NPs, the unilingual NPs of interest are the Papiamento ones. I hypothesize that the nouns that are not switched are (partly) constrained

---

[11] Number of excluded NPs: DetN (DP 1), DetAN (PDD 11, PPD 3); DetNA (PDP 2, PPD 2); DetNAdvA (PYPYD 1, PDPP 1); AN (DP 3, PD 4); QuantN (PD 5); AdvN (PD 1); NA (PD 2); QuantNA (PDD 1) [A= adjective, P= Papiamento, D= Dutch, Adv= adverb, Y= unadapted established Dutch loans, Quant= quantifier].

by the fact that their stress pattern is less likely to match that of their TE. Therefore, I also compiled a list of unilingual Papiamento Det-N NPs (n= 494) and translated them in order to compare them to the nouns from the CS NPs. Only unilingual Papiamento NPs were included because the nouns in the CS NPs are all Dutch. There was only one instance of a Papiamento noun in a CS NP (conv. 5, rec. 0004: *de cadushi* ‘the candle-shaped cactus’), so this item was not included in the analysis. One single item is not enough data to also warrant compiling a list of unilingual Dutch NPs for a comparison in the other direction.

The Papiamento unilingual NPs were targeted by searching the \gr line in the transcripts of the corpus for 4-1 sequences. In order to mirror the CS NP data, items with 4= quantifier or demonstrative did not make it onto the list because the Dets of the NPs on the CS items list were all either articles or possessive pronouns. Other criteria that caused NPs to not make it onto the unilingual items list were: NPs in the speech of the experimenters (coded by name in the \id line); repetitions of the same NP within the same utterance; nouns coded with Y or Q in the \la line of the transcripts (Y= unadapted established Dutch loan, Q= unclassifiable word); NPs started by one speaker and finished by another; NPs with Dutch homonyms with the same meaning, e.g. *mama* ‘mother’ and *ticket* ‘ticket’; NPs with English nouns, e.g. ‘mansion’ and ‘style’; NPs with repetitions or repairs of syllables.

Each NP and its TE was coded for number of syllables and which syllable carries the main stress. The translations and syllable coding are based on a dictionary (Van Putte & Putte-De Windt, 2005) and they were checked by a native speaker of Papiamento. I checked a random sample of 30 items by listening to the corpus recordings to ultimately confirm the coding. This led to the exclusion of two unilingual Papiamento NPs because I could not trace them back to the recordings[12]. The finalized data set consisted of a list of unilingual Papiamento NPs with 492 items and a list of 47 CS NPs and their TEs. The tables below present the number of items within each category with a certain number of syllables (see Table 1) and the number of items of which a certain syllable is stressed (see Table 2). An example of each category is presented in (34) and (35) below. Stress is indicated by a single quotation mark. In the examples, the stress pattern of the Ns in the TEs neither matches the stress pattern of the CS NP, nor that of the unilingual Papiamento NP respectively.

(34)	CS NP	CS NP (Papiamento TE)		
	un ‘**reden**	un mo’tibo	‘a reason’	(conv. 1, rec. 0445)
(35)	unilingual NP	unilingual NP (Dutch TE)		
	e pa’labranan	**de ‘woorden**	‘the words’	(conv. 1, rec. 0144)

Table 1 Items per number of syllables

	1 syllable	2	3	4	5	6+
CS NPs	6	19	12	8	2	-
CS NPs (Papiamento TE)	1	6	19	8	7	6 (3)[13]
monolingual NPs	38	205	193	50	5	6
monolingual NPs (Dutch TE)	188	192	87	24	-	1

---

[12] It concerns the NPs *mi cede* ‘my headquarters’ (conv. 3, rec. 0841) and *e combersacion* ‘the conversation’ (conv. 4, rec. 0003).

[13] The number between brackets indicates the number of items with more than the number of syllables of that column.

Table 2 Items per stressed syllable position

	1	2	3	4+
CS NPs	31	13	2	1
CS NPs (Papiamento TE)	10	25	7	5 (1)
monolingual NPs	270	183	28	11 (1)
monolingual NPs (Dutch TE)	375	101	15	1

5.2.2 Tone

The dataset for the analysis of tone started as a list of all Papiamento words that directly precede or follow a Dutch switch (n= 446). As explained in Section 2.1.1, I searched for switches on the basis of the utterances (i.e. clauses) that make up the corpus. This means that whether a word precedes or follows a switch was determined within and not across utterances. For example, *siman* 'week' in (36) is not said to precede the Dutch word *nou* 'well' in (37) because the words occur in different utterances.

(36)	1-0302\tr	sincu	siman							
	1-0302\gl	five	week							
	1-0302\la	P	P							
(37)	1-0303\tr	nou	na	drie	weken	heb	ik	het	wel	gezien
	1-0303\gl	well	after	three	weeks	have	I	it	well	see
	1-0303\la	N	N	N	N	N	N	N	N	N

All Papiamento items were coded for number of syllables, grammatical category and sentence type. A total of 353 items were excluded based on the extent to which the data could be checked for tone. I asked several native Papiamento speakers about their awareness of tone; they seem to have very little intuition with regard to tone, so I needed to check the tone of the data largely by means of a dictionary (Van Putte & Putte-De Windt, 2005). To facilitate this, the final dataset only included two-syllable words. Additionally, one of the tone patterns – 'HL – only occurs on disyllabic words (Remijssen, Martis & Severing, 2008). Loans (i.e. words coded with X/Y in the \la line), words with Dutch homophones (e.g. *mama* 'mother'), words that formed contractions (e.g. *ta'ta* [*tabata*] 'was', *asin'n* [*asina un*] 'such a') and words with an intervening pause between Dutch insertion and target (indicated in the corpus transcription with '…') were excluded as well. Furthermore, words in non-declarative sentences – i.e. questions (n= 5) and negations (n= 13) – were excluded. The tonal patterns in these sentences may differ radically from the patterns in affirmative declaratives (Remijssen, Martis & Severing, 2008).

The remaining 93 items were coded for tone, the language of the verb in the utterance, type of switch (insertion vs. alternation), relative position to the verb (pre vs. postverbal), phrase type of the switch, whether the target occurs in the same phrase as the switch, syntactic category of the switch (specifier vs. adjunct vs. complementizer) and relative position to the switch (preceding vs. following). Items in utterances with alternations were excluded (n= 13) because these types of switches combine fragments from different languages independent of the grammars involved (Muysken, 2013, p. 714). In the case of four items, the switched material coincided with the targeted tonal word. The words were all Papiamento insertions in an otherwise Dutch utterance. They could not be coded for all variables along with the rest of the items, so they were also excluded. Depending on the analysis (phrase type, syntactic category, or pre vs. postverbal), a number of other items were excluded. For the first analysis (including phrase type and the cooccurrence of target and switch in the same phrase), no further exclusions were made, leaving a data set of 76 items (henceforth referred to as the first tone data set). The second analysis looked at the relative position of the target to the verb, so items in utterances without a finite verb (n= 2) and targets that were the finite verb (n= 4) were excluded, leaving a data set of 70 items (henceforth: the second tone data set). Finally, a third analysis looked at the syntactic category of the switch, where the categories revolve around the relation to the verb. Effects of preverbal vs. postverbal switches has been looked at in the domain of CS processing (Suurmeijer, Parafita Couto & Gullberg, 2020).[14] I included this variable to see whether it is relevant in production. Switches that were themselves the finite verb had to be excluded (n= 1), leaving a data set of 75 items (henceforth: the third tone data set).

The tone distribution of the data was as follows for the first, second and third tone data set respectively: ‘HL (n= 30, n= 29, n= 30); ‘LH (n= 37, n= 33, n= 37); L’H (n= 9, n= 8, n= 8). The position relative to the Dutch insertion stated whether the Papiamento target word preceded (for each data set in order: n= 48, n= 45, n= 47) or followed it. In the first tone data set, a target was said to occur within the same phrase as the switch (n= 20) if their phrases share the same mother node in the hierarchical syntax structure. The types of phrases that were represented were the following: AdjP (n= 20), AdvP (n= 8), ConjP (n= 1), NP (n= 36), PP (n= 8) and VP (n= 3). In the second tone data set, a target was said to be preverbal (n= 22) if it preceded the finite verb or marker. In the third data set, a complement (n= 46) is defined as the first phrase a head merges with; a specifier (n= 7) is defined as a constituent indirectly selected by a head; an adjunct (n= 22) is defined as a constituent that is neither directly nor indirectly selected by a head (Koeneman & Zeijlstra, 2017).

---

[14] Suurmeijer, Parafita Couto & Gullberg (2020) did not find a main effect of preverbal vs. postverbal. However, given that I consider production and not perception, I thought it could be informative for the way tone constricts structural occurrences of switches.

5.2.3 Speech rate

My analysis of speech rate is based on analysis of speech rate in the article by Johns & Steuck (2021), which I discussed earlier in my literature review (see Section 2.2.3). Where permitted by my data, I adopt Johns & Steuck's coding method. A crucial difference between the corpora is that the NMSEB corpus is transcribed prosodically and the corpus I work with is not. As mentioned before in Section 5.2.2, the utterance transcription of the Papiamento-Dutch corpus is initially based on a syntactic criterion (i.e. clausal completion) and only secondarily on a prosodic one (i.e. pauses). Therefore, I do not make use of IUs and PSs in my coding, but of clauses (referred to as such in this section, but as 'utterance' in other sections) and sentences. This does not pose a problem though, because a clause – like an IU – is a holistic speech unit that intends to transmit information (Tench, 2009; Chafe, 1994).

The speech rate dataset contained all (n= 49) bilingual sentences from the corpus (148 clauses across 14 speakers[15]) with at least one switched clause (e.g. one clause in Dutch and the others in Papiamento). Sentences with single-word switches were not included because normalized speech rate could not have been calculated per clause otherwise (for an explanation, see below). The dataset also contained all (n= 87) Dutch unilingual sentences from the corpus (171 clauses across 14 speakers) and a sample of 92 Papiamento unilingual sentences (251 clauses across 14 speakers). Sentences of all lengths were included – also the ones containing only one clause – to ensure the maximum number of tokens. Sentences with more than one interruption were not included; neither were one-word sentences and speech with laughter. Laughter cannot be

[15] For reference, the total number of speakers in the corpus is 25.

counted towards speech; such sentences would skew the duration measurements. Sentences from speakers that were not represented in all three samples were excluded to ensure adequate comparisons. This meant that 25 unilingual Dutch sentences (i.e. complex clauses) were excluded (54 clauses across 8 speakers). Consequently, unilingual Papiamento sentences were not included for these speakers in the first place. Crucially, as many bilingual sentences as possible were included in the dataset.

Sentences were first separated based on the language of the sample (Papiamento, Dutch, both) and for the purpose of the statistical comparison they were ascribed a type (bilingual or unilingual). Within sentences, all clauses were coded for language (Papiamento or Dutch), and sentence position (i.e. in which order they occurred in the sentence) – even if the sentence contained only one clause, which was sometimes the case in the unilingual Dutch sample. Given that the first clause cannot be counted as a switch (it is not preceded by other material within the sentence), this sometimes led to low variability in the sentence position of clauses in bilingual sentences. The sentence position coding (see first column in Table 3) was therefore only included to look at speech rates within sentences, rather than compare the position of codeswitches across sentence types (cf. Johns & Steuck, 2021). To account for differences in sentence length, sentence position was normalized by dividing the clauses' position by the total number of clauses in the sentence. This gave each clause a value between 0 and 1, representing its position within the sentence. An example of the coding of an entire bilingual sentence is presented in Table 3 below.

Speech rate was calculated as the number of syllables in each clause divided by the duration of the clause in seconds. The duration of the clauses was extracted using Praat (Boersma & Weenink, 2021). I counted the number of syllables in each clause for all 228 sentences in the dataset. Filled pauses (e.g. 'uhm') were counted towards to number of syllables of a clause. If the number of syllables was ambiguous (e.g. due to a potential diphthong), I checked the recording for the correct segmentation. In order to draw a direct comparison between Papiamento and Dutch, the speech rates were normalized within speakers. This means that every speakers' average Papiamento unilingual speech rate was subtracted from the speech rates of all Papiamento clauses from that speaker in both bilingual and unilingual sentences, likewise for Dutch. The resulting values represent the magnitude of the difference from each speaker's unilingual speech, levelling the differences between Papiamento and Dutch (Johns & Steuck, 2021, p. 3).

Table 3 Example and coding of bilingual sentence, made up of unilingual clauses[a]

Position of clause	Normalized position of clause	Language	Transcription
0	0,00	P	bo por siñanan pero 'you could teach them but'
1	0,50	D	*het dringt gewoon niet door* 'it doesn't get through'
2	1,00	P	paso.. nan no sa miho 'because they don't know better'

[a] Source: Papiamento-Dutch corpus, conversation 5, records 0924-0926; P= Papiamento, D= Dutch (in italics), [..]= short pause; for readability, one interruption is not shown.

5.3 Statistical analysis

Before presenting the analyses that I used to assess my data, it is important to acknowledge the fact that the number of tokens per analysis is very low. This means that the results in Section 6 should be taken as a reflection of possible outcomes within the data, not an absolute indication of effects in Papiamento-Dutch CS in general. I present the analyses and results as I would have for a larger more encompassing data set. All analyses are executed in R (R Core Team, 2021).

I ran a chi-square test on the stress data (see Section 5.2.1). Pearson's chi-square test is used to determine whether there is a statistically significant difference between the expected frequency and the observed frequency in one or more categories. The category I looked at was 'match in stress pattern' for CS NPs and unilingual NPs. I tested whether or not it is more likely for the stress pattern of a noun in a CS NP to match the stress pattern of its TE than for a noun in a unilingual NP.

I ran a loglinear analysis on the tone data (see Section 5.2.2). This analysis examines the relationship between two or more categorical variables. As mentioned before, the tone data was coded into three distinct data sets, so I ran three separate analyses. In the first analysis, I included the following variables (see below for examples): (i) relative position of the target to the switch (preceding, following); (ii) phrase type of the switch (AdjP, AdvP, ConjP, NP, PP, VP); (iii) phrasal position of the target in relation to the switched phrase (within, across); and (iv) tone of the target ('HL, 'LH, L'H). The second analysis included the variables: (i) relative position of the target to the switch (preceding, following); (v) syntactic category of the switch (specifier, adjunct, complement); and (iv) tone of the target ('HL, 'LH, L'H). The third loglinear analysis included: (i) relative position of the target to the switch (preceding, following); (vi) relative position of the target to the verb (pre vs. post verbal); (iv) tone of the target ('HL, 'LH, L'H). In the case of a significant interaction, I ran a Fisher's Exact test as a follow-up to break down the effects. This test is a chi-square test for small samples; it helped determine the direction of the interaction.

(i) Preceding: pasa un dushi **verblijf**[16] (conv. 1, rec. 0549)

spend a nice stay

'have a nice stay'

Following: un **elftal** mixto (conv. 3, rec. 0141)

a soccer team mixed

'a mixed soccer team'

(ii) NP: unda **officiële** **taal** ta Hulandes (conv. 6, rec. 0573)

where official language is Dutch

'where Dutch is the official language'

PP: paso **in** **het** **begin** (conv. 1, rec. 0343)

because in the beginning

'because in the beginning'

(iii) Within: e ta hopi **algemeen** (conv. 6, rec. 0059)

it is very general

'it is very general'

Across: **hypocriet** pero bo mes sa (conv. 4, rec. 0600)

hypocritical but you self know

'hypocritical but you yourself know'

(iv) 'HL: …Nijmegen ta hopi **gevaarlijk** (conv. 5, rec. 1066)

…Nijmegen is very dangerous

[16] The Dutch insertions are in boldface, and the targets are underlined. In (vi) the verb, or rather finite marker, is in italics.

‘…Nijmegen is very dangerous’

‘LH: ya porta ta un **oordeel** pero (conv. 2, rec. 0957)

well maybe is a judgment but

‘well maybe it’s a judgment but’

L’H: e **babystoel** patras pero (conv. 6, rec. 0342)

the baby seay in rear but

‘the baby seat in the back but’

(v) Specifier: unda **officiële taal** ta Hulandes

Adjunct: paso **in het begin**

Complement: pasa un dushi **verblijf**

(vi) Preverbal: unda **officiële taal** *ta* Hulandes

Postverbal: e *ta* hopi **algemeen**

Lastly, I ran a multiple regression analysis on the speech rate data (see Section 5.2.3). I tested whether normalized utterance position (value between 0 and 1) within the sentence, type of sentence (bilingual vs. unilingual) and their interaction are good predictors of normalized speech rate. Sentence type, being a categorical variable, was introduced as a factor with two levels. The analysis produced a model of which I present the results in Section 6.3.

6. Results

Chapter 6 presents the results of the statistical analyses that I announced in Section 5.3. This chapter is again divided into sections based on the different prosodic variables and their respective data sets. Section 6.1 presents the results for the stress data, Section 6.2 for the tone data and Section 6.3 for the speech rate data. The (empty cells in the) tables in these sections make the low number of data points very evident. I want to preface the results with a repetition of the need for caution in the interpretation of the results.

6.1 Stress

This section presents the results of the chi-square test that was performed on the stress data. With this analysis, I intended to find out whether or not it is more likely for the stress pattern of a N in a CS NP to match the stress pattern of its TE than for a N in a unilingual NP. Table 4 contains an overview of the input for the statistical analysis. The contingency table shows the number of items with stress matches with their TEs for the CS NPs and the Pap unilingual NPs and the number of items that do not have a stress match with their TE for both categories.

Table 4 Contingency table: stress data

	CS NPs	Pap unilingual NPs
Stress match	17	329
No stress match	30	163

There is a significant association between the type of NP (codeswitched vs. unilingual) and whether or not the stress pattern of the TE would match, $\chi^2(1) = 17.59$, $p < 0.001$. This represents that, based on the odds ratio, the odds of a stress match were 0.28 (0.14-0.54) times higher (i.e. 3.55 times lower) if the noun was in a codeswitched NP.

6.2 Tone

The following sections each present the results of one of the tone data sets. Section 6.2.1 contains the outcomes for the analysis that includes the phrase type variable, Section 6.2.2 for the analysis that includes the variable of syntactic category, and Section 6.2.3 for the analysis that includes the variable of relative position of the target to the verb.

6.2.1 Phrase types

The four-way loglinear analysis produced a final model that retained four two-way interaction effects. The likelihood ratio of this model was $\chi^2(49)= 27.29$, $p= 0.995$. This model represents the fact that the interactions between the relative position of the target to the switch and the phrasal position of the target in relation to the switched phrase ($\chi^2(1)= 7.06$, $p= 0.008$), the relative position of the target to the switch and the phrase type of the switch ($\chi^2(5)= 24.66$, $p< 0.001$), the phrasal position of the target in relation to the switched phrase and the phrase type of the switch ($\chi^2(5)= 14.46$, $p= 0.013$) and the phrasal position of the target in relation to the switched phrase and the tone of the target ($\chi^2(2)= 34.56$, $p= 0.00$) were significant. To break down these effects, separate two-tailed Fisher's Exact tests were performed on the phrasal position, the phrase type and the tone variables for each level of the position in relation to the switch (i.e. preceding, following). For both 'preceding' and 'following' there were significant associations between the phrasal position and the tone ($p= 0.007$; $p= 0.008$). Additionally, for 'preceding' the association between the phrase type and the tone was significant ($p< 0.001$).

Table 5 Contingency table targets preceding switch: number of items occurring across or within switched phrase per phrase type

		AdjP	AdvP	ConjP	NP	PP	VP
'HL	Across	3	-	-	1	-	2
	Within	8	-	-	7	-	-
'LH	Across	3	4	1	6	6	-
	Within	-	-	-	-	-	-
L'H	Across	1	2	-	-	2	1
	Within	-	-	-	1	-	-

Table 6 Contingency table targets following switch: number of items occurring across or within switched phrase per phrase type

		AdjP	AdvP	ConjP	NP	PP	VP
'HL	Across	2	1	-	2	-	-
	Within	-	-	-	4	-	-
'LH	Across	3	1	-	13	-	-
	Within	-	-	-	-	-	-
L'H	Across	-	-	-	2	-	-
	Within	-	-	-	-	-	-

Table 5 shows that most targets preceding the switch occur across the phrasal boundary of the switched phrase for all phrase types. Only the across vs. within ratios for the AdjP and NP are more equal (n across= 7 vs. n within= 8 for both phrase types). The table also shows that most targets with a 'HL tone occur within the switched phrase, and that the targets with a 'LH or L'H tone all occur across the boundary of the switched phrase. Table 6 shows that – similar for targets preceding the switch – targets following the switch with a ‘LH or L’H tone all occur across the boundary of the switched phrase. On the other hand, the targets with a ‘HL tone almost equally occur across vs. within the switched phrase (n= 5 vs. n= 4 respectively).

6.2.2 Syntactic categories

The three-way loglinear analysis produced a final model that retained all effects. The likelihood ratio of this model was $\chi^2(0)= 0.00$, $p= 0.000$. This indicated that the highest order interaction (position to switch x syntactic category x tone) was significant, $\chi^2(4)= 11.96$, $p= 0.018$. To break down this effect, separate two-tailed Fisher’s Exact tests were performed on the syntactic category and the tone variables for each level of the position to switch (i.e. preceding, following). Only ‘following’ yielded a significant association between the syntactic category of the switch and the tone of the target ($p< 0.001$). Table 7 shows the number of items per syntactic category per tone for the targets preceding the switch, for which no significant effects were found. Table 8 shows that the syntactic category of the switch was a complement for most targets following the switch (n= 22) and that most of these targets have a ‘LH tone (n= 15).

Table 7 Contingency table targets preceding switch: number of items per syntactic category per tone

	Adjunct	Complement	Specifier
‘HL	2	12	5
‘LH	17	6	1
L’H	2	2	-

Table 8 Contingency table targets following switch: number of items per syntactic category per tone

	Adjunct	Complement	Specifier
‘HL	2	1	-
‘LH	5	15	2
L’H	2	1	-

6.2.3 Pre vs. postverbal targets

The three-way loglinear analysis produced a final model that retained three main effects. The likelihood ratio of this model was $\chi^2(7)= 11.17$, $p= 0.131$. This model represents the fact that there were no interactions between the predictors and the frequencies of each predictor only differed significantly for the levels of that predictor. There was a main effect of position to the switch ($\chi^2(2)= 18.36$, $p< 0.001$), position to verb ($\chi^2(1)= 5.79$, $p= 0.016$) and tone ($\chi^2(1)= 9.89$, $p= 0.002$). Tables 9 and 10 show the number of items in pre- and post-verbal position per tone for targets preceding the switch and following the switch respectively. The main effects signify that most targets preceded the switch (n= 45 vs. n= 25); most targets occurred post-verbally (n= 48 vs. n= 22); most targets had either a ‘HL tone (n= 29) or a ‘LH tone (n= 33 vs. n=2).

Table 9 Contingency table targets preceding switch: number of items in pre- and post-verbal position per tone

	Pre-verbal	Post-verbal
‘HL	3	18
‘LH	9	9
L’H	3	3

Table 10 Contingency table targets following switch: number of items in pre- and post-verbal position per tone

	Pre-verbal	Post-verbal
‘HL	2	6
‘LH	5	10
L’H	-	2

6.3 Speech rate

This section presents the results of the multiple regression analysis that was performed on the speech rate data. The analysis produced a model with sentence type and normalized sentence position as the predictor variables and normalized speech rate as the outcome variable. Table 11 presents the significance value of the model and its variables, as well as the sum of squares, beta values and their standard error.

Table 11 Multiple regression model speech rate data

	ΔR^2	***B***	***SE B***	***P***
	0.0064			.3047
Constant		0.13	0.14	.350
Sentence type (bi)		-0.074	0.30	.805
Sentence position		-0.27	0.23	.234
Type (bi):Position		-0.19	0.46	.678

The model accounts for only 0.64% of the variance in the normalized speech rate data at a non-significant level (p= .305). As sentence type changes from bilingual to unilingual, normalized speech rate decreases by 0.074 units (i.e. syllables/s) at a non-significant level (p= .805). As normalized sentence position increases by one unit (i.e. the next clause in the sentence), normalized speech rate decreases by 0.27 syllables/s at a non-significant level (p= .234). There is no contribution of the interaction between the two variables to the variance in the normalized speech rate (p= .678).

7. Discussion

This chapter is organized in a way that resembles the structure of Chapter 6 by discussing each of the phonetic variables in a separate section: stress in Section 7.1, tone in Section 7.2, and speech rate in Section 7.3. After that, I combine the trends I have found in a general discussion to answer my overarching question on whether prosody constrains CS. The chapter is concluded by a brief section that considers the limitations of this study.

7.1 Stress

The research question I set out to answer about the possible constraining properties of stress on CS from Chapter 4 is repeated below in (38).

(38) Is Papiamento-Dutch CS in the nominal domain constrained by stress?

To answer this question, I compared the likelihood of a stress match between a noun and its TE in codeswitched vs. unilingual Papiamento NPs. Hence, I compared stress matches of nouns in codeswitched NPs and their TE to stress matches of nouns in unilingual NPs and their TE. The results of the chi-square test showed that there is a significant association between the type of noun (codeswitched vs. unilingual) and whether or not the stress pattern of its TE would match. This represented that the odds of a stress match were 3.55 times lower if the noun was in a codeswitched NP. These findings do not match my hypothesis, which was that the stress pattern of a noun in a codeswitched NP would be more likely to match the stress pattern of its TE than the stress pattern of a noun in a unilingual NP. I argued for this by extending the Equivalence Constraint (Poplack, 1980) to include that switches are most likely to occur at points in discourse where the surface stress patterns of the two languages match each other. Along the same lines, Akinremi (2016) found that the integration of English verbs in the Igbo morpho-syntactic frame is constrained by the adaptation of English stress to match the tone in Igbo affixes (i.e. a match in prosodic features). Following this, it seemed plausible that the switch of a noun is constrained to (or at least more likely to occur at) a site where stress patterns match.

Firstly, given that the amount of stress research within the domain of CS is very slim, Akinremi (2016) provided the only findings I could base myself on. The results might not be corroborated by those findings because the relevant prosodic systems of the Igbo-English language pair do not entirely match those of the Papiamento-Dutch language pair. On the one hand, Igbo has tone but lacks stress, and English has stress but lacks tone. On the other hand, Papiamento and Dutch both have stress, and Papiamento also has tone. The difference between my results and my hypothesis could partly be reflected in the difference between the union of two similar suprasegmental properties (i.e. Papiamento and Dutch stress) and the prosodic integration of one type of suprasegmental into another (i.e. English stress into Igbo tone).

The fact that the results do not seem to reflect the extension of the Equivalence Constraint could be explained by a lack of applicability of this constraint on prosodic structure. Originally, this constraint was applied only to the morpho-syntax of CS. Torres Cacoullos (2020) does also extend the Equivalence Constraint to investigate prosodic variables in spontaneous Spanish-English CS, but in a sense that still only applies to syntactic sites of variable equivalence – which can be mitigated by prosody. In Section 2.2.2, I also mention that Zheng's (1997) findings of the constraints on switches to English after Mandarin tones could be seen as an extension of the Equivalence Constraint, since the switches occur at the sites where the prosodic features of the two languages coincide. However, the Equivalence Constraint has already received criticism in the past for not being representative of different CS patterns, because linguistic structure alone cannot account for all patterns observed in codeswitched speech (e.g. Muysken, 2000; cf. Poplack, 1980). This does not mean that the constraint has no merits as a descriptor of CS, but simply that it is not able to describe my findings – and CS in general – by itself.

Before considering any further explanations for my results, I need to reiterate that my findings are based on a very limited data set. There is a large discrepancy between the number of items for the codeswitched vs. the unilingual NP category (see Section 6.1, Table 4). The size of the data set is thus not ideal for conclusive answers to my research question. Nevertheless, the data I used for my analysis comes from an understudied population, and the importance of including these populations sometimes outweighs the need for a homogenous, large participant pool. Most of what is known about bilingualism comes from so-called WEIRD (Western, Educated, Industrialized, Rich, Democratic) participants, but these participants are not really representative of entire populations (see e.g. Azar, 2010; Henrich, Heine & Norenzayan, 2010 for a discussion). This highlights the need for both naturalistic, ecologically valid data and more artificial, controlled, experimental data (Gullberg, Indefrey & Muysken, 2009). The data from the Papiamento-Dutch conversation corpus may be ecologically valid, but it does not allow much control over the factors that constrain CS.

The discussion above has mostly been concerned with why my results do not match my hypothesis. Now I aim to explain my results in consideration of other CS literature. The results were the opposite of what I expected: a stress match between a noun and its TE was more likely in unilingual Papiamento NPs than in codeswitched NPs. Does this mean that Papiamento-Dutch CS in the nominal domain is constrained to non-stress matches between a noun and its TE? I do not believe so. First of all, the fact that the probability of a stress match was higher in unilingual NPs might be a direct reflection of the much larger number of data points in the unilingual vs. codeswitched NP category. Secondly, such a constraint would be too harsh of an inference, seeing as there are most certainly cases of switching when the stress pattern of a Dutch inserted noun matches that of its Papiamento TE, as seen in example (29) in Section 4.3, repeated below in (39).

(39)	CS NP		CS NP (Papiamento TE)	
	un **par'tij**	(conv. 3, rec. 1014)	un par'tido	'a (political) party'

Then, a logical interpretation could be that a constraint-based approach might not be able to accurately describe stress in Papiamento-Dutch CS in the nominal domain. Taking a step back to the more general question in (38), the results could also mean that stress simply does not constrain CS in this case. Given that the separate monolingual stress systems do not seem to form a constraint on switching, one could carefully take this as evidence towards an integrated bilingual grammar that includes prosodic features, since the lexical items are selected from the lexicon regardless of stress in either language. How exactly this would be implemented lies beyond the scope of this thesis, but López' (2020) MDM model includes a list that takes care of assigning a phonetic form to syntactic terminals. This, or an additional suprasegmental list may also assign stress in a way that integrates the monolingual prosodic systems.

7.2 Tone

In (40) below I repeat my research question concerning the constraining properties of Papiamento tone on Dutch insertions.

(40) Is the position and/ or the form of switches constrained by the tone of the surrounding Papiamento words?

I hypothesized that the position and form of Dutch insertions would indeed be constrained by the tone of adjacent Papiamento words. I analyzed the tone of Papiamento words (‘HL vs. ‘LH vs. L’H) surrounding Dutch insertions, taking into consideration the relative position of the target to the switch (preceding vs. following), the phrasal position of the target in relation to the switched phrase (within vs. across), the phrase type of the switch (AdjP, AdvP, ConjP, NP, PP, VP), the syntactic category of the switch (specifier vs. adjunct vs. complement), and the position of the switch to the verb (pre vs. postverbal). The results showed that most targets preceded the switch, most targets occurred post-verbally, and most targets had either a ‘HL tone or a ‘LH tone.[17] Most targets with a ‘HL tone occurred in an AdjP or a NP, and most targets with a ‘LH tone occurred in a NP. Most targets with a ‘HL tone occur within the switched phrase – especially targets preceding the switch, and targets with an ‘LH or L’H tone all occur across the boundary of the switched phrase. In targets following the switch, the syntactic category of the switch was significantly more often a complement than a specifier or adjunct, and the tone of most of those targets was significantly more often a ‘LH tone than a ‘HL or a L’H tone. From these results, we can deduce, among other things, that all targets with LH tone (regardless of stress) occur across the phrasal boundary of the switch, that targets that occur within the same phrase as the switch mostly have ‘HL and mostly precede the switch, and that most switches occur around targets with penultimate stress.

[17] For the exact numbers of the tone analysis results, see Section 6.2.

It seems that the results indicate that the position of Dutch insertions is to some extent constrained by Papiamento tone because they exclusively occur within a phrase with targets with HL tones (i.e. not with target with LH tones), and most switches occur post-verbally. The form of the Dutch insertions (i.e. phrase type or syntactic category) does not necessarily seem to be constrained by Papiamento tone, because – even though there are general trends – there is a lot of variability in the types of phrases where the Dutch insertions occur, as well as the type of general syntactic category to which they belong. Only when the tonal target followed the insertion, most of them were complements. Interestingly, most of these Dutch complements were followed by a ‘LH tone which is not in line with the general prediction of declination in Dutch prosody. However, the complements were of course inserted in an otherwise Papiamento utterance. Dutch prosody might thus not be of much influence after the insertions. Additionally, these ‘LH tones always occurred across the phrasal boundary, potentially in a new Intonational Phrase (see Section 4.2). This latter claim is difficult to confirm because I analyzed tone at the lexical level, not taking Papiamento intonation into account (see e.g. Remijsen & Van Heuven, 2005). The reason for this was mainly the fact that the Papiamento-Dutch bilingual speech corpus (Gullberg, Indefrey & Muysken, 2004) did not include a prosodic annotation. Lacking the native knowledge to provide this myself, I deemed it better to start the researching tone on Papiamento-Dutch CS at the lexical level. I did take the surrounding syntactic structure into account to provide a grammatical context for my findings on tone. Adding intonation to the analyses of tone could be something to pursue in future research. Continuing the discussion on declination, the ‘HL tones that occur in the same phrase as the Dutch insertions usually precede it. This would be compatible with the possibility that within the same phrase the pattern of declination does apply. Declination typically applies to a whole utterance. In my data, it would then apply in the sense that, like Dutch utterances, the tone follows the pattern of pitch lowering within the phrase of the Dutch insertion. These findings are generally in accordance with my hypothesis. The strength of the above claims needs to be considered with care again though, due to the many empty cells in my data tables (see Section 6.2).

The exploratory nature of my research question makes it difficult to directly place my findings in the context of the literature. So far, studies of tone in CS have investigated the integration of other language material on a purely suprasegmental basis (Zheng, 1997; Tuc, 2003). By this I mean to say that previous research has not considered syntactical variables in relation to tonal constraints on CS in the way that I have. Torres Cacoullos (2020) did find that switches at the main and complement clause boundary in Spanish-English CS are essentially constrained so that the clauses may not be uttered in the same Intonation Unit (see Section 2.2). This is to some extent comparable to my finding that Dutch insertions exclusively occur within a phrase with targets with HL tones. It should be mentioned that my analysis only included disyllabic Papiamento words with tone, so the inclusion of mono- and polysyllabic words in potential future research may alter this finding.

Given that most switches occurred around either a ‘HL or a ‘LH tone, another interesting finding of this analysis is that switches occurred most often around a Papiamento word with penultimate stress. This is a noteworthy finding with regard to my discussion of stress in the previous section. Maybe the stress of the switched material itself does not constrain CS, but the stress of the surrounding material. This could be interpreted as support for the Triggering Hypothesis (Clyne, 2003; Broersma & De Bot, 2006) which states that spontaneous CS can be triggered by cross-language phonological overlap (see Section 2.2.3).

7.3 Speech rate

My analysis of speech rate is based on the study by Johns & Steuck (2021). Hence, I formulated the research question in (32) in Section 4.3, repeated below in (41). The answer to this question sheds light on speech planning in CS and, in turn, the advantages CS may provide for bilingual speakers.

(41) Is the speech rate in bilingual utterances faster than the speech rate in unilingual utterances?

My hypothesis followed their finding: speech rates during CS (or, while in a bilingual mode) are faster than unilingual speech rates (see Section 2.2.3). My analysis of speech rate resulted in a non-significant model that only represented 0.64% of the variance in the data (see Section 6.3). At a non-significant level, the results showed a slower speech rate in bilingual utterances, and a slowdown in speech rate within utterances in general. These findings are not in line with my hypothesis or Johns & Steuck's (2021) results. This is most likely, again, related to the limited number of data points. The inclusion of sentences was based on whether they were made up of unilingual clauses (or utterances), and most of the switches to Dutch (given that the ML in most of the corpus was Papiamento, switches to Papiamento were extremely rare) were nominal insertions. Nevertheless, using this criterium to include sentences was the only way to ensure the possibility of normalizing the data across languages, and it makes my findings my findings more comparable to those of Johns & Steuck. Their results suggest that CS is associated with a global facilitation in speech rates, which argues for the idea that CS is used by bilinguals to aid speech planning and production.

One might say that the trend of slower speech rates in bilingual sentences in my findings are more like those of Fricke, Kroll & Dussias (2016) who found that articulation rates preceding a switch were longer than in matched unilingual utterances. This is indicative of a processing cost when speakers switch languages in spontaneous speech. This study crucially differs from Johns & Steuck's (2021) in the measure for speech rate (excluding pauses vs. including pauses) and the domain across the rate is measured (pre-switch vs. entire utterance). These measurement differences make it hard to align my findings with those of Fricke, Kroll & Dussias, besides the fact that my results were not significant.

As I mentioned before, speech rate does not directly constrain CS. Rather, it is a prosodic measure of planning and production costs in CS. Assessing articulation rate in spontaneous Papiamento-Dutch CS – which would allow the inclusion of utterances with single word insertions – might be able to tell us more about these costs in this language pair.

7.4 General discussion

Does prosody constrain CS? I hypothesized, based on the individual phonetic variables I analyzed, that CS would indeed be constrained by prosody. The preceding sections in this chapter have revealed, however, that my findings cannot provide a definitive answer to that question. On the one hand, Section 5.2.1 shows that the stress of the switched material does not seem to constrain Papiamento CS, which could be interpreted as a careful hint towards an integrated bilingual lexicon (see Section 7.1). On the other hand, the discussion in Section 7.2 seems to indicate that the stress of the material surrounding a switch could potentially be a constraining factor to the occurrence of that switch. The lack of research on stress in the CS domain leaves me to speculate about an explanation for these findings. I think that bilingual speech planning might play a role here. For example, when a bilingual Papiamento-Dutch speaker plans a Papiamento utterance and encounters a word with penultimate stress, it is more likely for a switch to Dutch to occur. The stress pattern of the material that is then switched is not of influence on the occurrence of the switch. This is a facilitative approach that argues in favor of the Equivalence Constraint (Poplack, 1980) and the Triggering Hypothesis (Clyne, 2003; Broersma & De Bot, 2006): switches are more likely to occur within clauses that contain words that are phonologically similar across a bilingual's two languages. The suggested future research on the articulation rate (see Section 7.3) in combination with a distinction between a match vs. mismatch in stress in the part of an utterance that precedes a switch could provide an interesting addition to speech planning research in CS. This highlights the importance of prosody research in the CS domain, because it can inform other properties of CS.

Along these lines, my speech rate analysis did not find support for Johns & Steuck's (2021) claims of CS being associated with generally faster in speech rates. However, their interpretation is also facilitative in a way: CS facilitates speech rate as a means to aid speech planning.

The results of my tone analysis, in which tone seemed to operate as a constraining factor, could also be reinterpreted in a way that switches (i.e. Dutch insertions) are actually facilitated by preceding 'HL tones within the same phrase. This is also in accordance with Zheng's (1997) and Tuc's (2003) facilitative interpretation of switching at sites where the prosodic features of the two languages coincide.

The facilitative nature of my findings is not necessarily incompatible with a constraint-based approach. My findings show how a switch is more likely to occur under certain circumstances, but that this facilitation is constrained to particular contexts. The prosodic systems of both languages contribute to the production of bilingual speech in a way that CS aids communication between bilinguals. This is in alignment with Beatty-Martinez, Navarro-

Torres & Dussias' (2020) claim that CS is "a toolkit, or an opportunistic strategy for optimizing task performance in cooperative communication" (p. 2). They consider the advantages that CS may offer to bilinguals in interactions with each other. The study finds support for the notion that both languages can openly contribute to bilingual production because both languages remain active and accessible. The constrained faciliatory properties of prosody on CS, and the previously found facilitation of speech planning contribute to support for that same notion.

Before discussing my limitations in the next section, I would like to emphasize that this thesis provides innovation to the field of CS research. Such a wide array of prosodic features has not yet earlier been examined in a language pair.

7.5 Limitations

An important part of research is the acknowledgment of the limitations of your analyses. This helps to put the discussion into perspective, and it inspires subsequent improvements. This section provides a brief overview of the limitations of my study. I also propose ways on how to improve upon these limitations.

A big limitation throughout my thesis has been the low number of data points. This restricts the ability to find conclusive answers to my research questions and generalize my findings to CS in a more general sense. Of course, more data collection of spontaneous bilingual Papiamento-Dutch speech would resolve this issue. It would be especially beneficial to collect data in other Papiamento-Dutch speaking communities. As mentioned before, CS is a learned behaviour and that different patterns may be learned in different bilingual communities (Valdés Kroff, 2016). Moreover, Papiamento-Dutch CS in the Antilles, where Papiamento is more dominant than in the Netherlands, could also provide more variety in the observed patterns. This could all provide insight into the reproducibility of my findings across communities, and it could reveal potential community norms. Additionally, it might broaden the data to include variation in the ML, as Papiamento was consistently the ML in my data.

Future research should also take intonation into account to a larger extent than I have. The exploratory nature of my research led me to focus on a smaller prosodic domain, rather than considering entire utterances. This could inform the analyses of Papiamento tone to a higher degree because of the potential interaction with intonation (it also being pitch correlate).

8. Conclusion

In this thesis, I set out to answer the question: does prosody constrain CS? Additionally, I set out to find support for or evidence against the existing findings in the literature that CS facilitates speech rates, and thus speech planning. I explored these topics by examining stress, tone and speech rate in spontaneous Papiamento-Dutch CS data from a bilingual conversation corpus (Gullberg, Indefrey & Muysken, 2004). I considered whether stress and tone could constrain CS. My findings certainly contain trends that suggest prosody constrains CS. The nature of these constraints lies in the prosodic context of the sites where switches can occur. My findings also highlight that prosody facilitates CS. Switching tended to be facilitated at sites where the prosodic systems of Papiamento and Dutch coincided (Zheng, 1997; Tuc, 2003). I therefore conclude that CS is facilitated by prosody, in a constrained prosodic context. This conclusion aligns with the view that CS may be an opportunistic strategy that bilinguals use to aid speech planning, seeing as prosody in both languages openly contributes to production (Beatty-Martinez, Navarro-Torres & Dussias, 2020).

Overall, my thesis provides new innovative insights into the prosodic influences on CS. It also underlines the importance of testing the different approaches to CS and the inclusion of understudied communities or language pairs. While the exact effects of prosody on codeswitching are yet to be fully understood, I hope this thesis inspires people to pursue this line of research in the future.

9. References

Akinremi, I. (2016). Structural patterns and strategies of codeswitching in Igbo-English bilingual discourse. *Studies in African Linguistics, 45*(1/2), 1-25.

Azar, B. (2010). Are your findings 'WEIRD'? *Monitor on Psychology*, *41*(5). http://www.apa.org/monitor/2010/05/weird

Backus, A., & Dorleijn, M. (2009). Loan translations versus code-switching. In B. E. Bullock & A. J. Toribio (Eds.), *The Cambridge Handbook of Linguistic Code-switching* (pp. 75-94). Cambridge: Cambridge University Press.

Balam, O., Parafita Couto, M. C., & Stadthagen-González, H. (2020). Bilingual Verbs in Three Spanish/English Code-Switching Communities. *International Journal of Bilingualism*. Available via Online First.

Beatty-Martínez, A. L., Navarro-Torres, C. A., & Dussias, P. E. (2020). Codeswitching: A bilingual toolkit for opportunistic speech planning. *Frontiers in Psychology, 11*. https://doi.org/10.3389/fpsyg.2020.01699

Blanco-Elorrieta, E., Emmorey, K., & Pylkkänen, L. (2018). Language switching decomposed through MEG and evidence from bimodal bilinguals. *Proceedings of the National Academy of Sciences, 115*(39), 9708-9713. https://doi.org/10.1073/pnas.1809779115

Blokzijl, J., Deuchar, M., and Parafita Couto, M. C. (2017). Determiner asymmetry in mixed nominal constructions: the role of grammatical factors in data from miami and nicaragua. *Languages, 2*(4). doi: 10.3390/languages2040020

Boersma, P., & Weenink, D. (2021). Praat: doing phonetics by computer [Computer program]. Version 6.0.36. Retrieved from http://www.praat.org/

Bullock, B. E. (2009). Phonetic reflexes of code-switching. In B. E. Bullock & A. J. Toribio (Eds.), *The Cambridge Handbook of Linguistic Code-switching* (pp. 163-181). Cambridge: Cambridge University Press.

Bullock, B. E., & Toribio, A. J. (2009). *The Cambridge Handbook of Linguistic Code-Switching*. Cambridge, UK: Cambridge University Press.

Cantone, K. F., & MacSwan, J. (2009). The syntax of DP-internal codeswitching. In L. Isurin, D. Winford, & K. de Bot (Eds.), *Multidisciplinary approaches to codeswitching* (pp. 243–278). Amsterdam: John Benjamins Publishing.

Cantone, K. F., & Müller, N. (2008). Un nase or una nase? What gender marking within switched DPs reveals about the architecture of the bilingual language faculty. *Lingua*, *118*, 810–826.

Chafe, W. (1994). Discourse, consciousness, and time. *Discourse, 2*(1).

Chomsky, N. (1995). *The minimalist program*. Cambridge, MA: MIT Press.

Collins, B. (2003). Pitch, tone and intonation. In B. Collins & I. M. Mees (Eds.), *The phonetics of English and Dutch* (pp. 245-255). Leiden: Brill.

Costa, A., & Santesteban, M. (2004). Lexical access in bilingual speech production: Evidence from language switching in highly proficient bilinguals and L2 learners. *Journal of Memory and Language, 50*(4), 491–511.

Deuchar, M. (2005). Congruence and Welsh-English code-switching. *Bilingualism, 8*(3), 255-269.

Deuchar, M. (2012). Code-switching. In Chapelle, C. A. (Ed.) *Encyclopedia of Applied Linguistics* (pp. 657-664). New York: Wiley.

Deuchar, M. (2020, July). *Questioning assumtions in code-switching research* [Video file]. Retrieved from https://aovivo.abralin.org/en/lives/margaret-deuchar-2/

Deuchar, M., Davies, P., Herring, J., Parafita Couto, MC., & Carter, D. (2014). Building bilingual corpora. In E. M. Thomas, & I. Mennen (Eds.), *Advances in the Study of Bilingualism* (pp. 93-110). Bristol, U.K.: Multilingual Matters.

Di Sciullo, A. M. (2014). On the Asymmetric Nature of the Operations of Grammar: Evidence from Codeswitching. In J. MacSwan (Ed.), *Grammatical Theory and Bilingual Code-switching* (pp. 63–85). Cambridge: MIT Press.

Du Bois, J. W., Schuetze-Coburn, S., Cumming, S., & Paolino, D. (1993). Outline of discourse transcription. In J. A. Edwards & M. D. Lampert (Eds.), *Talking data: Transcription and coding in discourse research* (pp. 45–89). New York: Psychology Press.

ELAN [Computer software]. (2004). Nijmegen: Max Planck Institute for Psycholinguistics, The Language Archive. Retrieved from https://archive.mpi.nl/tla/elan

Eppler, E. D., Luescher, A., & Deuchar, M. (2017). Evaluating the predictions of three syntactic frameworks for mixed determiner-noun constructions. *Corpus Linguistics and Linguistic Theory, 13*(1), 27-63.

Fairchild, S., & Van Hell, J. G. (2017). Determiner-noun code-switching in Spanish heritage speakers. *Bilingualism: Language and Cognition* 20(1), 150-161.

Fricke, M., Kroll, J. F., & Dussias, P. E. (2016). Phonetic variation in bilingual speech: A lens for studying the production-comprehension link. *Journal of Memory and Language, 89,* 110-137.

Gardner-Chloros, P. (2009). Social factors in code-switching. In *Code-switching* (pp. 42-64). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511609787.004

Gingràs, R. (1974). Problems in the description of Spanish-English intra-sentential code-switching. In G.D. Bills (Ed.), *Southwest Areal Linguistics* (pp. 167-185). San Diego: Institute for Cultural Pluralism.

Gollan, T. H., & Ferreira, V. S. (2009). Should I stay or should I switch? A cost-benefit analysis of voluntary language switching in young and aging bilinguals. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 35*(3), 640–665.

Gullberg, M., Indefrey, P., & Muysken, P. (2004). Papiamento-Dutch code-switching conversation corpus. PID: https://hdl.handle.net/1839/00-0000-0000-0001-289F-4

Gullberg, M., Indefrey, P., & Muysken, P. (2009). Research techniques for the study of code-switching. In B. E. Bullock & A. J. Toribio (Eds.), *The Cambridge Handbook on linguistic code-switching* (pp. 21-39). Cambridge: Cambridge University Press.

Gumperz, J. J., & Hernandez-Chavez, E. (1971). Cognitive aspects of bilingual communication. In W.H. Whiteley (Ed.) *Language use and social change* (pp. 111-25), Oxford University Press.

Gussenhoven, C. (2014). Possible and impossible exceptions in Dutch word stress. In H. van der Hulst (Ed.), *Word stress: Theoretical and typological issues* (pp. 276-296). Cambridge University Press.

Henrich, J., Heine, S., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences, 33*(2-3), 61-83. doi:10.1017/S0140525X0999152X

Henriksen, N., Coetzee, A., García-Amaya, L. & Fischer, M. (2021). Exploring language dominance through code-switching: intervocalic voiced stop lenition in Afrikaans–Spanish bilinguals. *Phonetica*, *78*(3), 201-240. https://doi.org/10.1515/phon-2021-2005

Hyman, Larry (2001). Tone systems. In M. Haspelmath, E. König, W. Oesterreicher and W. Raible (Eds.), *Language typology and language universals: An international handbook,* Vol.2 (pp.1367–1380). Berlin & New York: Walter de Gruyter.

Jacobs, B., & Muysken, P. (2019). Heritage languages in a post-colonial setting: focus on Papiamentu. In S. Aalberse, A. Backus, P. Muysken (Eds.), *Heritage Languages: A Language Contact Approach* (pp. 203–223). John Benjamins Publishing Company.

Johns, M. A., & Steuck, J. (2021). Is codeswitching easy or difficult? Testing processing cost through the prosodic structure of bilingual speech. *Cognition*, *211*, 104634. https://doi.org/10.1016/j.cognition.2021.104634

Kager, R. (1995). The metrical theory of word stress. In J. A. Goldsmith (Ed.), *The handbook of phonological theory* (pp. 367–402). Cambridge, MA: Blackwell.

Koeneman, O., & Zejlstra, H. (2017). *Introducing Syntax*. Cambridge University Press.

Kootstra, G. J., & Şahin, H. (2018). Crosslinguistic structural priming as a mechanism of contact-induced language change: Evidence from Papiamento-Dutch bilinguals in Aruba and the Netherlands. *Language, 94*(4), 902-930.

Liceras, J. M., Fernández Fuertes, R., Perales, S., Pérez-Tattam, R., & Spradlin, K. T. (2008). Gender and gender agreement in bilingual native and non-native grammars: A view from child and adult functional–lexical mixings. *Lingua, 118*, 827–851.

Lipski, J. M. (2019). Field-Testing Code-Switching Constraints: A Report on a Strategic Languages Project. *Languages 4*(1). https://doi.org/10.3390/languages4010007

López, L. (2020). *Bilingual Grammar: Toward an Integrated Model*. Cambridge University Press.

MacDonald, M. C. (2013). How language production shapes language form and comprehension. *Frontiers Psychology,* 4:226. doi: 10.3389/fpsyg.2013.00226

MacSwan, J. (1999). *A minimalist approach to intra-sentential code-switching*. New York: Garland.

MacSwan, J. (2005). A minimalist approach to intra-sentential code-switching. *Rivista di Linguistica, 17.1*, 55-92.

Meuter, R. F., & Allport, A. (1999). Bilingual language switching in naming: Asymmetrical costs of language selection. *Journal of Memory and Language, 40*(1), 25–40.

Munarriz-Ibarrola, A., Ezeizabarrena M.-J., De Castro Arrazola, V., & Parafita Couto M. C. (2021). Gender assignment strategies and L1 effects in the elicited production of mixed Spanish-Basque DPs. *Linguistic Approaches to Bilingualism.* Available via Online First. https://doi.org/10.1075/lab.20016.mun

Muysken, P. C. (2000). *Bilingual Speech: A Typology of Code-mixing*. Cambridge: Cambridge University Press.

Muysken, P. (2013). Language contact outcomes as the result of bilingual optimization strategies. *Bilingualism: Language and Cognition 16*(4), 709-730. Cambridge University Press.

Muysken, P., Kook, H., & Vedder, P. (1996). Papamiento/Dutch code-switching in bilingual parent- child reading. *Applied Psycholinguistics, 17*(4), 485-505. Cambridge University Press.

Myers-Scotton, C. (1993). *Social motivations for codeswitching: Evidence from Africa*. Oxford: Clarendon Press.

Myers-Scotton, C. (1997). *Duelling languages: Grammatical structure in codeswitching*. Oxford: Oxford University Press.

Myers-Scotton, C. (2002). *Contact linguistics: Bilingual encounters and grammatical outcomes*. Oxford: Oxford University Press.

Nortier, J. (1990). *Moroccan Arabic-Dutch code-switching: among Moroccans in the Netherlands.* Dordrecht: Foris.

Parafita Couto, M.C., Bellamy, K., & Ameka, F. (forthcoming). Theoretical approaches to multilingual switching. In J. Cabrelli, A. Chaouch-Orozco, J. González Alonso, S. M. Pereira Soares, E. Puig-Mayenco & J. Rothman (Eds.), *Cambridge Handbook of Third Language Acquisition and Processing*. Cambridge University Press.

Parafita Couto, M. C. & Gullberg, M. (2017). Code-switching within the noun phrase: Evidence from three corpora. *The International Journal of Bilingualism, 23*(2), 695-714. https://doi.org/10.1177/1367006917729543.

Pfaff, C. (1976). Functional and syntactic constraints on syntactic variation in code mixing. In B. Steever et al. (Eds.), *Papers from the parasession on diachronic syntax* (pp. 248-59). Chicago: Chicago Linguistic Society.

Pfaff, C. W. (1979). Constraints on language mixing: Intrasentential code-switching and borrowing in Spanish/English. *Language*, *55*(2), 291–318.

Poplack, S. (1980). Sometimes I'll start a sentence in Spanish *y termino en Español*: Toward a typology of code-switching. *Linguistics*, *18*, 581–618.

Poplack, S. (1981). Syntactic structure and social function of code-switching. In R. Duran (Ed.), *Latino language and communicative behavior* (pp. 169–184). Norwood, NJ: Ablex.

Poplack, S., & Meechan, M. (1998). How languages fit together in code-mixing. *International Journal of Bilingualism*, *2*(2), 127–138.

R Core Team. (2021). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/

Remijsen, B., Martis, F., & Severing, R. (2008). The intonational system of Papiamentu (Curaçao variant). In N. Faraclas, & C. M. Roose-Weijer (Eds.), *Linguistic Studies on Papiamentu* (pp. 181-220). Fundashon pa Planifikashon di Idioma.

Remijsen, B. & Van Heuven, V. (2005). Stress, tone and discourse prominence in the Curaçao dialect of Papiamentu. *Phonology, 22*(2), 205-235.

Rivera-Castillo, Y., & Pickering, L. (2004). Phonetic Correlates of Stress and Tone in a Mixed System. *Journal of Pidgin and Creole Languages, 19*(2), 261-284.

Römer, R. G. (1991). *Studies in Papiamentu phonology*. Amsterdam and Kingston: The University of Amsterdam.

Stammers, J., & Deuchar, M. (2012). Testing the nonce borrowing hypothesis: counter-evidence from English-origin verbs in Welsh. *Bilingualism: Language and Cognition*, *15*(3), 630–643.

Suurmeijer, L., Parafita Couto, M. C., & Gullberg, M. (2020). Structural and Extralinguistic Aspects of Code-Switching: Evidence from Papiamentu-Dutch Auditory Sentence Matching. Frontiers in Psychology, 11, 592266. https://doi.org/10.3389/fpsyg.2020.592266

'T Hart, J. (1998). Intonation in Dutch. In D. Hirst & A. Di Cristo (Eds.), *Intonation systems: A survey of twenty languages* (pp. 96-111). Cambridge: Cambridge University Press.

Tench, P. (2009). *Intonation, meaning and grammar.* Unpublished manuscript. Centre for Language and Communication Research, Cardiff University. Retrieved from https://www.paultenchdocs.co.uk/?cat=2

Torres Cacoullos, R. (2020). Code-Switching Strategies: Prosody and Syntax. *Frontiers in Psychology 11*, 2130. doi: 10.3389/fpsyg.2020.02130

Torres Cacoullos, R., & Travis, C. (2018). Good Data: Capturing Language Use. In *Bilingualism in the Community: Code-switching and Grammars in Contact* (pp. 35-56). Cambridge: Cambridge University Press. doi:10.1017/9781108235259.003

Tuc, H-D. (2003). *Vietnamese-English Bilingualism: Patterns of Code-Switching*. Routledge.

Valdés Kroff, J. R. (2016). Mixed NPs in Spanish-English bilingual speech: Using a corpus-based approach to inform models of sentence processing. In R.E. Guzzardo Camargo, C. M. Mazak, & M. Carmen Parafita Couto (Eds.), *Issues in Hispanic and Lusophone Linguistics: Vol. 11. Spanish-English codeswitching in the Caribbean and the US* (pp. 281-300). John Benjamins Publishing Company. https://doi.org/10.1075/ihll.11.12val

Van Hell, J. G., Litcofsky, K. A., & Ting, C. Y. (2015). Sentential code-switching: Cognitive and neural approaches. In J. W. Schwieter (Ed.), *The Cambridge handbook of bilingual processing* (pp. 459–482). Cambridge University Press.

Van Putte, F., & Putte-De Windt, I. M. G. (2005). *Groot woordenboek Papiaments-Nederlands*. Zutphen: Walburg Pers.

Yip, M. (2007). Tone. In P. Lacy (Ed.), *The Cambridge Handbook of Phonology* (Cambridge Handbooks in Language and Linguistics, pp. 229-252). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511486371.011

Zheng, L. (1997). Tonal Aspects of Code-Switching. *Monash University Linguistics Papers, 1*(1), 53-63.