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TABLE OF CONTENTS

Forward	3
Mismatches between European Portuguese lexical and phonological words KELLY D. BURKINSHAW	4-18
L2 transfer of stress, tones, and intonation from Mandarin: A case study UNA Y. CHOW	19-40
Subject contact relatives: A cross-dialectal approach SARA WILLIAMSON	41-60
Contrast, phonological features, and phonetic implementation: Aspiration in Blackfoot JOSEPH W. WINDSOR	61-80

FORWARD

The Calgary Working Papers in Linguistics, or CWPL ([k^wupɫ]) is a Graduate Student-lead publication that focuses on current work-in-progress in theoretical and experimental linguistics.

This year, the Graduate Students' Association (GSA) of the University of Calgary generously provided Quality Money funding to digitize all of the back issues of CWPL back to Vol. 1 which was first published in 1975. All issues of CWPL are now stored in PRISM: The University of Calgary Digital Repository and can be accessed at:

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Previously, CWPL articles before Vol. 25 were only available through print copies held in the graduate office and scanned by request. Thanks to the generous support of the GSA, CWPL is now far more accessible to researchers outside of our university.

The editors of this volume wish to thank the GSA for enabling the digitization project to proceed, and to Adam Daniel for completing all the digitization work.

Mismatches between European Portuguese lexical and phonological words

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Abstract

This paper analyzes sandhi phenomena in European Portuguese in which coda consonants in word-final position are resyllabified to become onsets in two ways: by epenthesis when they occur at utterance boundaries (excluding /ʃ/), and by associating with following onsetless words (within the same utterance). I present an Optimality Theoretic account for why this resyllabification occurs, which includes a constraint against assigning moras to consonants (*C μ), and a constraint against having codas (No-CODA). These constraints work together to produce the facts we see in the European Portuguese data: /r/ and /l/, which I argue are moraic codas, are resyllabified in both environments mentioned above, but /ʃ/, which I argue is a non-moraic coda, is only resyllabified utterance-medially before onsetless words. I then discuss the ramifications that resyllabification across word boundaries has for the relationship between syntactic and phonological words, with reference to Selkirk's (2011a; 2011b) Match Theory; although there is correspondence between words on these two levels, those corresponding items need not consist of exactly the same number of segments.

1. Introduction*

In this paper, I discuss sandhi phenomena in European Portuguese (EP). Codas seem to be dispreferred in this language (in fact, the inventory of codas is quite limited); in some environments, this means that speakers will arrive at outcomes which systematically redistribute codas so that they occur in the less-marked onset position, either occurring at the beginning of a following (originally onsetless) word, or with a following epenthetic vowel. This means, in many cases, that some words in particular utterances lose the codas they came with, and that other words gain those codas as onsets, where before they were onsetless. The phonological word is therefore a different animal than the original, underlying, syntactic word. In this paper, I consider the ramifications that this redistribution of segments has for the status of the phonological word in European Portuguese, using an Optimality Theory framework (Prince & Smolensky 2004).

This paper will be focusing on data from the Lisbon dialect of European Portuguese. In terms of the moraic status of its codas, EP is understudied, and so this paper will provide insight into previously-noted patterns which occur in the language. As well, I make initial hypotheses about the prosodic word structure of EP, upon which further studies could build.

In Section 2, I briefly introduce EP phonotactics. In Section 3, I introduce the phenomenon of coda resyllabification, and in Section 4, I give an Optimality Theoretic account of why this resyllabification occurs. In Sections 5 and 6, I consider the possible consequences that resyllabification has for the status of the phonological word and its relationship with the syntactic word, and I conclude in Section 7.

2. European Portuguese Phonotactics

European Portuguese has phonotactic restrictions which provide an avenue for research in phonological theory. Although a large number of consonants may occur in onset position in EP, including voiced and voiceless stops and fricatives, nasals, approximants, etc., it has a restricted inventory of coda consonants; syllables can only end in /l/, /r/, or /ʃ/ (Mateus & Andrade 1998; 2000).

There is some allophony associated with EP codas: /l/ surfaces as [ɫ] in codas (but [l] in onsets). As well, /ʃ/ surfaces as [ʒ] before voiceless consonants or utterance-finally, but undergoes voicing assimilation before voiced consonants to surface as [ʒ] (Cruz-Ferreira 1999; Mateus & Andrade 1998, 2000). Coda /r/ does not appear to undergo any allophony in the same contexts. For examples, see (1) below:

(1) European Portuguese codas (examples from Correia et al. 2010)¹

parte	'part'	/'par.ti/	['partɨ]
soldado	'soldier'	/sol.'da.du/	[soɫ'dadu]
mostru	'monster'	/'mõʃ.tru/	['mõʒtru]
mesmo	'same'	/'mɛʃ.mu/	['mezmu]

* This research was supported by the Social Sciences and Humanities Research Council. The author would like to thank Dr. Laetitia de Almeida for verifying and editing transcriptions and translations of the EP data.

¹ Unless otherwise specified, examples in this paper are drawn from this database but may have been subject to editing.

As we see here, /r/ surfaces as [r], /l/ surfaces as [ɫ] in codas, and /ʃ/ surfaces as [ʃ] preceding a voiceless consonant and as [ʒ] preceding a voiced consonant.

However, these three consonants may display additional allophony, depending on their following environment across word boundaries. I discuss this allophony below.

3. Coda Resyllabification

Although EP does have a small inventory of possible codas, several additional facts about the language indicate that codas are dispreferred. First, word-final codas which precede vowel-initial words in the same utterance will be resyllabified to act as the onset of the following word. Although /r/ is pronounced the same in both positions,² resyllabified /l/ is produced with the onset variant [l] rather than the coda variant [ɫ], and resyllabified /ʃ/ is produced as a [z], having undergone both voicing assimilation to match the vowel it precedes, and slight fronting. See the examples in (2) for illustration:

(2)	Coda resyllabification between words			
	pôr aqui	'to put here'	/ˈpɔr ɐˈki/	[ˈpo rɐˈki] ³
	mal à	'bad for'	/ˈmaɫ a/	[ˈma la]
	pois é	'indeed'	/ˈpojʃ ˈɛ/	[ˈpoj ˈzɛ]

Note that in normal (underlying) onset position, [ʃ], [ʒ], [s] and [z] are all allowed, with no voicing assimilation to match following vowels. Change in voicing and fronting only occurs with resyllabified sibilants.

This could be likened to French liaison, where certain word-final codas, which would normally not appear, may surface in the onset position of a following (vowel-initial) word to prevent vowel hiatus, e.g. the first word final 'r' in *premier ministre* [pʁɛ.mje.mi.nistʁ] vs. *premier étage* [pʁɛ.mje.re.taʒ] (Tseng 2003:315, syllabification added). However, the French and EP phenomena are crucially different, due to the restricted nature of French liaison, and the unrestricted nature of EP resyllabification. In French, liaison is restricted mostly to the following environments: between a determiner and a noun, between two pronominal clitics, between a clitic and verb, in some fixed expressions, and in some other variable contexts (Tseng 2003:323). French liaison does not occur in every case where a potentially coda-final word precedes a vowel-initial one. EP resyllabification, on the other hand, is systematic; regardless of the syntactic category of the words, if a coda-final word precedes a vowel-initial one, resyllabification of the coda occurs.⁴

As well, another form of resyllabification occurs at the end of utterances in EP. When an utterance ends in an /l/ or /r/ coda, speakers will add a final epenthetic vowel so that the

² Or at least similarly enough that they are transcribed the same, as in Mateus & Andrade (1998, 2000) and Correia et al. (2010).

³ Although the lack of allophony of /r/ makes its resyllabification not as easy to see as with /l/ and /ʃ/, there is evidence from child language that the resyllabification of /r/ does occur; Burkinshaw (2014) shows a case study where a child named Inês consistently produced /r/ as [l] in the resyllabified context.

⁴ For an analysis of a similar phenomenon in another Romance language, Catalan, see Bermúdez-Otero (2006).

coda is syllabified as an onset (and /l/ in this position is realized as [l]) (Freitas 2003). See (3) below for illustration:

- (3) Utterance final coda resyllabification
 Minha flor?⁵ 'My flower?' /'mew 'flor/ ['mew 'florɨ]
 Ao hospital. 'To the hospital.' /aw ɔʃpi'taʃ/ [aw ɔʃpi'taliɨ]

These phenomena suggest that EP resists syllabifying consonants in coda position wherever possible. In their description of EP syllabification, Mateus & Andrade (1998) invoke a series of ordered steps for syllabification in which assigning consonants to coda position occurs last, as described below:

"If the consonants are underspecified, that is, [/r/, /l/ or /ʃ/], (those that can occur in Portuguese codas), they remain non-associated and become floating segments. At the end of base syllabification, these floating segments are assigned to the codas of the preceding rhyme." (Mateus & Andrade 1998)

Following an OT framework, rather than a rule-based one, this resistance to codas can be explained with a constraint against codas, such as proposed by Kager (1999) below:

- (4) No-CODA (Kager 1999:94)
 *C]_σ ('Syllables are open.')

If No-CODA were a high-ranking constraint in EP, this would explain the tendencies we see toward avoiding codas. However, there is some inconsistency in this pattern of coda resyllabification, and that is that utterance-final coda /ʃ/ is never resyllabified through final vowel epenthesis. As shown in (5) below, there is no vowel added to the end of utterances ending in /ʃ/, and /ʃ/ is realized as [ʃ] (rather than [z]):

- (5) Utterance-final /ʃ/
 Não há mais. 'There is no more.' /'nẽw̃ 'a 'majʃ/ ['nẽw̃ 'a 'majʃ]
 Estas estão boas. 'These are good.' /'ɛʃtɛʃ 'tẽw̃ 'boɛʃ/ ['ɛʃtɛ 'tẽw̃ 'boɛʃ]

In general, /ʃ/ seems to have special status in EP, which allows it to occur at the beginning of words preceding consonant clusters, as shown in the second word, *estão*, of the second example in (5); Fikkert & Freitas (2004) and Almeida (2011) analyze this extra position as the coda of an empty-headed syllable (CEHS). In EP orthography, words with this extra consonant are spelled with an initial 'e', indicating that either underlyingly or historically this was a non-empty syllable with a nucleus, but it is produced without one.

⁵ In this example, the child produced an error in gender agreement ("Meu flor?"), but I have corrected it to reflect the proper agreement, since what is of interest is the utterance-final position of *flor* rather than the word choice made by the child.

In the following section, I address the limitations of using just NO-CODA to account for resyllabification, and expand on my OT account for the phenomenon by analyzing in detail which codas are resyllabified and why.

4. The Moraic Status of EP Codas, and the Consequences for Resyllabification

So, if codas are generally avoided in the language, why are not all codas avoided equally as discussed in the previous section (i.e., /ʃ/ is not resyllabified utterance-finally), and why are some codas less constrained than others (i.e., /ʃ/ can occur as a CEHS)? A brief investigation of stress assignment in EP reveals a possible answer to both of these questions: that /r/ and /l/ are moraic codas, and /ʃ/ is not.

Regarding EP stress, Cruz-Ferreira (1999) says that EP words are most commonly (but not exclusively) stressed on the penultimate syllable, but that "lexical stress is distinctive," and can "[provide] very productive class-changing contrasts" (p. 128-129). In spite of the fact that stress is frequently defined lexically, meaning that it can occur on closed or open syllables alike, seemingly at random, there is still some evidence that coda weight can cause stress shift in related EP words.

In order to investigate the moraic status of codas, I looked at several pairs of related EP words from the Correia et al. (2010) data corpus, which follows the language development of five children learning EP as their first language, but also contains target (adult) transcriptions of words attempted by the children. Data in this corpus are organized into (recording) sessions – I looked at the final session for the child named Inês, as this represented the recording in which her vocabulary should be most varied and advanced. I selected pairs of words which differed by the presence of a coda, some of which are shown in examples (7) to (9) below. As shown in (7), there seems to be some evidence that stress can shift to syllables which are closed by /r/. This suggests that these closed syllables may be heavy in EP, and thus receive word stress by the Weight-to-Stress-Principle (WSP), defined by Kager (1999):

- (6) WSP (Kager 1999:155)
Heavy syllables are stressed.

See the examples in (7) for illustration:

- (7) Stress shift to syllables closed by /r/
- | | | |
|-------------|---------------|--------------|
| começar ... | 'to begin' | [ku.mi.'sar] |
| começa ... | 'begin.3sg' | [ku.'mɛ.sɐ] |
| dizer ... | 'to say' | [di.'zɛr] |
| diz ... | 'say.3sg' | ['dij] |
| apertar ... | 'to tighten' | [ɐ.pɨr.'tar] |
| aperta ... | 'tighten.3sg' | [ɐ.'pɛr.tɐ] |

As we see in these examples, the infinitive form in each case (*começar, dizer, apertar*), which ends in an /r/ coda, has stress on the final closed syllable. When that /r/ is removed in the conjugation of the verb, stress occurs elsewhere in the word (in the case of *aperta*, the stress occurs on the remaining syllable closed by /r/). Further investigation is required to determine whether /l/ in codas shows the same behaviour; /l/ in codas is not as frequent in the Correia et al. (2010) data as /r/ in codas. As well, because /r/ is the ending for infinitives, examples with the type of alternation seen in (7) are much more common than for /r/ than for /l/.

I can find no indication that syllables closed by /ʃ/ behave this way (i.e., they do not seem to attract stress); rather there are several counterexamples to indicate that /ʃ/ does not add weight to syllables it closes. As you can see in the examples in (8), there are cases where an added /ʃ/ does not cause a stress shift. In fact, I was able to find no examples where added /ʃ/ did seem to cause a stress shift.

(8) Examples where coda /ʃ/ does not cause stress shift⁶

amigo	'friend.MascSing'	[e'migu]
amigos	'friend.MascPl'	[e'miguʃ]
coisa	'thing.FemSg'	['kojzɐ]
coisas	'thing.FemPl'	['kojzɐʃ]

As well, looking at the examples in (9) below of the adjective *comprido* 'long', we see that stress shifts to a syllable that ends in a glide, indicating that glides may carry weight as well (compare *comprida* and *compridão*), but that stress does not shift to a syllable that ends in an /ʃ/ (compare *compridão* and *compridas*).

(9) More examples where coda /ʃ/ does not cause stress shift

comprida	'long.FemSg'	[kõ'pridɐ]
compridão	'long.very'	[kõ'pri'dẽw]
compridas	'long.FemPl'	[kõ'pridɐʃ]

Based on the lack of evidence for stress shift to syllables closed by /ʃ/, I conclude that /ʃ/ in coda positions is not associated with a mora. As discussed in Davis (2011), research has been done which suggests that in some languages, sonorant consonants can be moraic while obstruents are not, and thus syllables closed by sonorants may be heavy while ones closed by obstruents are light.

If this is the case for EP, this sheds light on the peculiarities of /ʃ/ in coda position, compared to the other codas. As stated above, although /ʃ/ is resyllabified utterance-medially when preceding a word that begins with a vowel, it is not resyllabified utterance-finally via the epenthesis of a final vowel. As well, /ʃ/ can occur word-initially before

⁶ One might argue that there is no stress shift in these examples because the /ʃ/ suffix is an inflectional one, and inflectional suffixes often do not affect stress. However, it may be that /ʃ/ is allowed to be such an inflectional subject because it does not add a mora.

consonant clusters as a coda of an empty-headed syllable. Although it is possible that /ʃ/ does not have weight because it is an obstruent, since only three different phonemes are allowed in EP codas, it is difficult to make a concrete claim to this effect. It may be the case that because /ʃ/ may occur in an exceptional position (CEHS), it is allowed by extension to occur in the other position (codas, either utterance-final or before another consonant – the before-vowel context is discussed below) without having an effect on syllable weight by adding a mora.

Therefore, what seems to be avoided in the language is having a moraic consonant in a coda position. I surmise, then, that NO-CODA does not fully capture the patterns we see in EP, but rather there is a (violable) restriction against putting consonants in a position in which they must be given moras. Such a constraint might be formulated as below:

- (10) *C μ
 Consonants must not have moras (must be weightless).

A similar constraint called *FINAL-C- μ is proposed in (Kager 1999:268), in which the final consonant of a syllable must not have a coda. For EP, I propose the more general constraint where no consonant should have a mora.

This does leave the question, however, of why /ʃ/ is resyllabified utterance-medially at all (i.e., before a word that starts with a vowel). If /ʃ/ is not moraic, then why is it being avoided in coda position in this case? It could be that speakers resyllabify /ʃ/ to match the general pattern of resyllabifying syllable-final consonants, as seen with /l/ and /r/. It could also be argued, perhaps more convincingly, that NO-CODA is still an active constraint in EP; in the utterance-final case for /ʃ/, we would see that NO-CODA is outranked by a constraint preventing the epenthesis of vowels (e.g. DEP-V).⁷ To illustrate these constraints at work for /r/ and /ʃ/, see the tableaux in (11)-(14) below:

(11) Word-final /r/ preceding a vowel, *por aqui*

Input: /'por e'ki/	*C μ	DEP-V	NO-CODA
a. ['por e'ki]	*!		*
b. ^{EP} ['po re'ki]			

(12) Utterance-final /r/, *flor*

Input: /'flor/ _v	*C μ	DEP-V	NO-CODA
a. ['flor]	*!		*
b. ^{EP} ['flori]		*	

⁷ Some further work needs to be done on this, to account for why, if vowel epenthesis is a valid strategy for avoiding codas, it does not occur utterance-internally, for example within a word, or between a word that ends with a coda and a word that starts with a consonant.

(13) Word-final /ʃ/ preceding a vowel, *pois e*

Input: /'poʃf'ɛ/	*C μ	DEP-V	NO-CODA
a. ['poʃf'ɛ]			*!
b. ['poʃ'zɛ]			

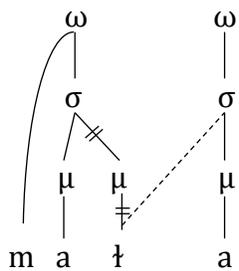
(14) Utterance-final /ʃ/, *mais*

Input: /'majʃ/ _v	*C μ	DEP-V	NO-CODA
a. ['majʃ]			*
b. ['majzi]		*!	

As we see in the tableaux, the difference between /r/ and /ʃ/ is that an occurrence of /ʃ/ in coda position does not violate the high-ranked constraint *C μ , while an occurrence of /r/ in coda position does.

5. Consequences for the Phonological Word (ω)

Regardless of why these resyllabifications occur, the fact remains that they do—this means that consonants which should fall on the right edge of the words that would normally contain them, instead occur as onsets at the left edge of the following word. Obviously this does not mean that these consonants are lexically specified on the following words, as they only occur there in this specific context: when an onsetless word follows another that would normally end in a coda. The syntactic word, and the phonological word, are defined as they always were, with the affected consonant occurring at the end of the first word. What about the phonological (produced) word, then? Considering the example in (15) below, is there one phonological word, or two? If there are two, where should we draw the line between them?

(15) /l/ resyllabification across two (lexical) words⁸

mal à, 'bad for'

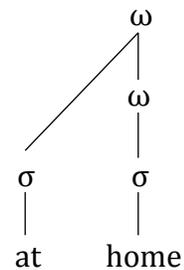
⁸ Note that there is no need to account for the 'disappearance' of the mora in this example, since as the /l/ is resyllabified in an onset position, it never received a mora in the first place. Alternately, there may be a mora left behind which is only realized as stress, as we would see when examples such as in (7), which end in stressed syllables closed by moras, occur in the resyllabification context. In such a case, stress would shift (because of WSP) to the final (heavy) syllable, but then the coda would be pushed to the following syllable as its onset, and stress would remain on the final syllable of the first word, which is now open. See Bermúdez-Otero (2001) for discussion of similar interactions between constraints.

In the remainder of this paper, I consider the different possibilities for the division, or lack thereof, between these prosodic words.

5.1 *Two Become One*

There is some cross-linguistic motivation behind the possibility that these two lexical words are combined at the prosodic level to form one word. As discussed in Selkirk (1995, 1996) and Ito & Mester (2009), in English, function words (including prepositions) may optionally attach to words following them as prosodic clitics. This occurs with single syllable function words and prepositions: weak syllables which can lean on the words they precede, as with 'can,' 'her,' 'of,' and 'at' in the following sentence, "[Diane] [can paint] [her portrait] [of Timothy] [at home]" (Selkirk 1995; 1996). According to Ito & Mester (2009), these weak syllables attach to the following lexical words above the word level, forming an additional recursive word. See (16) below for illustration:

(16) English function word proclitics



If it were the case that the EP resyllabification happened between syntactic words that were grouped into a single phonological word, then we would expect to find resyllabification occurring in only restricted environments (as occurs with both the English examples and with French liaison), such as with function words, prepositions, or compounds. However, as we see in (17) below (some examples repeated from (2)), EP resyllabification occurs with a wide variety of words.

(17) Further examples of EP coda resyllabification⁹

a.	pôr aqui	'to put here'	/'por e'ki/	['po re'ki]
b.	mal à	'bad for'	/'maʎ a/	['ma la]
c.	pois é	'indeed'	/'pojʃ 'ɛ/	['poj 'zɛ]
d.	mas eu	'but I'	/mɛʃ 'ew/	[mɛ 'zew]
e.	seis anos	'six years'	/'sejʃ 'ɛnuʃ/	['sej 'zenuʃ]
f.	mas esse	'but this'	/'mɛʃ 'esi/	['mɛ 'zesi]
g.	maus amigos	'bad friends'	/'mawʃ e'miguʃ/	['maw ze'miguʃ]
h.	duas almas	'two souls'	/'dueʃ 'aʎmɛʃ/	['due 'zaʎmɛʃ]

⁹ Examples (g) and (h) from Mateus & Andrade (2000), pages 12 and 144 respectively.

In the examples above, neither the first word nor the second is always a function word; for example we see *maus* ('bad'), an adjective, preceding *amigos* ('friends'), a noun. Nor is either always reduced, although it appears from *mas eu* ('but I') that they can be, as *mas* in this case has no stress.

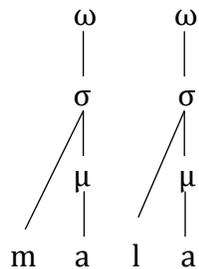
As well, it is clear that these examples cannot all be compounds (see *mal à, mas esse*, above); resyllabification simply occurs when a word ending in a coda is followed by a word beginning with a vowel. If the two are separated, we see no strange or unexpected effects such as those we see in French, where if the liaison context is not satisfied, the final consonant of the first word is not pronounced. Further consideration must be given to understand the shape and contents of the EP prosodic word, and whether multiple syntactic words may fall within it, but the variable nature of the words involved in resyllabification suggests that the pair does not uniquely fall together into one prosodic word.

5.2 Just the Two of Us

Beyond grouping two syntactic words into one phonological one, the other logical possibility is to count them as two separate phonological words. If this is the case, then we must decide how to divide them, given that resyllabification crosses a word boundary. If the coda is underlyingly a part of the first word, which it must be, but it is phonologically realized as a part of the second word, this still constitutes a mismatch between the syntactic word and the prosodic word, for both words.

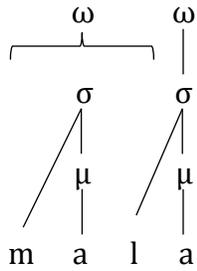
Consider the diagrams in (18) and (19), where I show two possible ways to divide the prosodic words. In (18), the word level is defined by the prosody, in that the /l/ in *mal à*, as the onset of the second syllable, falls under the second word.

(18) Prosodically-defined word division of *mal à*



In (19), on the other hand, the words are defined syntactically, following the underlying position of /l/ in the coda of the first syllable. This requires some machination of the word diagram, as the /l/, which surfaced as part of the second syllable, must be grouped with the first syllable at the word level:

(19) Syntactically-defined word division of *mal à*



As mentioned above, this second possible division of words is based on the syntactically-defined boundaries of the words. However, although such a diagram may be helpful to understand the resyllabification facts, its depiction of the prosodic words is critically misleading; the syllable tier and below depict phonological facts, and the word tier depicts syntactic ones. I therefore reject (19) as a possible division of the prosodic words involved in *mal à*, and conclude that they must be divided as in (18) above. Therefore, in the case of EP resyllabification, there is a distinct difference between the prosodic word and the syntactic one: When a word ending in a coda precedes one beginning with a vowel, the coda of the first (syntactic) word becomes the onset of the second (phonological) word.

In the following section, I discuss how such a mismatch can be accounted for using Selkirk's (2011) Match Theory.

6. Resyllabification and Match Theory

There is some precedent to the idea that EP has mismatches between the syntactic and prosodic word. In her 2011 chapter, Selkirk discusses Match Theory, in which there is a series of OT constraints which govern the relationship between syntax and phonology. These constraints occur at three levels; the clause, the phrase, and the word. Selkirk defines the word-level constraint, Match Word, as follows:

(20) MATCH WORD (Selkirk 2011a:439)

A word in syntactic constituent structure must be matched by a corresponding prosodic constituent, call it ω, in phonological representation.

The EP data does satisfy MATCH WORD to the extent that there is a syntactic constituent, the syntactic word, which does correspond to a prosodic constituent, the phonological word. However, these two types of word do not correspond exactly, as we saw above; they correspond but are not equal. Selkirk discusses mismatches between syntactic and phonological structure as arising from prosodic wellformedness constraints, which fits nicely with the account presented in Sections 3 and 4 of this paper, in which we saw that the constraints *Cμ and No-CODA prevented the phonological word from ending with a coda. As Selkirk states in a presentation of her 2011 paper: "Prosodic wellformedness constraints,

not constraints on the syntactic-prosodic structure relation, are responsible for any divergence between syntactic constituency and prosodic constituency ('nonisomorphism') produced by the grammar" (Selkirk 2011b:Slide 22). This implies that the mismatches between the syntactic and prosodic word in EP arise purely because of the constraints which prevent the assignment of moras to codas and result in them being resyllabified as onsets.

Under this account, such mismatches are not only allowed, but are expected, to the extent that the language has constraints governing the edges of prosodic words and their relationships. Although the syntactic structure of EP provides one definition of words in the language, phonological constraints can manipulate those words at the phonological level, causing them to surface differently in speech than in the syntactic representation. This means that we are free to divide examples such as *mal à* into two prosodic words, with /l/ falling at the beginning of the second, without this causing any ramifications for the status of the word *mal* (with underlying coda /l/), or the word *à* (without the underlying /l/) at the syntactic level.

7. Conclusion

In this paper, I have presented data which show that EP speakers avoid having consonants in coda positions where possible by redistributing them into onset positions. I provided an Optimality Theoretic account of why they do so; they are avoiding assigning moras to consonants in the case of /r/ and /l/, and are also avoiding codas in general as we see with /ʃ/, although /ʃ/ cannot receive a mora. This explains why we see differences in behaviour between /r, l/ and /ʃ/: /r/ and /l/ alone may be resyllabified utterance-finally via epenthesis of a final vowel, and /ʃ/ may occur as a coda of an empty-headed syllable.

I then considered the ramifications that resyllabification might have for the status of the phonological word. Resyllabified consonants fall under the umbrella of the second phonological word rather than the first, even though they originate from the first syntactic word. This constitutes a mismatch between the phonological words and the syntactic ones, which have a consonant transferred between them. Following Selkirk's (2011) Match Theory, this occurs because constraints on phonological wellformedness can blur the lines between words provided by a speaker's syntax. If it is the case that a match between the syntactic word and the phonological word means that there is simply a correspondence between those items, it may also be the case that the items can differ in terms of the segments they contain (or in terms of the nature of those segments). Future work on this topic would benefit from a more in-depth analysis of prosodic phrases in EP, to determine whether words participating in resyllabification fall within the same prosodic phrase.

Also of potential relevance to this paper is work by Ito & Mester (2009), which suggests that the edges of words may not always be "crisp,"¹⁰ leading to the possibility of sounds being ambisyllabic across word edges, and belonging to both the coda of the first word and the onset of the second. Although there seems to be no indication that resyllabified EP consonants are straddling a word boundary rather than shifting across it, it may prove

¹⁰ Where having a crisp edge means that the spread or sharing of phonological/prosodic features is not allowed between words, as defined in Windsor (2012), from Ito and Mester (1999).

fruitful to consider constraints on the crispness of word edges in EP. In addition to this consideration, in my future work on this paper I will search for more data to analyze, as it would be beneficial for verification of the stress-shifting patterns of both /r/ and /l/, and the lack of stress shift for /ʃ/.

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L2 transfer of stress, tones, and intonation from Mandarin: A case study

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Abstract

This study examined the prosodic patterns of Mandarin, Cantonese, and English in order to address the question: Will a native speaker of Mandarin acquire Cantonese intonation more easily than English intonation? According to the Markedness Differential Hypothesis (Eckman 1997), second language (L2) features that are universally rarer than the first language (L1) features will create difficulty for L2 acquisition. English has word stress, Cantonese has lexical tones, and Mandarin has both. English has more variation in word stress patterns than Mandarin, and Cantonese has more lexical tones than Mandarin. The prediction was that a Mandarin speaker would have difficulty in acquiring English stress and Cantonese tones.

In a field study, I elicited speech samples from a female, adult native speaker of Mandarin who learned Cantonese and English from age 5-6. My pitch analysis of her speech revealed near native-like intonation patterns in English. In Cantonese, however, her declarative questions reflected an overall raise in pitch range, characteristic of her Mandarin questions. My results demonstrated that the consultant showed more difficulty in her acquisition of the native intonation of Cantonese than that of English. The implication is that lexical tones interfere with L2 intonation more so than word stress, because both lexical tones and intonation rely on fundamental frequency (F0) as a primary cue.

1. Introduction*

In speech, intonation is meaningful variation in the pitch of the voice. It functions as a grammatical marker for different types of sentences, such as statements (as in 1a) and questions (as in 1b, c). For example, a yes/no question is a type of question that expects either a 'yes' or 'no' response (1c). A declarative question is a type of yes/no question that has the same syntactic structure as a statement. A declarative echo question (1b) repeats part or all of what the speaker has just heard.

- (1) a. John is reading a book. (statement)
 b. John is reading a book? (declarative echo question)
 c. Is John reading a book? (yes/no question with subject-aux inversion)

Because declarative (echo) questions lack subject-auxiliary inversion and an overt question marker, intonation is used to distinguish between statements and declarative questions in speech. However, intonation systems differ from language to language. For example, English signals echo questions with a rising intonation at the end of the utterance (Wells 2006), whereas Mandarin raises the pitch range of the entire utterance (Peng *et al.* 2005). Because English's question intonation differs from Mandarin's question intonation, native English speakers may fail to recognize Mandarin's question intonation. They may misperceive the raise in pitch as anger, for example, since anger is also expressed with increased pitch and pitch range (Williams & Stevens 1972). Thus, cross-linguistic differences pose a challenge for L2 learners.

According to the Markedness Differential Hypothesis (Eckman 1997), L2 features that are universally rarer than the L1 features will create difficulty in L2 learning. Many L2 studies have compared native Mandarin speakers to bilingual Mandarin-English speakers (Marinova-Todd *et al.* 2010, among others) or to bilingual Mandarin-Cantonese speakers (Chen *et al.* 2004, among others). Few studies, if any, have compared the acquisition of two L2s by the same speaker. To gain a better understanding on native language interference on the acquisition of L2 intonation, this case study examines the prosodic patterns of Mandarin, Cantonese, and English of a trilingual speaker in order to address the question: Will a native speaker of Mandarin acquire Cantonese intonation easier than English intonation?

English has word stress, Cantonese has lexical tones, and Mandarin has both. Between the stress languages, English has more variation in stress patterns (*e.g.*, as shown by the capitalized syllables in the following pairs: *phoNETic* [fə.'nɛ.tɪk] vs. *PHOnetician* [fə.nə.'tɪ.ʃən], or *CANada* ['kʰæ.nə.də] vs. *baNAna* [bə.'næ.nə]) than Mandarin (*e.g.*, 妹妹 *MEI4 mei* [mei⁵¹.mei] 'younger sister'). Between the two tone languages, Cantonese has six contrastive tones, while Mandarin has four. The prediction is that a Mandarin speaker would

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have difficulty in acquiring English stress and Cantonese tones. Given that word stress is perceived based on F0, intensity, and duration in English, and that lexical tone is perceived primarily based on F0 in Cantonese, both of which interact with intonation (Ladd 2008), the prediction is that there would be L1 interference and that there would be some degree of intonation transfer from the speaker's L1 to L2.

2. Background

2.1. Mandarin and Cantonese lexical tones

Mandarin has a tonal system of four contrastive tones and one neutral tone, as shown in Table 1. The contrastive, or specified, tones are high-level (mT1), rising (mT2), low-fall-rise (mT3), and falling (mT4). Using Chao's (1930) five-scale tonal system, with 1 the lowest and 5 the highest point in a speaker's F0 range, mT1 to mT4 are represented as [55], [35], [214], and [51], respectively. The third tone, mT3, has two allotones: [21] and [214]. The neutral tone, written without a tone number (*e.g.*, *ma* '(question particle)'), is unspecified and assimilates the tone from the immediately preceding syllable that carries a specified tone.

In Mandarin, every syllable has a lexical tone, including the four specified tones and one unspecified tone. In addition, the first syllable of a word must have a specified or full tone (mT1, mT2, mT3, or mT4). The unspecified, neutral tone occurs only on non-word-initial syllables.

Tone	mT1	mT2	mT3	mT4
Number	1	2	3	4
Shape	High-level	Rising	Low-fall(-rise)	Falling
Pitch level	55	35	21(4)	51
Phonological feature	H	LH	L	HL
Example	<i>ma</i> 1 'mother'	<i>ma</i> 2 'hemp'	<i>ma</i> 3 'horse'	<i>ma</i> 4 'to scold'

Table 1. The four contrastive tones of Mandarin.

Phonological feature: H/L = [+/- upper register] (Yip 1980, Pulleyblank 1986).

Cantonese has a tonal system of six contrastive tones, as shown in Table 2. Unlike Mandarin, every syllable has a specified tone. The contrastive, or specified, tones are high-level (cT1), high-rise (cT2), mid-level (cT3), low-fall (cT4), low-rise (cT5), and low-level (cT6). Using Chao's five-scale tonal system, cT1 to cT6 are represented as [55], [25], [33], [21], [23], and [22], respectively. According to Bauer & Benedict (1997:131), cT1 has an allotone that is high-falling [53], but most Cantonese speakers in Hong Kong produce cT1 with the [55] tone.

Tone	cT1	cT2	cT3	cT4	cT5	cT6
Number	1	2	3	4	5	6
Shape	High-level	High-rise	mid-level	Low-fall	Low-rise	Low-level
Pitch level	55	25	33	21	23	22
Phonological feature	Hh	Hlh	Hl	Ll	Llh	Lh
Example	<i>fan1</i> 'point'	<i>fan2</i> 'flour'	<i>fan3</i> 'training'	<i>fan4</i> 'grave'	<i>fan5</i> 'raise'	<i>fan6</i> 'portion'

Table 2. The six contrastive (non-checked) tones of Cantonese. Shape and pitch level (source: Flynn 2003). Phonological feature: H/L = [+/-upper register], h/l = [+/- raised pitch] (Yip 1980, Pulleyblank 1986).

There are two types of lexical tones in Cantonese: non-checked tones which occur on open syllables and checked tones which occur on closed syllables with an unreleased voiceless stop in the coda (*i.e.*, [p^h], [t^h], or [k^h]). The six unchecked tones are cT1 to cT6. There are three checked tones (cT7, cT8, and cT9), which have the same tonal shape as cT1, cT3, and cT6, respectively, but occur on closed syllables. For example, 食 *sik6* [sik²²] 'eat' has a checked [22] tone (cT9), whereas 事 *si6* [si:²²] 'matter' has a non-checked [22] tone (cT6). Checked tones are usually perceived as shorter in duration because the vowel which carries the tone (and sonority) is cut off by the obstruent coda. In contrast, although the majority of syllables in Cantonese has a consonant-vowel (CV) structure, the vowel in these syllables is lengthened in favour of a binary foot, *e.g.*, *si6* [si:²²]. Therefore, non-checked tones are perceived as longer.

Because there are six contrastive tones in Cantonese and each one can occur on an independent syllable, Cantonese has more monosyllabic words than Mandarin. In addition, because a high frequency of words in Cantonese is bimoraic (*i.e.*, CV: or CVC), the rhythmic pattern of spoken Cantonese is perceived as syllable-timed, with approximately the same amount of time given to each syllable.

2.2. Mandarin and English word stress

Typically, native Mandarin speakers perceive stress contrasts in trochees with a full tone on the first syllable and a neutral tone on the second syllable (Peng *et al.* 2005, Duanmu 2007). This stress pattern appears in words with either a reduplicated syllable (*e.g.*, 妹妹 *mei4 mei* ['mei⁵¹.mei] 'sister') or a suffix (*e.g.*, 他們 *ta1 men* ['tʰa⁵⁵.mən] 'they'). Lexical minimal pairs based on stress patterns alone are rare in Mandarin.

English has a more complicated word stress system than Mandarin. Normally, the stress is on the penult, but it can fall on a different syllable depending on the prosodic context. Lexical minimal pairs based on stress patterns exist in English, *e.g.*, the noun *permit* ['p^hɹ.mɪt] vs. the verb *permit* [pɹ.'mɪt]. The rhythmic pattern of spoken English is perceived as stress-timed, with a fairly equal amount of time spaced between consecutive stressed syllables. The rhythmic pattern of spoken Mandarin, on the other hand, is perceived as syllable-timed (Mok 2009).

2.3. Intonation of declarative questions in Mandarin, Cantonese, and English

Mandarin and Cantonese have at least two types of yes/no questions: A-not-A questions and declarative questions. A-not-A questions are translated into *do*-questions in English, as the examples in (2) show.

- (2) a. *ni3 hui4-bu4-hui4 juo4 shi1?* (Mandarin)
 you know-not-know create poem
 ‘Do you know how to write a poem?’
 b. *nei5 sik1-m4-sik1 jok3 si1?* (Cantonese)
 you know-not-know create poem
 ‘Do you know how to write a poem?’

Because A-not-A questions are syntactically marked by the A-not-A construction, variability in intonation does not affect the interrogative mood of the sentence. Therefore, there is no motivation to have specified intonation patterns to signal this type of questions.

Declarative questions are not syntactically marked as questions. They appear in the same word order as a statement, as shown in (3).

- (3) a. He has a hundred percent. (statement)
 b. He has a hundred percent? (declarative echo question)

Thus, there is motivation for distinct intonation patterns between statements and declarative questions. In Mandarin, declarative echo questions are typically produced with a raised pitch range (Yuan *et al.* 2002). That is, the pitch range of the speaker on the entire utterance is relatively higher than that on the statement. In English (Wells 2006) and Cantonese (Gu *et al.* 2005), however, declarative echo questions are realized with a rise in pitch or a high boundary tone (H%) at the end of the utterance only.

3. Methods

3.1. The language consultant

The language consultant for this case study was a female native speaker of Mandarin, born and raised in Singapore. She moved to Canada at age 22 and lived there for more than ten years. Mandarin was the first language that she learned and also the primary language spoken at home when she was growing up. At age five, she began to learn Cantonese, mostly from watching television. From age six, she learned English formally in school, along with Mandarin. At the time of the study, she was speaking English at home with her family, but continued to speak Mandarin and Cantonese with her friends, occasionally code-switching among Mandarin, Cantonese, and English. She could speak and read all three languages fluently. She could read traditional Chinese characters. The dialects of her Mandarin, Cantonese, and English resembled Huayu, Hong Kong Cantonese, and British English, respectively.

3.2. Elicitation sessions

The language consultant participated in 14 weekly sessions of two hours each between January and April 2011. All elicitation sessions were conducted by the author in a quiet room in the consultant's house, except for one which was at my home. In each session, the consultant performed two or three reading tasks. For each task, she was first presented with a list of words, phrases, or sentences on a sheet of paper in either traditional Chinese characters for eliciting Mandarin or Cantonese, or in English for eliciting English. She was then asked to replace any words or phrases that did not sound natural to her or that she could not say. After the consultant had familiarized herself with the list, she was asked to say each token aloud as naturally as she could, as if she was speaking to her friends or family.

Each reading task was repeated twice. In the first iteration, I manually transcribed the prosodic features (*i.e.*, tones, stress, and F0 contours) of the utterance by ear. The consultant spoke more naturally when she was not being recorded. In the second iteration, I audio-recorded the readings with Praat (Boersma & Weenink 2010) on a MacBook Pro for Tones and Break Indices (ToBI) annotation (Beckman *et al.* 2005) of the prosodic features after the session. During the recording phase, the consultant spoke each token twice in sequence. A token was re-recorded if the consultant misread it, or if there was noticeable background noise, such as phone ringing. In general, the ToBI annotation was used for the final analysis. However, where Praat failed to show the F0 contours correctly (*e.g.*, due to low tones, vowel devoicing, or perturbation), the manual transcription aided in determining the final transcription, if possible.

Corresponding tokens from two or all three languages were elicited. For example, the same Chinese tokens 媽 'mother', 麻 'hemp', 馬 'horse', and 罵 'to scold' were used to elicit both Mandarin and Cantonese tones; place names with similar pronunciation, such as 密西西比 'Mississippi', were used to elicit Mandarin and English stress; and sentences with equivalent meanings, such as 你會不會作詩? (Mandarin), 你識唔識作詩? (Cantonese), and 'Do you know how to write a poem?' (English), were used to elicit intonation patterns of all three languages. Several reading tasks were repeated at later sessions to verify the accuracy and consistency of earlier readings, including the Mandarin and Cantonese tones, and the statement-and-question pairs in different sentence orders.

3.3. Stimuli

The stimuli were prepared between sessions based on the prosodic patterns of the tokens elicited from the previous session(s). Over a thousand speech samples were elicited, including declarative questions, *A-not-A* yes/no questions and *wh*-questions. However, only part of the data was analyzed and reported in this paper, as follows.

1. Lexical tones
 - a. a complete paradigm of the four contrastive Mandarin tones, and
 - b. three complete paradigms of the six contrastive Cantonese tones
2. Word stress
 - a. English disyllabic words with trochaic or iambic stress patterns, and
 - b. Mandarin disyllabic words with a full tone and a neutral tone
3. Intonation
 - a. Mandarin, Cantonese, and English cognates or loan words, and
 - b. Mandarin, Cantonese, and English statements and declarative (echo) questions.

To investigate the effect of Cantonese tones on sentence intonation, the Cantonese stimuli included a set of statement-and-question pairs, each ending with a different Cantonese tone, as shown in (4). The corresponding Mandarin stimuli were similar expressions in Mandarin, as shown in (5). For corresponding English stimuli, the English translation of the Cantonese sentences was used. To investigate the effect of Mandarin tones on sentence intonation, the stimuli were created using the same method as above but with the four contrastive Mandarin tones.

- (4) Declarative questions, ending with the Cantonese syllable 'fan':
- a. *keoi5 jau5 jat1 baak3 fan1?* (佢有一百分?)
 he have one hundred point
 'He has a hundred percent?'
 - b. *keoi5 soeng2 sik6 loeng4.fan2?* (佢想食涼粉?)
 he want eat jello
 'He wants to eat jello?'
 - c. *keoi5 jiu3 heoi3 sau6 fan3?* (佢要去受訓?)
 he must go receive training
 'He must go for training?'
 - d. *keoi5 soeng2 heoi3 soeng5 fan4?* (佢想去上墳?)
 he want go up grave
 'He wants to visit the grave?'
 - e. *keoi5 dak6.bit6 hing1.fan5?* (佢特別興奮?)
 he especially excited
 'He is especially excited?'
 - f. *keoi5 soeng2 jiu3 jat1 fan6?* (佢想要一份?)
 he want have one portion
 'He wants to have a portion?'

- (5) Equivalent set of questions in (4), uttered in Mandarin:
- a. *ta1 you3 yi1 bai3 fen1?* (他有一百分?)
he have one hundred point
'He has a hundred percent?'
 - b. *ta1 xiang3 chi1 liang2.fen3?* (他想吃涼粉?)
he want eat jello
'He wants to eat jello?'
 - c. *ta1 yao4 qu4 shou4 xun4?* (他要去受訓?)
he must go receive training
'He must go for training?'
 - d. *ta1 xiang3 qu4 shang4 fen2?* (他想去上墳?)
he want go up grave
'He wants to visit the grave?'
 - e. *ta1 te4.bie2 xing1.fen4?* (他特別興奮?)
he especially excited
'He is especially excited?'
 - f. *ta1 xiang3 yao4 yi1 fen4?* (他想要一份?)
he want have one portion
'He wants to have a portion?'

In order to rule out effects from sentence order, the statement-and-question pairs were presented in three different sentence orders, as shown in (6), each in a separate session.

- (6) a. Statement followed by the question (S-Q)
S: He wants to have a share.
Q: He wants to have a share?
- b. Question followed by the answer (Q-A)
Q: He wants to have a share?
A: Yes, he wants to have a share.
- c. Statement, followed by the question and answer (S-Q-A)
S: He wants to have a share.
Q: He wants to have a share?
A: Yes, he wants to have a share.

3.4. Transcription system

To assist in identifying any tone and intonation transfer from Mandarin to Cantonese, a labeling system is necessary for annotating lexical and boundary tones of both languages, in particular, focal prominence signaled by raised pitch range over a localized or the entire part of the utterance. Wong *et al.* (2005) proposed a ToBI system, C_ToBI, for annotating Hong Kong Cantonese, and Peng *et al.* (2005) proposed M_ToBI for annotating Pan-Mandarin. Since I needed to identify potential prosodic transfer from Mandarin to Cantonese, I combined elements from C_ToBI and M_ToBI systems into one system, called MC_ToBI (see

Appendix A: Tables A1-A6). C_ToBI formed the basis of MC_ToBI. It adhered to the traditional lexical tone numbers instead of those proposed for C_ToBI. Since I also needed to identify potential prosodic transfer from Mandarin to English, I used break indices that were compatible with the indices from the Mainstream American English ToBI system (MAE_ToBI) (Beckman *et al.* 2005). Then I incorporated the Mandarin tones, stress levels, and tags for backdrop pitch range effects from M_ToBI into MC_ToBI. A *gloss* tier and defined uses of the *misc* tier were also added. C_ToBI doubled the first number of all the contour non-checked tones to distinguish them from the checked tones, *e.g.*, [35] → [335] for non-checked and [35] for checked tone. This numbering system could create confusion since [335] could refer to [33] or [35]. Instead, I marked contour tones on checked syllables with a ‘-’ after the tone number, *e.g.*, *sik1* [53-].

4. Results

4.1. Comparison of Mandarin and Cantonese lexical tones

Table 3 shows a representation of the consultant’s F0 range and duration of the four contrastive Mandarin tones, with the consultant’s production of *ma*. Similarly, Table 4 shows a representation of the consultant’s F0 range and duration of the six contrastive Cantonese tones, with the consultant’s production of *si*. The values are averages of both readings.

Tone	mT1	mT2	mT3	mT4
Token	媽 ‘mother’	麻 ‘hemp’	馬 ‘horse’	罵 ‘scold’
F0 (Hz)	192	129 → 231	175 → 106	207 → 121
Duration (ms)	650	830	820	550

Table 3. F0 and duration of the consultant’s production of *ma* in Mandarin.
The F0 values of mT2, mT3, and mT4 show a rise or fall in pitch.

Tone	cT1	cT2	cT3	cT4	cT5	cT6
Token	詩 ‘poem’	使 ‘to cause’	試 ‘to try’	時 ‘time’	市 ‘city’	事 ‘matter’
F0 (Hz)	200	165 → 222	178	179 → 141	172 → 120	175 → 125
Duration (ms)	930	925	780	865	920	1065

Table 4. F0 and duration of the consultant’s production of *si* in Cantonese.
The F0 values of cT2, cT4, cT5, and cT6 show a rise or fall in pitch.

In isolation, these tones are 2 to 3 times longer than in connected speech. Overall, the consultant spoke the Cantonese tones with longer duration than the Mandarin tones. This is expected because the consultant was more familiar with her native language, so she tended to speak Mandarin faster than Cantonese during elicitation. Her shortest Mandarin tone, mT4, is nearly half the duration of her longest Cantonese tone, cT6. The short duration of her mT4 is consistent with the general production of this tone. Her unusually long cT6 suggests that she might be having difficulty in producing this tone.

As for the F0 values of these tones, they are approximately the same in both languages, ranging from 120 to 240 Hz in isolation, with the exception of mT3 which drops to 106 Hz. In Northern China, mT3 is normally produced as a [214] tone, but the consultant

produced it as a [21]. The [21] allotone matches cT4 in shape, thus, facilitating mapping between these two tones.

The last two Cantonese tones were problematic for the consultant: cT5, a low-rise [23] tone, and cT6, a low-level [22] tone. She produced both incorrectly as a falling tone, with similar F0 value and pitch movement as cT4, a low-fall [21] tone. Further analysis of the additional readings of Cantonese tokens ending with *ji* and *fan*, shown in Table 5, confirmed that the consultant was consistent in producing these cT5 and cT6 errors. When I compared the Cantonese tone letters of these tokens with the tone letters of the Mandarin pronunciation, an interesting pattern emerged. In five out of six cases, cT5 and cT6 both corresponded to mT4 in Mandarin. Interestingly, all of the cT5's and cT6's falling-tone errors were produced on tokens which had an mT4 tone in Mandarin, as shown in Table 5.

Token	Cantonese (Jyutping)	Mandarin (Pinyin)	Consultant F0 (Hz)	Token	Cantonese (Jyutping)	Mandarin (Pinyin)	Consultant F0 (Hz)
市 'city'	si5	shi4	172 → 120	事 'matter'	si6	shi4	175 → 125
耳 'ear'	ji5	er3	176	二 'two'	ji6	er4	175 → 126
憤 'angry'	fan5	fen4	182 → 132	份 'portion'	fan6	fen4	152 → 128

Table 5. F0 of the consultant's production of *si*, *ji*, and *fan* in cT5 and cT6. The corresponding tokens in Mandarin are included to show the correlation between cT5/cT6 production errors and mT4.

As the prediction holds, a native Mandarin speaker would have difficulty in acquiring Cantonese tones because the latter has more contrastive tones. The mapping in Table 6 shows that cT1, cT2, and cT4 have corresponding tones in Mandarin, whereas cT3, cT5, and cT6 do not.

Cantonese	cT1 [55] ↑	cT2 [25] ↑	cT3 [33]	cT4 [21] ↑	cT5 [23]	cT6 [22]	GAP
Mandarin	mT1 [55]	mT2 [35]	GAP	mT3 [21]	GAP	GAP	mT4 [51]

Table 6. Mapping of Mandarin tones to Cantonese tones, based on pitch level.

In one of the three readings of *si*, *ji*, and *fan*, the consultant produced cT3 as a cT6 (*i.e.*, [168 → 134] Hz). However, in general, she produced cT3 correctly in connected speech. The persistent problematic tones were cT5 and cT6.

One possible explanation as to why cT5 and cT6 were produced incorrectly as a falling tone is that the consultant had linked cT5 and cT6 to mT4, a falling tone. Since mT4 is the only Mandarin tone that had not yet been linked to a Cantonese tone, it is potentially available for mapping onto cT5 and cT6. This is shown in Table 7.

Cantonese	cT1 [55] ↓ [55]	cT2 [25] ↓ [35]	cT3 [33] Acquired	cT4 [21] ↓ [21]	cT5 [23] ↑ [51]	cT6 [22] ↑ [51]
Mandarin	mT1	mT2		mT3	mT4	mT4

Table 7. The consultant's acquisition of Cantonese tones. One possibility is to map cT5 and cT6 onto mT4.

Another possible explanation relates to the phenomenon that many cognates or loan words with a cT6 in Cantonese have a corresponding mT4 tone in Mandarin, as shown in Table 8. This tonal relationship suggests that native speakers of Mandarin and of Cantonese may perceive cT6 and mT4 as the same tone.

	Chinese Token	Cantonese (Jyutping)	Mandarin (Pinyin)
bus	巴士	baa1 si6	ba1 shi4
Shanghai	上海	soeng6 hoi2	shang4 hai3
Mississippi	密西西比	mat6 sai1 sai1 bei2	mi4 xi1 xi1 bi3

Table 8. Tone 6 in Cantonese with corresponding tone 4 in Mandarin, in cognates or loan words.

If cT6 maps onto mT4, cT5 becomes the only tone without an association. Since cT6 is very similar in pitch level to cT5 (*i.e.*, [22] vs. [23] or Lh vs. Llh), it is plausible that cT5 loses its [-raised] (l) pitch and assimilates to cT6, as shown in Table 9.

Cantonese	cT5 ← cT6 Llh L h L h ↑ HL
Mandarin	mT4

Table 9. The consultant's acquisition of Cantonese tones.

Another possibility is mapping mT4 to cT6 and then assimilating cT5 to cT6.

A third possibility is that, phonologically, cT4, cT5, and cT6 all have a low register (*i.e.*, [-upper] feature) with different pitch levels (*i.e.*, [±raised] feature). Perhaps the similarity in register makes these low tones difficult for the consultant to produce. Apparently, she was able to perceive the different [±raised] pitches on a high register but not on a low register. This is similar to the problem that a Cantonese speaker with a cochlear implant encounters when trying to distinguish low tones (Ciocca *et al.* 2002). The F0 values of the consultant's cT4, cT5, and cT6 in the production of *si* shown in Table 4 above (*i.e.*, [179 → 141], [172 → 120], and [175 → 125] Hz, respectively) support the analysis that she was merging all three tones together, as shown in Table 10.

Cantonese	cT4 [21] L ↕ L [21]	↔	cT5 [23] L	↔	cT6 [22] L	[-upper] [-upper]
Mandarin	mT3					

Table 10. The consultant's acquisition of Cantonese tones. A third possibility is that the [raised] feature is ignored on Cantonese tones with a low register (cT4, cT5, and cT6).

4.2. Comparison of Mandarin and English word stress

A phonological analysis of the speech samples from the English reading tasks shows that, in general, the consultant preferred trochees over iambs. She was presented with disyllabic words that were either a trochee or an iamb (or potentially either), but she tended to place the main stress on the first syllable more frequently than the second, as shown in Table 11. This persistent pattern resembles a common stress pattern in Mandarin which appears on disyllabic words as well: trochees with a full tone followed by a neutral tone, forming a heavy and light binary foot. Samples from the consultant's Mandarin reading tasks reveal the same trochaic pattern, as shown in Table 12. The high-low F0 and intensity patterns in English (Table 11) and Mandarin (Table 12) closely resemble each other, which suggests that the consultant may be using the same acoustic cues to signal stress in both languages. It also suggests that her Mandarin stress pattern is influencing her English.

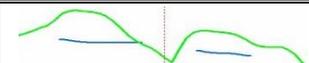
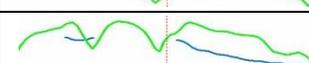
Token	Stress (Target)	Stress (consultant)	F0 (blue), Intensity (green)
southern	[ˈsʌ.ðə.ɪn]	[ˈsaʊf.tən]	
southeast	[saʊθ.ˈɪst]	[ˈsaʊθ.ɪst]	
sixteen	[ˌsɪk.ˈstɪn] or [ˈsɪks.tɪn]	[ˈsɪks.tʰɪn]	

Table 11. The stress patterns of the consultant's production of English disyllabic words.

The target stress patterns (source: Merriam-Webster Dictionary m-w.com).

The target pronunciation (source: m-w.com, converted to IPA by the author).

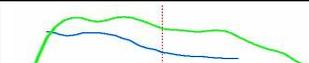
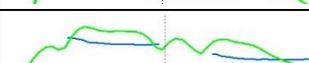
Token	Mandarin (Pinyin)	IPA	Stress	F0 (blue), Intensity (green)
妹妹 'sister'	mei4 mei	[mei ⁵¹ .mei]	heavy - light	
清楚 'clear'	qing1 chu	[tʰɪŋ ⁵⁵ .tʂʰu]	heavy - light	

Table 12. The stress patterns of the consultant's production of Mandarin disyllabic words.

Table 13 shows that the consultant's preference for a trochaic binary foot extends to place names. Although the consultant moved the primary stress from the third syllable to the first syllable in *Mississippi*, she placed a secondary stress on the third syllable to preserve the trochee and binary foot. Since the only prosodic element that was affected is the stressed

foot (Σ), it suggests that the consultant prefers not only a left-headed foot but also a left-headed word. She prefers to align the primary stress with the leftmost edge of the word (ω). This preference is also evident in her pronunciation of *Mexico City*, in which she placed the main stress on the leftmost syllable of each word: $\omega(\ \Sigma('m\epsilon k.s\text{I}\ \Sigma(,kou))\ \omega(\ \Sigma('s\text{I}.t^h\text{i}))$). Alternatively, she could have placed the main stress on [kou] but did not. Both examples show that the consultant consistently placed the main stress on the leftmost syllable of the word, regardless of the stress pattern of the native speaker.

Place names	Mandarin (Pinyin)	IPA (Target)	IPA (Consultant)
Mississippi		[,mɪ.sə.'sɪ.pi]	['mɪ.sɪ.,sɪ.pi]
密西西比	mi4 xi1 xi1 bi3	[mi ⁵¹ ɕi ⁵⁵ ɕi ⁵⁵ pi ²¹]	[mi ⁵¹ ɕi ⁵¹ ɕi ⁵⁵ pi ²¹]
Mexico City		['mɛk.sɪ.,kou 'sɪ.rɪ]	['mɛk.sɪ.,kou 'sɪ.t ^h i]
墨西哥城	mo4 xi1 ge1 cheng2	[mo ⁵¹ ɕi ⁵⁵ kɤ ⁵⁵ tɕ ^h əŋ ³⁵]	[mo ⁵¹ ɕi ⁵¹ kɤ ⁵⁵ tɕ ^h əŋ ³⁵]

Table 13. The stress and tone patterns of the consultant's production of place names in English and Mandarin.

4.3. Comparison of Mandarin, Cantonese, and English intonation in declarative questions

4.3.1 Raised pitch range

A raised pitch range is a specific intonation pattern that Mandarin uses to signal a question. This grammatical use of intonation is not a feature of Cantonese or English. Surprisingly, when the question preceded the statement in the reading (*i.e.*, Q-A order), the declarative questions in all three languages showed a higher pitch range than the statements. However, when the statement preceded the question (*i.e.*, S-Q order), only Mandarin and Cantonese questions showed this pitch effect. A third reading order in which the question preceded the answer but followed the statement (*i.e.*, S-Q-A order) confirmed evidence of a raised pitch range pattern in the consultant's Mandarin and Cantonese declarative questions but not in her English questions. The reason why the question had a higher pitch range than the statement in English in the Q-A order was due to the universal tendency for the F0 to gradually decrease toward the end of the discourse (Gussenhoven 2004). Thus, the initial sentence in a discourse is usually higher in pitch than the second sentence.

Figure 1 compares the consultant's production of English intonation patterns with Mandarin intonation patterns in declarative questions. Each pitch track contains a statement followed by a declarative echo question that repeats the entire statement. The Mandarin statement-and-question pairs each ends with a different Mandarin tone. The English sentences are translations of the Mandarin sentences.

In the English examples, the statement intonation shows an emphasis on the main verb *wants*, followed by a gradual fall. The question intonation begins at the F0 level of the tail end of the statement and gradually moves upward until near the end of the utterance where it rises sharply to signal a yes/no question. The raised pitch range pattern of Mandarin is not evident in the English questions.

In the Mandarin examples, the statement intonation shows an emphasis on the subject pronoun *ta1* 'he' instead of the first verb *xiang3* 'want', probably because *ta1* 'he' has

a high-level tone [55] and *xiang3* ‘want’ has a low-fall tone [21]. The question intonation shows a higher pitch range than the statement intonation. At the tail end of the question, F0 rises except when the final tone is mT4, in which case, F0 falls. This is a tonal effect due to the fact that the offset of mT1 [55], mT2 [35], and mT3 [214] all are relatively higher in pitch than the immediately preceding pitch value(s).

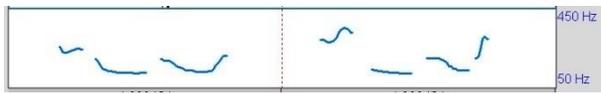
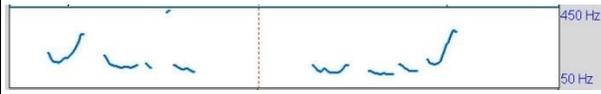
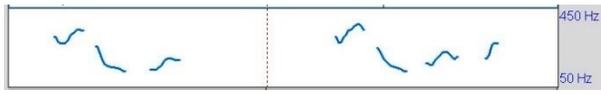
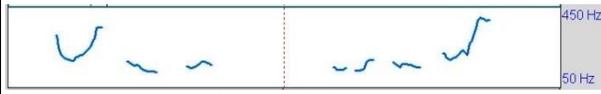
English	Mandarin
 <p>(eS1) He wants to see his Mom. (eQ1) He wants to see his Mom?</p>	 <p>(mS1) 他想見他媽媽。 (mQ1) 他想見他媽媽? <i>ta1 xiang3 jian4 ta1 ma1.ma</i> he want see he Mom 'He wants to see his Mom'</p>
 <p>(eS2) He wants to buy some hemp. (eQ2) He wants to buy some hemp?</p>	 <p>(mS2) 他想買大麻。 (mQ2) 他想買大麻? <i>ta1 xiang3 mai3 da4.ma2</i> he want buy hemp 'He wants to buy some hemp'</p>
 <p>(eS3) He wants to ride a horse. (eQ3) He wants to ride a horse?</p>	 <p>(mS3) 他想騎馬。 (mQ3) 他想騎馬? <i>ta1 xiang3 qi2 ma3</i> he want ride horse 'He wants to ride a horse'</p>
 <p>(eS4) He wants to be scolded. (eQ4) He wants to be scolded?</p>	 <p>(mS4) 他想被罵。 (mQ4) 他想被罵? <i>ta1 xiang3 bei4 ma4</i> he want (passive particle) scold 'He wants to be scolded'</p>

Figure 1. Examples of English and Mandarin statement and question intonation. In each pitch track, the F0 contour (shown in blue) to the left of the vertical dotted red line belongs to the statement, and the pitch contour to the right belongs to the question.

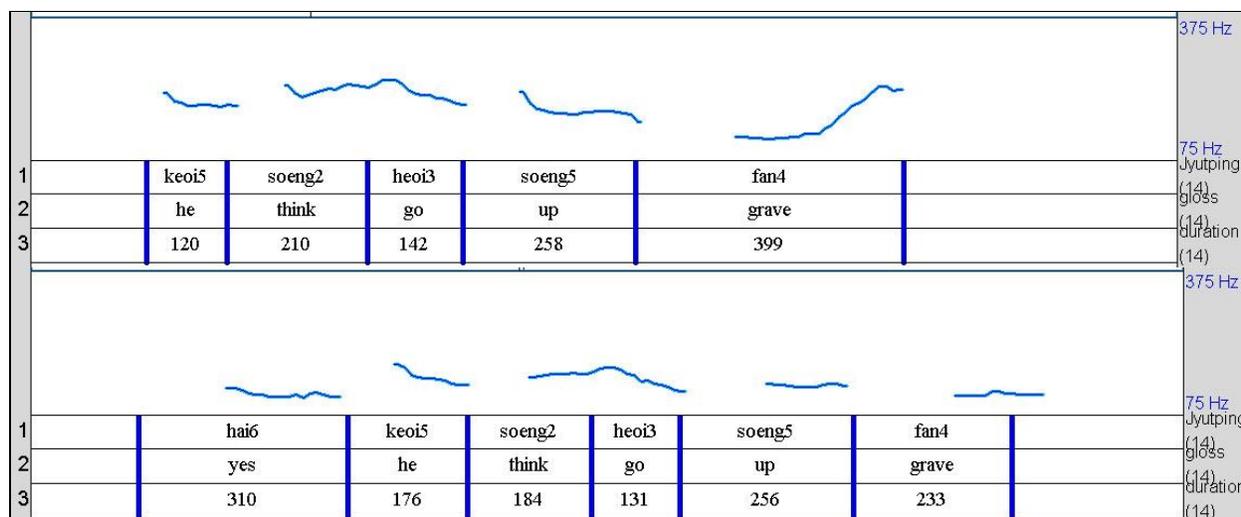


Figure 2. Pitch contours of a question and a statement in Cantonese:
'He wants to visit the grave? Yes, he wants to visit the grave.'

The raised pitch range effect of Mandarin is also evident in the consultant's production of Cantonese declarative questions, as shown in the example in Figure 2. This elevated intonation pattern is not native in Cantonese. Figure 3 shows a statement-question-answer sequence produced in Mandarin. The declarative question in the middle has a higher pitch throughout the utterance than the statement on the left and the answer-statement on the right. This is evidence of a raised pitch range effect on Mandarin questions. There also appears to be a lowered pitch effect on the last answer-statement, which is the declination effect described earlier.

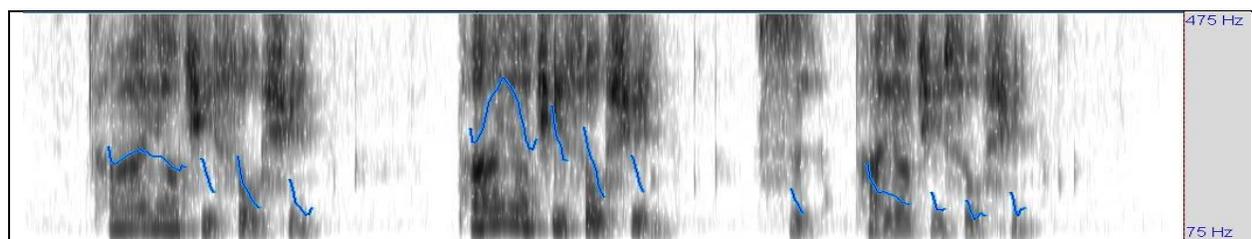


Figure 3. The pitch contours of the consultant's production of the sequence of a statement, question, and answer in Mandarin: *Ta1 yao4 qu4 shou4 xun4*. 'He must go for training.' *Ta1 yao4 qu4 shou4 xun4?* 'He must go for training?' *Shi4, ta1 yao4 qu4 shou4 xun4*. 'Yes, he must go for training.'

In summary, there is evidence of intonation transfer from Mandarin to Cantonese in the consultant's production of declarative questions. This intonation transfer is not evident in the English questions.

4.3.2 High boundary tone

A high boundary tone appears in a final rise of an utterance, *i.e.*, intonational phrase (IP). The consultant's Mandarin intonation shows a lack of a high boundary tone at the end of declarative questions. The IP-final tone seems to depend on the utterance-final lexical tone.

If it is a falling tone [51], the boundary tone is low (L%) and the tail end of the utterance falls; otherwise, the boundary tone is high (H%) and the tail end rises. The influence of lexical tone on the IP-final tone is shown in Table 14.

Token	Cantonese		Mandarin		English	
	Utterance-final Tone	IP-final Pitch Direction	Utterance-final Tone	IP-final Pitch Direction	Utterance-final Tone	IP-final Pitch Direction
Q11	cT1	↑	mT1	↑	n/a	↑
Q12	cT2	↑	mT3	↑	n/a	↑
Q13	cT3	↑	mT4	↓	n/a	↑
Q14	cT4	↑	mT2	↑	n/a	↑
Q15	cT5	↑	mT4	↓	n/a	↑
Q16	cT6	↑	mT4	↓	n/a	↑

Table 14. Pitch movement (‘↑’ rise or ‘↓’ fall) at the end of questions ending in ‘fan’ for Cantonese, and their corresponding sentences in Mandarin and English. English has no lexical tone (n/a).

The English declarative questions produced by the consultant show an upward pitch movement at the tail end, as indicated in Table 14. This intonation pattern is consistent with that of a native speaker of English.

Finally, in the case of Cantonese declarative questions, the consultant produced them with a rising F0 at the end regardless of the lexical tone at utterance-final position. This rising intonation pattern is consistent with the question pattern produced by native speakers of Cantonese. Figures (4, 5) show examples of the consultant’s production of a question ending in cT5 and cT6, respectively. In both cases, the boundary tones were H%.

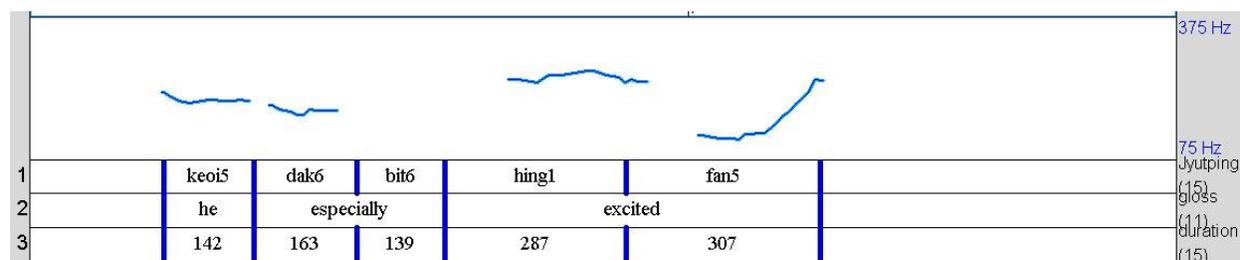


Figure 4. The consultant’s production of a question ending in cT5 in Cantonese: *Keoi5 dak6 bit6 hing1 fan5?* ‘He is especially excited?’ (Only partial annotation is shown.)

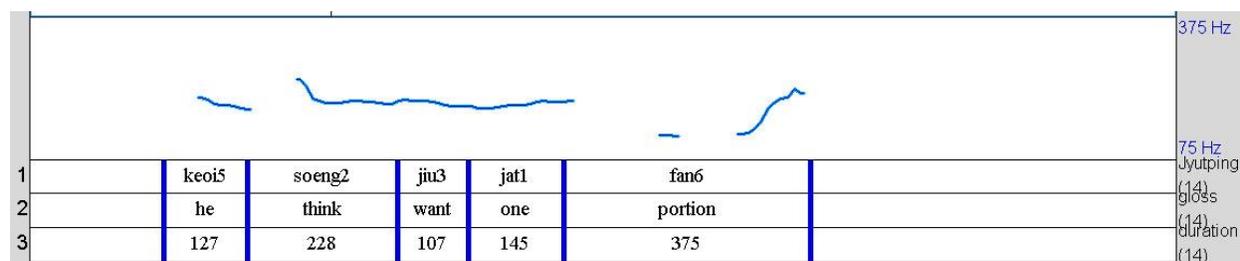


Figure 5. The consultant’s production of a question ending in cT6 in Cantonese: *Keoi5 soeng2 jiu3 jat1 fan6?* ‘He wants to have a portion?’ (Only partial annotation is shown.)

5. Conclusion

This study examined the speech of a native speaker of Mandarin to determine if there was an L2 transfer of intonation, as well as lexical tones and word stress, from Mandarin to Cantonese and English. As predicted, the consultant demonstrated difficulty in producing the low register tones in Cantonese (*i.e.*, cT5 and cT6) due to their markedness as compared to Mandarin tones. It was also predicted that there would be influence from her Mandarin stress pattern on her English. Her preference for a trochaic stressed binary foot was evident in her production of Mandarin disyllabic words and place names. Her production of English disyllabic words also consistently showed a pattern of trochees and a left-headed word, even when an alternate, acceptable pattern was possible.

From the elicited speech samples, I was unable to determine if the stress pattern of Mandarin had an effect on the consultant's English sentence intonation. However, the intonation on her English questions was near native-like and did not show any signs of intonation transfer from Mandarin. Cantonese, on the other hand, was affected by Mandarin. Although the consultant showed acquisition of the native Cantonese question pattern, she also adopted the raised pitch range effect from her Mandarin questions. The result of this study suggests that the consultant encountered more difficulty during her acquisition of the intonation of Cantonese than that of English. The implication is that lexical tones interfered with sentence intonation more so than word stress for this speaker. This is in accordance with Yuan's (2011) claim that both lexical tones and intonation use pitch as a primary cue.

This study examined the speech of a single speaker from Singapore. A future direction would be to repeat the study with other speakers, including males, teenagers, and speakers of other dialects of Mandarin (*e.g.*, Taiwan's Guoyu and China's Putonghua).

This case study shows that lexical tones are difficult to acquire, even for an L2 learner who has acquired the lexical tones of her L1. It also shows that word stress is difficult to acquire, especially in an L2 language, such as English, which has complex stress patterns.

One related finding from this study is the potential link between cT1 and cT6 in Cantonese and syllable stress in English. In English and Cantonese loan words, such as *strawberry* and *bus*, a stressed syllable (S) is associated with a [55] tone (cT1) and a non-stressed syllable (NS) is associated with a [22] tone (cT6), as shown in Table 15.

strawberry	bus
[s 'tʰiɑ ,bɛ ˌi]	['bʌ s]
↓ ↓ ↓	↓ ↓
[si: ²² tɔ: ⁵⁵ pɛ: ⁵⁵ lei ²⁵]	[pa: ⁵⁵ si: ²²]
NS S S	S NS

Table 15. Examples showing a link between a stressed syllable (S) and a [55] tone, and a link between a non-stressed syllable (NS) and a [22] tone.

This characteristic is also seen in S-language (Jernudd & Yan 1995), a secret language used by teenage students in Hong Kong, in which the tone of the actual syllable is changed to cT6

(to make it the least prominent) and the reduplicated syllable which follows is assigned cT1 (to make it the most prominent). This phenomenon, in which a high tone is associated with stress and a low tone is associated with no stress, is perhaps unique to Hong Kong Cantonese because of its linguistic interaction with the English language, and perhaps specific to loan words.

According to Flynn (2003), although there is no contrast of stressed and unstressed syllables in Cantonese, there are varying degrees of prominence between syllables. If one important element in creating prominence in Cantonese is lexical tones (complemented by duration and, optionally, intensity), could there be common perception cues between how prominence is achieved in Cantonese and how stress is realized in English? Could these common cues help an L2 learner to perceive these prosodic elements in their non-native language? Future research in this area might provide insight into L2 English stress patterns of Hong Kong Cantonese speakers.

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Appendix A: MC_ToBI

Tier	Description
tones	lexical tones and intonational phrase boundary tones
stress	stress levels associated with a full, reduced or neutral tone in Mandarin
breaks	end of the syllable, word, intermediate phrase or intonational phrase
pitch range	change or reset in pitch range
foot	(a) fusion forms and their combined tones, <i>e.g.</i> , jik5+hai22 → je55-22 ‘that is’ (b) emphasized syllables and phrases (<i>e.g.</i> , longer duration, higher intensity, expanded pitch range relative to any pitch range change noted in the <i>pitch range</i> tier), tagged with <*>, or <*> and <*>.
syllables	(a) romanization of the Chinese character in the <i>words</i> tier: Jyutping for Cantonese and Pinyin for Mandarin (b) intervals of silence, labeled with <SIL>
words	Chinese character
gloss	English word-by-word translation
misc	(a) sentence type: <Q> for question and <S> for statement (b) the correct or normal lexical tone, if it is different from the transcribed tone

Table A1. MC_ToBI: Tiers, derived from M_ToBI (Peng *et al.* 2005) and C_ToBI (Wong *et al.* 2005)

Lexical Tones		Cantonese	Mandarin
55	high-level	cT1 55	mT1 55
33	mid-level	cT3 33	
22	low-level	cT6 22	
5	high-level (σ -final stop)	cT1 5 (for checked syllable)	
3	mid-level (σ -final stop)	cT3 3 (for checked syllable)	
2	low-level (σ -final stop)	cT6 2 (for checked syllable)	
23	low-rise	cT5 23	
35	high-rise	cT2 25 or 35	mT2 35
51	high-fall		mT4 51
53	high-mid-fall	cT1 53 (allophone of 55)	
32	mid-fall		
21	low-fall	cT4 21	mT3 21
214	low-fall-rise		mT3 214

Table A2. MC_ToBI: Tone numbers, and their equivalent in Cantonese and Mandarin.

The mid-fall [32] tone is not a specified Mandarin or Cantonese tone but appears in the elicited data.

Boundary Tone	Description
L%	fall from the IP-final lexical tone
H%	rise from the IP-final lexical tone
LH%	fall then rise from the IP final lexical tone
HL%	rise then fall from the IP final lexical tone
%	no extra tone added to the IP-final lexical tone

Table A3. MC_ToBI: Intonational phrase (IP) boundary tones, from C_ToBI (Wong *et al.* 2005:296) with ‘LH%’ added

Stress Level	Description
S3	syllable with fully-realized lexical tone
S2	syllable with substantial tone reduction
S1	syllable that has lost its lexical tonal specification
S0	syllable with lexical neutral tone

Table A4. MC_ToBI: Stress levels in the *stress* tier, from M_ToBI
(These labels and descriptions were extracted from Peng *et al.* 2005:265.)

Break Indices	Description
0	reduced syllable boundary, or syllable boundary of a fused form
1-	syllable boundary within a polysyllabic word
1	word boundary
2	uncertainty between two boundaries or mismatch
3	intermediate phrase boundary (with a perceived pause or prolongation)
4	intonational phrase boundary (with reset of pitch) which is associated with a boundary tone on the <i>tones</i> tier

Table A5. MC_ToBI: Break indices, derived from MAE_ToBI (Beckman *et al.* 2005:23), C_ToBI (Wong *et al.* 2005:297), and M_ToBI (Peng *et al.* 2005:266)

Tag	Description
%reset	beginning of a new pitch downtrend or pitch reset
%q-raise	beginning of a raised pitch range (<i>e.g.</i> , in echo questions)
%e-prom	beginning of local expansion of pitch range due to emphatic prominence
%compressed	beginning of reduction of pitch range of syllables following the expansion of pitch range under %e-prom

Table A6. MC_ToBI: Tags for pitch range effects in the *pitch range* tier, from M_ToBI
(These tags and descriptions were extracted from Peng *et al.* 2005:260.)

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Subject contact relatives: A cross-dialectal approach

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Abstract

This paper advances a Minimalist structural account of subject contact relatives, such as *I met a man_ can speak five languages*, which are common to Belfast English and Ulster Scots but unacceptable in Standard British and North American Englishes. Previous accounts have treated these constructions as restrictive relatives (Doherty 1993) or topic-comment structures (Henry 1995). However, such approaches fail to describe the full range of syntactic and pragmatic restrictions affecting subject contact relatives; moreover, these studies have neglected dialectal differences in contact relative distribution. This paper treats subject contact relatives as TopicP constructions with null (or optionally resumptive) subjects but overt topics. These constructions are noted to be restricted to syntactic predicates that serve a presentational function in the discourse. Further, syntactic and pragmatic variations in the composition of TopicP engender the observed dialectal differences in subject contact relative distribution across Belfast English, Ulster Scots, and standard English.

1. Introduction

In Belfast English and Ulster Scots,¹ the subject pronoun in a relative clause may be omitted:

(1) I met a man [(who) can speak five languages.] (Henry 1995:125)

Such “subject contact relatives” occur in presentational sentences, as in (1), as well as *there*-existentials, *it*-clefts, and copula equatives in Belfast English and Ulster Scots. These structures are unavailable in standard English:² the relativized pronoun *who* in (1) is strictly necessary.

In the present article, I investigate the syntactic structure of subject contact relatives (henceforth, SCRs), accounting for both their contextual restriction and their cross-dialectal distribution. I analyse SCRs as TopicP constructions with null or resumptive subjects but overtly marked topics. These structures are restricted to predicates in presentational contexts, which I posit accept TopicP complements. Further, I suggest there is syntactic and pragmatic dialectal variation in the composition of TopicP, which enables the creation of SCRs in Belfast English and Ulster Scots, but not in standard English.

The remaining sections are organized as follows: Section 2 provides an overview of the distribution of contact relatives in standard English, Belfast English, and Ulster Scots. Section 3 outlines two previous approaches to Belfast English SCRs as advanced by Doherty (1993) and Henry (1995). Section 4 develops an analysis of SCRs as TopicP formations, accounting for both their semantic distribution and the cross-dialectal data. Section 5 concludes the paper with a comparison of the present and previous approaches, and also includes points for future consideration.

2. Distribution of Contact Relatives

At present, I summarize the syntactic distribution of contact relatives in standard English as well as that of SCRs in Belfast English and Ulster Scots.

Firstly, it is not the case that all contact relatives are ungrammatical in standard English. Object contact relatives are acceptable:

(2) I know I bought the book [*Op_i* you recommended <*Op_i*>.] (Carnie 2013:372)

In (2), a phonologically null operator may represent the object of *recommend* in place of a relativized pronoun, such as *which*.

Nevertheless, wherever the subject is relativized, a contact relative is impossible.

(3) a. There are people [who don't read books.]
 b. * There are people [_ don't read books.] (Henry 1995:124)

¹ The linguistic status of Ulster Scots as a dialect of English or a separate, but related, language is beyond the scope of this paper. Ulster Scots is at least intricately related to English (Montgomery 2006), and for this reason, the distribution of subject contact relatives in Ulster Scots merits present consideration. The term “dialect” will be used to compare Belfast English, Ulster Scots, and standard English.

² The dispreference for SCRs is common to Standard British and Canadian Englishes, from which the data are drawn.

In (3a), a relative clause with the overt relativized subject pronoun *who* is acceptable; however, in standard English, the removal of the relativized subject, as in (3b), is ungrammatical.

Conversely, in Belfast English, SCRs such as (3b) are grammatical in certain contexts.

- (4) a. There are some students [_ never do any work.]
 b. It was John [_ told us about it.]
 c. He's the one [_ stole the money.]
 d. I know a boy [_ has never worked.] (Henry 1995:125)

In Belfast English, SCRs may appear in *there*-existentials, such as (4a); *it*-clefts, as in (4b); equative sentences with the copula, as in (4c); and presentational sentences such as (4d), which generally serve to “introduce individuals into the discourse” (Henry 1995:125).

Moreover, in all contexts where SCRs are permitted in Belfast English, an overt pronoun form is also possible:

- (5) a. There's one woman in our street [_ went to Spain last year.]
 b. There's one woman in our street [she went to Spain last year.]
 c. There's one woman in our street [who went to Spain last year.] (Henry 1995:126)

Note that the SCR in (5a) and the overt subject pronoun form in (5b) have the same interpretation: both may be paraphrased by the relative clause in (5c). Thus SCRs and their overt variants seemingly share the semantic values of their standard English relative clause counterparts.

Additionally, overt pronoun variants may not appear alongside relativized elements.

- (6) *There's one woman in our street [who she went to Spain last year.]
 (den Dikken 2005:697)

Thus in (6), the overt subject *she* is disallowed after the relativized pronoun *who* in an SCR.

Moreover, in all other contexts in Belfast English, SCRs and their overt pronoun forms are both considered unacceptable.

- (7) a. * I lost the book [_ gives an account of this.]
 b. * I was talking to the lecturer [she takes the linguistics course.]
 c. * The students [_ have an exam next week] are working very hard.
 d. * The students [they are taking French] have an exam next week.
 (Henry 1995:125–127)

SCRs are disallowed after non-presentational matrix verbs, such as *lost* in (7a); the same restriction holds for the overt pronoun with *talking* in (7b). SCRs (7c) and overt pronoun variants (7d) are also impossible in matrix subject position in non-presentational contexts.

Note that SCRs are ungrammatical in matrix subject position, even in presentational contexts, such as in equatives.

(8) *The person [_ could help you with that] is John. (den Dikken 2005:699)

In (8), despite the appearance of the copula equative, an SCR is impossible with *the person*, the subject of the matrix clause. In sum, SCRs surface only in a restricted set of post-verbal complement contexts.

SCRs also surface in certain contexts in Ulster Scots. In this dialect, these structures appear in the same conditioned environments as in Belfast English, which are outlined in (9).

- (9) a. There wuz a yella cat [_ killed a power o mice.]
 'There was a yellow cat that killed a large number of mice.'
 b. It wuz Jim [_ growed the flures.]
 'It was Jim who grew the flowers.'
 c. That's a doag [_ wuz in mae shap.]
 'That's a dog that was in my shop.'
 d. I met a man [_ had a lock o money.]
 'We met a man who had a large quantity of money.'
 (Montgomery 2006:307–309)

In Ulster Scots, as in Belfast English, SCRs occur in *there*-existentials (9a); *it*-clefts (9b); copula equatives (9c); and presentational sentences (9d) after matrix verbs such as *meet*.

But Montgomery (2006) notes that Ulster Scots also allows SCRs in broader syntactic contexts than Belfast English. In particular, he observes that SCRs are permitted as modifiers of definite descriptions in presentational sentences;³ they may also modify matrix subjects, sentence-initially.

- (10) a. They caught the man [_ stole mae car.]
 'They caught the man who stole my car.'
 b. The man [_ stole the car] leeves nixt dorr.
 'The man who stole the car lives next door.'
 (Montgomery 2006:309)

In Ulster Scots, an SCR may modify a definite description, such as *the man* in (10a), in a presentational sentence. By contrast, in Belfast English, only indefinite DPs allow SCRs in presentational sentences (Montgomery 2006). Moreover, in Ulster Scots, an SCR may apply to the subject of the matrix clause, as in the case of *the man* in (10b).

Recall that this same construction is ungrammatical in Belfast English:

³ Although Belfast English restricts SCRs to modifying indefinite phrases in presentational type sentences, this constraint does not apply to all contexts. Definite descriptions are acceptable in *it*-clefts and equatives, for example.

- a. It was John [_ told us about it.]
 b. He's the one [_ stole the money.]

(Henry 1995:125)

Thus in (a) and (b), repeated from (4b, c), the proper name *John* and the definite DP *the one* are both acceptable antecedents for SCRs in an *it*-cleft and a copula equative, respectively.

(11) *The person [_ could help you with that] is John. (den Dikken 2005:699)

SCRs are disallowed in subject position in Belfast English, as with the subject *the person* in (11), repeated from (8).

I have now reviewed the syntactic distribution of contact relatives in standard English, Belfast English, and Ulster Scots. In the next section, I address two prior analyses of SCRs in dialectal English.

3. Previous Analyses

SCRs have hitherto received two styles of treatment: firstly as canonical relative clauses, as advanced by Doherty (1993); and secondly as topic-comment structures, as in Henry (1995).

In this section I summarize these disparate analyses and address certain problems therein.

3.1 SCRs as Relative Clauses

Doherty (1993:155) characterizes SCRs as variant “true restrictive relative clauses.” He parallels these structures to the object contact relatives of standard English, positing both types are finite TPs⁴ instead of CPs. SCRs are semantically and not syntactically constrained, he suggests, as “a noun phrase modified by an SCR must be interpreted as non-referential.” In these contexts, the contact relative may bind a null pronominal by means of a “covert resumptive pronoun strategy.”

Firstly, Doherty observes that English CP relative clauses allow adverbial adjunction at the TP level, but contact relatives—including Belfast English SCRs—do not.

- (12) a. The girl [who during the riot [the soldiers shot dead]]
 b. *The girl during the riot [who [the soldiers shot dead]]
 c. *The woman tomorrow [we’ll meet _ after lunch]
 d. *That’s the girl just yesterday [_ was talking about you]
- (Doherty 1993:161–162)

In (12a), the adverbial phrase *during the riot* may appear below the relativized pronoun *who* in [Spec, CP] but above the subject *the soldiers* in [Spec, TP]; thus it may adjoin at TP. Note the same adverbial is disallowed above the relativized pronoun, that is, adjoined at CP, in (12b). In the same way adjunction at the TP level is expected to be available in object (12c) and Belfast English subject (12d) contact relatives, but these forms are ungrammatical. Doherty (1993:162) posits “adverbial adjunction to the maximal projection of a relative clause is excluded.” In general restrictive relatives, this maximal projection is CP, but in contact relatives, it is TP. Thus SCRs pattern differently than general relative clauses, but similarly to object contact relatives.

Belfast English SCRs also resemble object contact relatives as well as other restrictive relatives in their syntactic distribution and semantic interpretation, as evidenced in (13).

(13) I gave a lift to anybody [_ asked for one.] (Doherty 1993:158)

⁴ Doherty (1993) makes reference to IP, but for consistency, I use TP throughout this paper.

In (13), the SCR co-occurs with “free-choice *any*,” a phenomenon Doherty (1993:159) argues is constrained to restrictive modifiers. Then SCRs occur in the same syntactic environments as restrictive relative clauses; they also share the relative clause’s function of restricting meaning. Doherty thus considers these constructions to be variant relative clause types.

Next, Doherty explains the limited distribution of SCRs semantically: A head noun phrase modified by an SCR cannot be extensional. He posits this generalization from his observation that the head noun phrase either does not refer at all or must denote an intensional entity.

- (14) a. It was a thing [_ came naturally to my mind.]
 b. *She . . . gave me all the change [_ was in the house.]
 c. *We want someone [_ knows John.] (Doherty 1993:158–160)

Predicate nominals, such as *a thing* in (14a), denote functions over entities, and not particular entities themselves (Heim & Kratzer 1998); similarly, nominals in the restriction of quantifiers, such as *the change* in (14b), fail to denote entities. Lastly, in intensional contexts, such as following the attitude verb *want* in (14c), Doherty notes that the nominal *someone* necessarily has an intensional meaning, and cannot have an extensional denotation.

Finally, Doherty claims SCRs license either a null or a resumptive pronoun in subject position. He notes that resumptive pronouns of this sort are generally disallowed in the highest subject position by McCloskey’s (1990:215) Highest Subject Restriction, which requires that “a pronoun must be A’-free in the least complete functional complex containing the pronoun and a subject distinct from the pronoun.” By this constraint, SCRs are disfavoured, as the resumptive pronoun is in A’-position in [Spec, TP] and is bound by the preceding head noun phrase. However, in the non-extensional cases outlined above, Doherty argues the non-referential head noun phrase has no overt indexing; thus it cannot be coreferential with nor bind the pronoun, and the Highest Subject Restriction fails to apply. In these semantically-defined cases, then, SCR structures are permissible.

There are inherent problems with Doherty’s analysis, however. Firstly, it is not clear that the head noun phrase is always non-referential; secondly, Doherty provides no restriction on SCRs in standard English.

Initially, Doherty claims that the head noun phrase of an SCR may not be extensional; yet an example from Ulster Scots shows that this is not always the case.

- (15) The man [_ stole the car] leeves nixt dorr. (Montgomery 2006:309)

In (15), reiterated from (10b), the nominal *the man* is not indefinite, nor is it constrained by a quantifier or a verb requiring an intensional context. Outside of these exceptional cases, the definite description *the man* is extensional, denoting a particular satisfier of the predicate *man* within the utterance context (Heim & Kratzer 1998). In (15), then, the referential nominal has an explicit indexing and therefore binds the null pronoun in the relative clause’s [Spec, TP]. Thus the Highest Subject Restriction should disallow (15) as a potential SCR.

Furthermore, Doherty suggests SCRs are made acceptable by general syntactic and semantic restrictions; by extension, he does not constrain these structures from occurring in standard English. Indeed, object contact relatives—which, according to Doherty, are

similarly structured—are permissible in standard English. Thus the unacceptability of SCRs in standard English requires further explanation.

In sum, although Doherty argues SCRs are mere variants of restrictive relative clauses with non-referential head nouns, he does not account for the dialectal acceptability of referential head nouns in Ulster Scots; nor can he explain the unacceptability of these types of contact relatives in standard English.

3.2 SCRs as Topic-Comment Structures

In contrast to Doherty (1993), Henry (1995) claims that SCRs are not to be analysed as relative clauses, but as topic-comment structures. She suggests that the SCRs of Belfast English are akin to overtly introduced topic structures, which serve to bring a new entity into the discourse and subsequently comment on that entity. Thus the head noun is part of a topic phrase; the apparent relative is, in actuality, a matrix clause. In this way, she accounts for the limited distribution of SCRs in topic-presenting contexts.

Firstly, Henry observes the sociolinguistic prevalence of topic-comment structures in Belfast English. Such constructions introduce new topics into the discourse with sentence-initial CPs.

- (16) a. See my brother, he never stops talking.
 b. You know John, he never shuts his bake. (Henry 1995:132)

In (16a) and (16b), the modified noun phrases are introduced as topics by *see* and *you know*. The following root clauses are comments: *he never stops talking* in (16a) and *he never shuts his bake* in (16b) provide some new information about *my brother* and *John*, respectively. Henry argues SCRs mirror the pragmatic function of these structures.

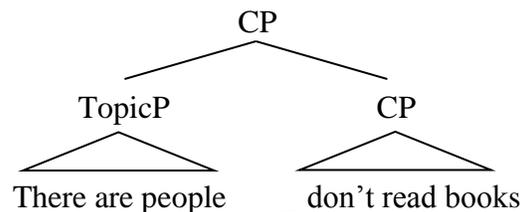
Moreover, where topic structures permit an overt pronoun in subject position, they also allow a gap.

- (17) You know John, never shuts his bake. (Henry 1995:132)

Compare the gap in (17), which is coreferential with the topic *John*, to the overt pronoun *he* in (16b). Topic structures allow either an overt resumptive or a null subject pronoun; SCRs permit the same alternation. In this way, SCRs also syntactically resemble overtly introduced topic structures.

Based on these pragmatic and structural similarities, Henry proposes a topic-comment analysis of SCRs. In these types, the apparent matrix clause is a TopicP, and the contact relative itself is the matrix clause. I outline this analysis in (18).

- (18) a. There are people don't read books. (Henry 1995:124)
 b.



Then by Henry's treatment, (18a), repeated from (3b), has the structure outlined in (18b). The introductory phrase *There are people* is a TopicP, adjoined at the CP level; the comment *don't read books* follows as the matrix CP. The subject of the CP here is null.

A topic-comment approach allows Henry to account for the general restriction of SCRs to presentational contexts, wherein new topics are introduced. Her analysis also allows resumptive pronouns in subject position within these structures. Henry cites McCloskey's (1990) Highest Subject Restriction,⁵ which disallows resumptive pronouns "in the highest subject position" generally; however, she observes that "topic structures do allow such pronouns coreferential with the topic" (Henry 1995:131). Similarly, topic-comment SCRs are exempt from this constraint.

However, a topic-comment analysis cannot provide a complete explanation for English data cross-dialectally. Specifically, English does not permit null subjects in general; and it remains unclear how Belfast English, Ulster Scots, and standard English differ syntactically such that CP topics are allowable in the former two with differing distributions, but are always ungrammatical in the latter.

Firstly, English is not a Null Subject language: both thematic and expletive subjects must be overt, and *pro*-drop is typically disallowed (Camacho 2013), as exemplified in (19).

- (19) a. *Seems to be raining.
 b. *Left. (Camacho 2013:3–4)

In English, matrix clause expletives (19a) and thematic subjects (19b) cannot be null.⁶ Then it is contrary that Henry allows null subjects to appear in matrix clauses in topic structures and SCRs with no further explanation, whereas these are not permitted generally.

Secondly, as observed in Section 2, the distribution of SCRs varies between Belfast English and Ulster Scots. In particular, the latter allows SCRs to appear sentence-initially, as in (10b), reiterated below as (20).

- (20) [The man [_ stole the car]] leeves nixt dorr. (Montgomery 2006:309)

Under Henry's analysis, (20) is currently ungrammatical. The SCR is a matrix CP; in that case, after adjoining the TopicP (here, just a DP, *the man*), the entire topic-comment structure is the subject of a further predicate, *leeves nixt dorr*. Yet, as a CP, the topic-comment structure cannot receive nominative case from T nor a Theta-role from *leeves*; then the derivation should crash. Thus Henry's analysis cannot generalize to all dialectal variations of SCRs; specifically, Ulster Scots subject-initial SCRs are problematic.

Moreover, topicalization is not unknown in standard English: a DP may be topicalized.

⁵ Henry (1995) adopts a different formulation of the Highest Subject Restriction than Doherty (1993). Note that Henry's articulation of the constraint disallows Doherty's treatment of SCRs, as in his relative clause types, [Spec, TP] remains the highest subject position and is filled by a resumptive pronoun.

⁶ Note that sentences with null subjects as in (19) may appear in informal speech, even in standard English: "I won't go out today. Seems to be raining," or, "Why isn't John with you?" "Left." These cases do not counter the present argument since the null subjects of SCRs, unlike those in (19), are not limited to informal discourse contexts.

- (21) a. Newspapers, I really like.
 b. *See newspapers, I really like. (Henry 1995:135)

While topicalization of an object DP, as in (21a), is acceptable in standard English, a CP may not be topicalized, and attempting to do so with *see newspapers* in (21b) is ungrammatical. Henry notes this distinction; nevertheless, she does not formally address why topic-comment structures such as (21b), as well as SCRs in general, are disallowed in standard English.

Thus while Henry's approach characterizes Belfast English SCRs, it cannot be generalized cross-dialectally. In particular, her account does not explain the grammaticality of null subjects in dialectal English; it also does not address structural variations in Ulster Scots, and the acceptability of DP but not CP topicalizations in standard English.

In this section, I have reviewed two treatments of SCRs in dialectal English: Doherty's (1993) relative clause analysis and Henry's (1995) topic-comment appropriation. Both approaches faced problems with regard to cross-dialectal data in Ulster Scots and standard English. Now I turn to my present TopicP analysis, which unifies the dialectal data.

4. A TopicP Complement Analysis

In this section I analyse SCRs as TopicPs, allowing these structures to be treated cross-dialectally. In Section 4.1, I present a syntactic analysis of SCRs wherein their heads are topic-marked DPs merged at the TopicP level. Next, in Section 4.2, I account for the limited syntactic distribution of these structures. Section 4.3 addresses SCRs cross-dialectally.

4.1 Subject Contact Relatives as TopicPs

I first establish a syntactic structure for SCRs, distinct from the accounts of Doherty (1993) and Henry (1995).

Initially, note that an SCR cannot simply be created by movement of a single DP.⁷

- (22) *I met a man_i [<a man_i> can <a man_i> speak five languages.]

The derivation depicted in (22) is ruled out straightforwardly for reasons of Case and Theta-role assignment: *a man* receives the role of Agent from *speak*, in A-position; the DP is then moved to [Spec, TP] in the lower clause, where it receives nominative case. If the DP moves beyond the relative, however, it may accept neither an additional accusative case nor Theme from *met*. Thus, as with restrictive relative clauses in standard English, there must be some separate operator in SCRs that fulfils the Case and Theta-role requirements of the lower clause.

But as Doherty (1993) notes, SCRs are not perfectly reducible to CP-based restrictive relatives. Indeed, SCRs are possible with an overt pronoun that is not relativized.

- (23) There's a woman on our street she went to Spain last year. (Henry 1995:126)

⁷ Similarly, an SCR cannot be generated through a theory of Copy and Merge, one particular account of which is given by Hornstein *et al.* (2005); for reasons of space, I refer only to a movement-based theory in this paper.

In (23), reiterated from (5b) in Section 2, the pronoun *she* is unexpected if SCRs are true restrictive relative clauses. In such a case, a null operator (*Op*) or a relativized *who* should move into [Spec, CP] to satisfy C's uninterpretable [+wh, -Q] features (Carnie 2013). Since a non-relativized resumptive occurs instead, I posit SCRs do not employ the same null operator, *Op* [+wh, -Q], as restrictive relatives. Instead a null subject, *pro*, or an overt resumptive pronoun fills the highest subject position.

SCRs also disallow complementizer *that*.

- (24) *There's a woman on our street that she went to Spain last year.
(den Dikken 2005:697)

The unacceptability of *that* in (24) suggests that an overt C is not compatible with an SCR. Based on the absence of *wh*-movement to [Spec, CP] and the unacceptability of an overt complementizer element, I adopt Doherty's (1993) argument that SCRs are based on TP and not CP projections.

Although Doherty suggests a similar treatment for object contact relatives as found in standard English, native speaker judgements⁸ reaffirm these structures are CPs.

- (25) This is the book [I bought] and [CP which you enjoyed.]

In (25), coordination of the object contact relative *I bought* is possible with a CP with an overt relativized pronoun; this suggests the two phrases are of analogous type.

Furthermore, object contact relatives exhibit island violations, as seen in (26).

- (26) a. I met someone [John knows.]
b. *Who did I meet someone [<who> knows?]

It is not possible to extract the subject *wh*-word *who* from the object contact relative in (26b), querying about the knower *John* in (26a). In this way object contact relatives demonstrate the same island character as observed of CP relative clauses in general (Santorini & Kroch 2006). Based on these data, I posit that object contact relative clauses are indeed CP projections, a fact that I return to in Section 4.2.

Then, unlike restrictive relatives and distinct from object contact relatives, SCRs involve TP structures. These employ a possibly null resumptive pronoun, which fills the subject position [Spec, TP]. (The status of the head noun in an SCR, above TP, is addressed later in this section.) (27) outlines the structure I have posited thus far for (1).

- (27) [TP *pro*/*he*_i can <*pro*/*he*_i> speak five languages.]

In (27), the null pronoun accepts the Agent Theta-role from *speak*, and nominative case from the finite T. Note that neither *pro* nor the optional resumptive pronoun *he* bears a [+wh] feature. To construct a hypothetical CP relative clause, the addition of a [+wh, -Q] C would be needed; however, with no [+wh]-valued element available for selection in the lower TP

⁸ My judgements for (25) and (26) were confirmed by three other native speakers of standard Canadian English.

structure, this uninterpretable [+wh] feature would be left unchecked. Thus, attempting to build a CP relative atop an SCR's TP causes the derivation to crash.

I turn now to a potential theoretical problem: As noted in Section 3.2, English is not a Null Subject language, and neither subjects nor expletives are generally permitted to be null. My analysis thus far seems to posit *pro*-drop in Belfast English and Ulster Scots. However, just as in standard English, null subjects are not generally permissible in Belfast English, either:

(28) *Are books on the table. (Henry 1995:128)

The overt expletive is necessary in (28). Thus *pro*-drop is not a general feature of dialectal English.

Moreover, as Henry (1995) notes, null subjects are made acceptable in Belfast English in topic-comment structures, in which the topic is previously made explicit.

(29) You know John, never shuts his bake. (Henry 1995:132)

The topic *John* is made explicit in (29), reiterated from (17); in the following clause, then, the null subject (which is implicitly indicative of *John*) is valid. Recall also that overt resumptive pronouns are possible in topic-comment constructions, which are explicitly coreferential with the preceding noun phrase (Doherty 1993). I conclude that null subjects are made possible in dialectal English only when bound by a preceding overt DP. I develop a syntactic account of this exception below.

Suppose that *pro*, alongside resumptive pronouns and expletives, is not a potential topic. All potential topics, then, are lexically defined by an interpretable feature [+topic],⁹ in contrast to the marked [-topic] elements listed above. Further, I presume a layer above C in the projection hierarchy, headed by Topic,¹⁰ which seeks a potential topic. This probing feature [TOPIC] need only be satisfied at LF, but it requires some [+topic] element to fill [Spec, TopicP].

In the case of a restrictive relative clause or an object contact relative, [TOPIC] may discover a valid [+topic] DP below in [Spec, TP] or in an object position and incite its movement to [Spec, TopicP]. In an SCR, however, the subject is necessarily null or resumptive; in either case, it is not [+topic]. If the subject is bypassed in selecting a lower DP, perhaps an object, the derivation encounters the problems addressed in (22) at the beginning of this section:

(30) *I met a man_i [_{TopicP} [_{DP} five languages_j] [_{Topic'} *pro*_i can speak <five languages_j>.]]

In (30), the selected DP is *five languages*, which has already received accusative case and Theme in the lower clause. In [Spec, TopicP], however, the DP receives a second case and

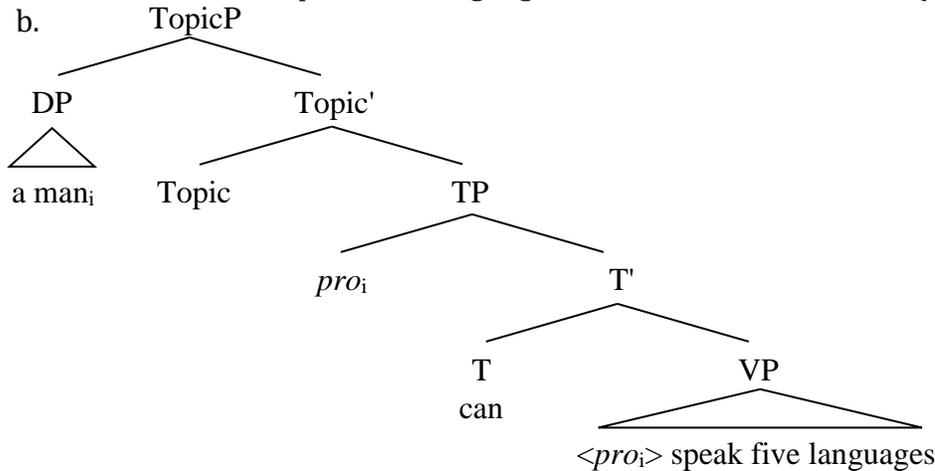
⁹ Note that [+topic] elements need not be topics in all contexts. Such elements only have the potential, depending on the context of a discourse, to be selected as topics.

¹⁰ The present analysis may also be adapted to comply with Rizzi's (1997) split CP. For simplicity, I assume only the existence of TopicP, or Rizzi's TopP, in this paper. It may be that SCRs project not only a TP, but a deficient CP, which contains TopP, but not all of Rizzi's proposed components. This possibility necessitates further research, however.

Theta-role from the matrix verb. As in (22), this invalid assignment causes the derivation to crash.

Instead, to generate a grammatical SCR, a supplementary [+topic] DP must be provided in the numeration of the TopicP clause, as outlined in (31).

- (31) a. I met a man can speak five languages. (Henry 1995:125)
 b.



In (31b), the null pronoun receives nominative case and the Agent role in the lower clause. We then project Topic. Note that the subject *pro* does not bear [+topic], but an additional [+topic] DP, *a man*, exists in the numeration. Merge over Move¹¹ prioritizes this new DP, and *a man* is merged in [Spec, TopicP]. At this level of the derivation, the topic DP awaits Case and a Theta-role. Note that an SCR lacks a C projection, and thus presents no phase boundary (Hornstein *et al.* 2005); therefore, the topic DP is visible to the matrix clause. The matrix verb *met* may then freely assign case and a Theta-role to the topic DP, and the output is grammatical.

In the case that a [+topic]-DP occupies [Spec, TP] in a potential SCR, the derivation should fail: SCRs allow only null or resumptive pronoun subjects. Invalid instances are ruled out by requiring the subject to be coreferential with the higher c-commanding topic, as is the case in (31) with the co-indexed *pro*_i and *a man*_i. Since no phase boundary exists between the referential topic in [Spec, TopicP] and [Spec, TP], any attempt to place a referential expression in [Spec, TP] incurs a Principle C binding violation. Similarly, the addition of a non-resumptive pronoun in [Spec, TP] incurs a Principle B violation (Hornstein *et al.* 2005).¹² In this way, [+topic] DPs are disallowed in [Spec, TP] in SCRs.

¹¹ For an account of Merge over Move, see Hornstein *et al.* (2005).

¹² This rules out all invalid [+topic] subjects of SCRs except for anaphors, which, unlike pronouns and referential expressions, must be bound in their domain.

A constraint against anaphors in [Spec, TP] in SCRs can be formulated with recourse to Reflexivity Theory as described by Runner (2007). Therein, by Condition A, a reflexive-marked syntactic predicate must be reflexive. The relative Tense predicate is reflexive-marked since a SELF anaphor occupies [Spec, TP], which is a Case-assigned argument position. However, no two arguments of Tense are coindexed; the topic, notably, is not an argument of Tense, as it receives its Theta-role and Case from the higher clause. Thus, the predicate is not reflexive; the derivation fails Condition A and crashes.

I further note that [-topic] DPs may never be selected to merge in [Spec, TopicP] by the feature requirements of the probe [TOPIC]. Also, as the uninterpretable feature [TOPIC] need only be checked at LF, the derivation may Procrastinate until after Spellout (Hornstein *et al.* 2005) to satisfy this feature. In typical clauses, English word order is thus unaffected by raising due to [TOPIC]-checking. The [+topic]-valued DP may move covertly from [Spec, TP] to [Spec, TopicP] at LF. In the case of SCRs, however, explicit insertion is necessary for [TOPIC]-checking. A topic DP is base-generated in [Spec, TopicP] and so this position is overt at phonological Spellout.

Moreover, the present formulation does not rule out [+topic] insertion for non-SCRs. As I address below in Section 4.2, there are certain constructions in standard English that also employ [+topic] insertion. Additionally, Case and Theta-role requirements already disallow extraneous topic insertion. For example, if TopicP forms the root level of a tree, there is no higher clause to supply Case or a Theta-role to the newly inserted DP, and the derivation crashes.

Theoretically, an approach to SCRs as TopicPs notably abides McCloskey's (1990) Highest Subject Restriction as presented by both Doherty (1993) and Henry (1995). Firstly, by Doherty's (1993) formulation, the resumptive pronoun must be A'-free in its least complete functional complex. In (31), the null pronoun (and, by a similar analysis, its overt variant) is coreferential with the higher DP, *a man*, which is distinct from it. While the pronoun is in A'-position, having moved to satisfy the lower T's [EPP], the topic DP is in A-position. Recall that in the next step of the derivation it is positioned to receive its Theta-role from the higher clause. Thus the topic does not A'-bind the null (or resumptive) pronoun, which is A'-free in its domain.

Contrary to Doherty's (1993) approach to SCRs, the present analysis also abides Henry's (1995) interpretation of the Highest Subject Restriction, in which the resumptive pronoun must not occupy the highest subject position in its clause. Indeed, the resumptive is always disallowed from the highest subject position [Spec, TopicP], as it is intrinsically [-topic].

Thus far I have considered SCRs to be TopicPs: that is, TP-based structures with either a null or a resumptive pronoun in [Spec, TP], and with a topic requirement filled by an additional [+topic] DP, which is exposed to the higher clause in [Spec, TopicP]. This approach is advantageous with regard to its consideration of the topic-comment nature of the dialects in which SCRs appear, and its adherence to the Highest Subject Restriction. In the following section, I treat the syntactic distribution of TopicP SCRs.

4.2 Subject Contact Relatives in Presentational Contexts

In this section I account for the limited distribution of SCRs as they appear in certain dialects of English. Recall, in Section 2, that SCRs may occur in *there*-existentials, *it*-clefts, equative sentences, and introductory contexts with verbs such as *know* or *meet*. In fact, Henry (1995:126) notes it is "very difficult to characterize syntactically" what restriction generalizes these contexts; however, they share a specific pragmatic function: namely, topic introduction.

Indeed, SCRs are parallel to a similar discourse structure in standard English: presentational relative clauses. Duffield *et al.* (2010:19) note that in these types of sentences, the matrix subject is "semantically bleached;" it is in fact what modifies the head noun which carries the "assertion of the utterance" (2010:18). In this way, presentational relatives have

both an explicit topic (the modified noun) and a comment (the relative clause). Unlike restrictive relative clauses, removing a presentational relative significantly alters the semantic value of a sentence.

- (32) a. I had a son.
 b. I had a son [that was an animal lover.]
 c. I've had a Burmese python, I've had rats, I've had mice [...] I had a son.
 d. I've had a Burmese python, I've had rats, I've had mice [...] I had a son [that was an animal lover.] (Duffield *et al.* 2010:21)

In standard usage, the relative *that was an animal lover* is restrictive; it reduces the subset of possible denotations of *a son* to those that also love animals, leaving the semantics otherwise unchanged (Heim & Kratzer 1998). Thus (32b) differs only from (32a) in providing a smaller set of possible referents for the head noun *a son*. Contrastively, in a presentational context, removing the relative pronoun results in a different semantic interpretation for the sentence. In (32c), *a son* is counted among the dependent pets of the speaker; but in (32d), the reason for the speaker's menagerie is understood in the following presentational relative clause—his son loved animals.

Similarly, SCRs display an explicit topic-comment structure. Removing the TP “assertion,” or comment, changes the semantic value of an SCR sentence.

- (33) a. There's one woman in our street [_ went to Spain last year.]
 b. There's one woman in our street. She went to Spain last year. (den Dikken 2005:694–697)

In (33a), the SCR *went to Spain last year* may not be extracted without altering the interpretation of the sentence. Without the contact relative, (33b) asserts that there is “precisely one woman living in the street in question” (den Dikken 2005:697), and she also happened to go to Spain last year. Contrastively, the SCR in (33a) makes no such conclusion about the street's population; there may, in fact, be other women living there who have not visited Spain in the past year. Then, similarly to presentational relatives, SCRs serve a topic-comment function which makes them semantically distinct from restrictive relative clauses.

Predicates in presentational contexts may take TopicP complements, such as presentational relatives or SCRs. Thus verbs such as *have*, *know*, and *meet*, as well as the copula in *there*-existentials, *it*-clefts, and equatives, all have at least two entries in the lexicon. One entry requires [uD] for a DP complement, as in standard usage, and one requires [uTopic] in presentational contexts. In this way, I ensure the possibility of the DP complement forms evidenced in (32a), (32c), and (33b), which, although not presentational, are still syntactically felicitous.

Note that this analysis may also be extended to overtly introduced topic structures and post-verbal adjectivals in Belfast English, which Henry (1995) observes both closely resemble SCRs.

I turn first to overtly introduced topics, which I outlined in Section 3.2.

- (34) a. You know John, never shuts his bake. (Henry 1995:132)
 b. You know [TopicP [DP John_i] [Topic' [TP *pro*_i never shuts his bake.]]]

I propose that the overtly introduced topic in (17), repeated here as (34a), is to be analysed as in (34b); that is, with *John* as the topic of the SCR *never shuts his bake*. In this introductory context, *know* requires a TopicP complement. The matrix verb's Theme and accusative case are assigned to *John* thusly, *in situ*.

Henry (1995) also notes that, in addition to *you know*, the verb *see* frequently introduces an overt topic. I argue *see* in such cases is imperative or otherwise has an optionally null but obligatorily second-person subject: *(You) see John, never shuts his bake*. In this way, overtly introduced topics are presentational and can be analysed as TopicP complements of a semantically bleached matrix clause.

Post-verbal adjectivals in Belfast English also demonstrate topic-comment structure with respect to certain finite embedded clauses, as evidenced in (35).

- (35) a. He was lucky [_ didn't get caught.]
 b. Mary was as well [_ took the other job.]
 c. *Mary forgot [_ was supposed to go.]
 d. *John is likely [_ will win.]
 e. *He was lucky [Bill didn't catch _ .] (Henry 1995:127–129)

The subject of the embedded clause following an adjectival predicate such as *was lucky* in (35a) or *was as well* in (35b) may be omitted, in much the same way as the resumptive pronoun in an SCR. However, this possibility is limited to post-adjectival contexts: null subjects are unacceptable in the embedded clausal complements of non-adjectival finite Vs (35c) or of raising constructions (35d). Null objects in the embedded clausal complements of adjectivals are also disallowed, as in (35e).

Then, like the presentational-type verbs seen thus far, adjectival predicates in Belfast English also accept topic-comment complements.

- (36) a. He was lucky didn't get caught. (Henry 1995:127)
 b. He_i was lucky [_{TopicP} [DP <he_i>] [_{Topic'} [TP *pro*_i didn't get caught.]]]

I analyse (35a), repeated here as (36a), in the same way as an SCR. In (36b), the adjectival predicate *was lucky* takes a TopicP complement, composed of the topic DP *he* and the TP comment *didn't get caught*. Further, the matrix predicate must assign Theme, and the matrix T has [uCase:Nom]. As *he* is without a Theta-role, and no C-boundary exists between the clauses, it receives Theme from the matrix verb. Further, *he* is selected by T for raising and receiving nominative case. This sequence of operations results in the surface order in (36a).

In this section, I have argued SCRs are limited to contexts wherein verbs take TopicP complements. Furthermore, I have examined several types of presentational structures in standard English and Belfast English, which may be analysed similarly; this suggests the robustness of the present hypothesis. What remains is to account for the restricted appearance of SCRs cross-dialectally.

4.3 Dialectal Restrictions on Subject Contact Relatives

In this section, I address dialectal variation in the permissibility of SCRs in standard English, Belfast English, and Ulster Scots. In particular, I discuss why these structures may be found

in certain dialects, but not in standard English; and I address pragmatic differences in the set of valid topics and topic-introducing contexts between Belfast English and Ulster Scots.

Firstly, as seen in Section 4.2, presentational sentences are permitted in standard English; however, SCRs are not. But I have analysed standard English presentational relative clauses as analogous to the topic-comment structures of SCRs. Then it would seem SCRs should also be acceptable in standard English, as both are merely TopicPs.

However, TopicPs in standard English, Belfast English, and Ulster Scots need not be identical. In Section 4.1, I argued that English restrictive relatives and object contact relatives involve CP complements of the modified DP; SCRs, by contrast, contain TPs. The complement of the modified DP in standard English may necessarily be a CP, whereas in Belfast English and other dialects, either a CP or a TP is acceptable.

That is, in standard English, Topic bears the selectional feature [uC]; in other varieties, two versions of Topic exist, one bearing [uC] and one bearing [uT]. This rules out SCRs in standard English, as a TP complement does not satisfy [uC]. Meanwhile, this duplicity permits restrictive relative clauses and object contact relatives in presentational contexts in all dialects of English, where Topic may select a CP complement to satisfy [uC]. Thus, the ungrammaticality of SCRs in standard English is a syntactic constraint on the feature specification of Topic.

I turn now to differences among dialects which permit SCRs. In particular, in Belfast English, SCRs may not appear modifying definite DPs in presentational sentences, nor may they occur sentence-initially; in Ulster Scots, nevertheless, these types are grammatical.

Firstly, in Ulster Scots, definite descriptions are valid topics for SCRs in general presentational sentences, as in (37).

- (37) a. We met a man [_ had a lock o money.]
 b. We met the man [_ had a lock o money.] (Montgomery 2006:309)

In Ulster Scots, in a presentational sentence, the topic DP of an SCR may either be indefinite, as *a man* in (37a), or definite, as *the man* in (37b). However, as Montgomery (2006) notes, definite descriptions such as (37b) may not appear with SCRs in general presentational sentences in Belfast English.

Pragmatically, new information—such as a new topic—is usually introduced as an indefinite DP (Saeed 2009:206); thereafter it is considered given, “conversationally salient” information. The discourse in (37a), for example, might continue with “The man owned a golden pocket watch and drove a red Ferrari.” As *a man* was introduced to the discourse context in the previous sentence, this contextually salient entity may now be indicated with *the*. The use of a definite description to introduce new information in (37b) is thus pragmatically odd.

Then Belfast English behaves as expected with regard to introducing new material with indefinite TopicPs. Ulster Scots is perhaps more lenient in what is an acceptable formulation for new topic information. I posit this is a pragmatic constraint: at LF, the element in [Spec, TopicP] is examined, and if it is definite, a referent must exist in the present discourse context. If no such entity is available in the discourse, there is an option—more readily available in Ulster Scots than in other dialects—to add such an entity to the context as a new topic.

Ulster Scots, but not Belfast English, also allows SCRs to appear sentence-initially.

- (38) a. The man [_ stole the car] leeves nixt dorr. (Ulster Scots)
 (Montgomery 2006:309)
 b. *The person [_ could help you with that] is John.¹³ (Belfast English)
 (den Dikken 2005:699)

In Ulster Scots, an SCR may appear modifying the matrix subject, such as the subject *the man* in (38a), reiterated from (10b). However, such subject modification is invalid in Belfast English, as (38b) (Section 2's (8)) demonstrates with *the person*.

Once again, Belfast English and Ulster Scots vary with respect to a pragmatic constraint. According to Behaghel's Second Law, old information usually precedes novel information in a given sentence (Murray 2006). In Belfast English, then, new topic information is restricted to a post-verbal position. Ulster Scots again allows some variation in this regard; however, Montgomery (2006) observes that the contact relative as in (38a) must be given level and not falling intonation in order to be interpretable. Ulster Scots sentence-initial SCRs are thus an exception to an otherwise general pragmatic constraint.

It is worth noting that the judgements in Belfast English and Ulster Scots, above, are from elicitation tasks and are not native speaker productions (Montgomery 2006). Thus it is difficult to determine the precise role of discourse in identifying valid topics for SCRs. It may be that, in dearth of any provided discourse context in an elicitation task, Ulster Scots speakers are simply more willing to accept definite descriptions as new topics, and thus as specifiers of TopicPs. This may not be the case in established discourses; such an investigation awaits further study.

In any case, I treat this as a pragmatic preference, and not a syntactic rule, as definite descriptions are valid topics of SCRs in certain other clause types in Belfast English.

- (39) He's the one stole the money. (Henry 1995:125)

As in (4c), reiterated here as (39), the definite DP *the one* may be modified by an SCR inside of an equative sentence. Then in Ulster Scots, the pragmatic constraints on new topic information, specifically, the preferences for indefinite DPs and right-edge structures, are weaker than in Belfast English.

In sum, I have accounted for the structure of SCRs as TopicPs composed of a [+topic] DP and a comment TP. These TopicP structures are restricted to topic-presenting contexts. Furthermore, syntactic and pragmatic constraints determine their dialectal distribution. The final section of my paper compares this analysis overall with those of Doherty (1993) and Henry (1995).

5. Conclusion

I have now provided an overview of subject contact relatives in Belfast English and Ulster Scots. Below, I summarize the structure and distribution of these constructions, and I compare my results to the approaches of Doherty (1993) and Henry (1995).

¹³ I postulate it is the subject position of the topic DP, and not its definiteness, that rules this example out. As noted in Section 2, definite topics may appear post-verbally with equatives in Belfast English.

I have analysed SCRs as TopicP structures. Like Doherty (1993), I suggest SCRs are composed of a TP element, with a null or possibly resumptive pronoun in [Spec, TP], which is coreferential with the modified DP. However, alongside Henry (1995), I argue that this modified DP is necessarily a potential topic. In the present analysis, this DP is merged at [Spec, TopicP] to satisfy the clause's overt [+topic] requirement. Notably, this treatment abides the Highest Subject Restriction (McCloskey 1990) in both presented formulations. Firstly, the resumptive pronoun is A'-free. Secondly, the highest subject position [Spec, TopicP] is never filled by the resumptive pronoun, a restriction which Doherty's analysis fails to meet.

I have also restricted SCRs to presentational contexts, where TopicP is desired to introduce a new topic element. Hence I explain the topic-comment structure of SCRs, as observed by Henry (1995). I have identified presentational constructions in standard English and in Belfast English that demonstrate similar topic-comment functions and may also be analysed as TopicPs.

Finally, I accounted for dialectal differences with syntactic and pragmatic constraints. Specifically, in standard English, Topic bears the selectional feature [uC], whereas in other dialects it bears [uC] or [uT]. Since SCRs require TP complements, they are disallowed in standard English. Moreover, a pragmatic restriction on new discourse information being non-definite and right-aligned produces the distinction between Belfast English and Ulster Scots; however, as I have noted, this constraint is not absolute.

In sum, the present analysis limits which DPs and predicates allow SCRs, as suggested by Doherty (1993); but I also construe SCRs as topic-comment structures, as put forth by Henry (1995). Overall, I have provided a broader cross-dialectal description of the data, restricting SCRs from standard English syntactically, and within certain constructions, pragmatically.

It remains to be defined precisely how pragmatics influences the syntax of Belfast English and Ulster Scots, allowing definite DPs in [Spec, TopicP] and sentence-initial SCRs in one but not the other. For this, further study of natural discourse productions is necessary. I might also examine how else pragmatic information—in particular, topic-comment structure—influences the syntactic derivation. We have thus far seen the impact of discourse in the SCRs of English; what other pragmatic differences exist between dialects and across languages remains a question for further research.

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**Contrast, phonological features, and phonetic implementation:
Aspiration in Blackfoot**

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Abstract

Blackfoot is generally regarded as lacking phonological contrasts based on laryngeal settings; it is typically analyzed as lacking aspiration, voiced obstruents, and the segment [h] (see Elfner 2006 or Frantz 2009). The simple fact that Blackfoot sonorants appear as voiced and obstruents as voiceless could be the result of redundancy rules (cf. Stanley 1967) or phonetic implementation rather than phonological contrast (Keyser & Stevens 2006; Stevens & Keyser 2010). However, at the end of an orthographic word, vowels in Blackfoot typically devoice such that “there can be no contrast between short and long vowels at the end of a word” (Frantz 2009:5, see also Gick *et al* 2012).

In this study, I examine whether Blackfoot final vowel devoicing —what I argue is better characterized as aspiration— is the result of phonological specification or phonetic implementation. I argue that the laryngeal feature [SPREAD GLOTTIS] is contrastive in Blackfoot and that the phonetic implementation of this feature leads to phonological opacity and a near-merger of phonemically short and long vowels in a phonological phrase-final position such that they are perceptually identical (Frantz & Russell 1995).

1. Introduction*

In Blackfoot, it is commonly observed that vowels devoice at the right edge of a phonological phrase (φ)¹ (Frantz & Russell 1995; Frantz 2009; Bliss 2013, see also Gick *et al* 2012). Blackfoot is suggested to lose vowel length contrasts in final position due to this devoicing rule which makes long and short vowels indistinguishable from one another (Frantz & Russell 1995:441; Frantz 2009:5):

(1) Vowel length contrasts

- | | | | |
|----|--|--------------------------|---|
| a. | <i>Áakokaawa</i>
yáak-okaa-wa
FUT-rope.AI-3.SG
'(s)he will rope' | [a:k o ka:m̩] | |
| b. | <i>Áakookaawa</i>
yáak-ookaa-wa
FUT-sponsor.sundance.AI-3.SG
'(s)he will sponsor a Sundance' ² | [a:k o ka:m̩] | |
| c. | <i>Nitopi</i>
nit-opi
1.SG-possess.archery.equipment.AI
'I had a bow and arrow' | [nitop̩] | |
| d. | <i>Nitopii</i>
nit-opii
1.SG-sit.AI
'I sat/stayed' | [nitop̩:] | <div style="display: inline-block; vertical-align: middle;"> { <i>cf. Opiiwa</i> [op̩:m̩]
 <i>opii-wa</i>
 <i>sit.AI-3.SG</i>
 <i>'(s)he sat/stayed'</i> } </div> |

As can be seen in examples (1a) and (1b), vowel length contrasts signal meaningful differences in Blackfoot. Despite a meaningful contrast between the forms in (1c) and (1d), however, vowel devoicing in final position is reported to neutralize the perceptual phonetic cues to this contrast (Frantz & Russell 1995). The fact that the contrast does exist at the level

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The author would like to thank his Blackfoot teachers and language consultants for their invaluable and ongoing contributions to this research. *Piitaiikihtsipimi, Aistanskiaki, Issapoiloan, kii Ainootaa, nitsíniyi'takihpinnaan*. Unless otherwise stated, examples in this article come from elicitation sessions with these speakers.

¹ The literature typically denotes the environment as “the end of a word” which describes a word-sized unit in the orthographic convention. A full analysis of the prosodic constituency of Blackfoot is beyond the scope of the present article. I assume, here, that Blackfoot follows the same pattern as the related Algonquian language, Cree, in that “the units of Cree which are usually called “words” are in fact phrases at the phonological level” (Russell & Reinholtz 1997:447). See Windsor (to appear) for a detailed analysis in support of this assumption.

² This verb is translated in Frantz & Russell (1995:168) as “sponsor the primary religious ceremony associated with the Sundance.” I use the abbreviated translation for simplicity (*cf.* Frantz 2009:2, from which examples 1a-b are adapted).

of the input can be observed through the addition of morphology to shift the vowel away from the right edge, such as the 3.SG suffix, *-wa* (Frantz 2009:5).

A second common assumption about Blackfoot is that stop consonants in the language generally lack aspiration (Frantz & Russell 1995; Elfner 2006; Frantz 2009). In fact, Blackfoot is typically analyzed as lacking laryngeal contrasts all together allowing the fact that —with the exception of the above mentioned vowel devoicing facts— sonorants are realized as voiced and obstruents as voiceless via redundancy rules (cf. Stanley 1967). This can be seen by the commonly assumed phonemic inventory of Blackfoot provided below.

(2) The commonly assumed Blackfoot phonemic inventory (Elfner 2006:12)

	Labial	Coronal	Dorsal	Glottal	Vowels	
Stops	p p:	t t:	k k:	ʔ	i i:	
Fricatives		s s:	x			
Affricates		ts t:s	ks k:s		o o:	
Nasals	m m:	n n:				
Glides	w	j			a a:	

From the above inventory, there is no reason to assume that any of the laryngeal features, [VOICE], [SPREAD GLOTTIS] ([SG]), or [CONSTRICTED GLOTTIS], are active in Blackfoot at all; there is no glottal contrast between /h/ and /ʔ/, there are no contrasts that depend solely on voicing, and obstruents are typically regarded as lacking aspiration.

Combining these two common assumptions about the Blackfoot sound system, one is left wondering what would cause final vowel devoicing in a language which lacks laryngeal contrasts and whether or not this is actually a phonological rule, or simply a language-specific phonetic implementation rule. In this article I argue that Blackfoot phonology does, in fact, make a meaningful contrast with respect to the feature [SG]; that it marks the right edge of φ s by epenthesising the feature there; and, that this phonological process is obscured by variation in the phonetic implementation of the [SG] feature.

This article proceeds as follows: I provide evidence for the unified treatment of vowel devoicing and consonant aspiration in Section 2. In Section 3 I discuss the possible phonetic vs. phonological causes of aspiration based on contrast, and I conclude in Section 4 with directions for future research.

2. Aspiration and the edge

Although Blackfoot is typically analyzed as lacking aspiration following consonants, aspiration does appear in one environment – the same environment as final vowel devoicing. In this section, I provide a phonetic analysis of final-vowel devoicing and final-consonant aspiration each in turn. I then argue that these seemingly separate processes have a common phonological source – the feature [SG] which is phonetically realized in different ways depending on the segmental host which that feature is epenthesized to.

2.1. Vowel devoicing

Vowel devoicing can be observed in several locations in the Blackfoot utterance such as the right edge of a demonstrative, the verbal complex, or the nominal complex:

- (3) [án:iksɨ́ áké:maxkiçkingksɨ́ inókiwə́]
Ánniksi ákaímahkihkinaiksi inókiwa
 ann-iksi áka-íimahkihkinaa-iksi ino-okiwa
 DEM-ANIM.PL old-sheep-ANIM.PL see.TA.21.PRO
 ‘those old sheep see us’

Frequently, the environment for this devoicing lines up with an orthographic word as can be seen above. This gives rise to the descriptive statement in the literature that vowels are typically voiceless at the end of a word (Frantz & Russell 1995; Frantz 2009; Bliss 2013). However, as can be seen in 4, this is not always the case:

- (4) [pɔ́ɪnapsɨ́ an:ə́ pokén:ɔ́kɔ́mita:wə́]
poinapssi anna pokáinnaokomitaa
 poinapssi ann-wa poka-innoka-imitaa-wa
 Frenzied.VB DEM.ANIM.SG stunted-elk-dog.ANIM.SG
 ‘that colt is frenzied’

These data suggest that if a target noun can be elicited both in and out of a devoicing environment (such as *pííta* ‘eagle’ in 5a, b), then the amount of devoicing can be contrasted between the two positions to better understand the effect that this process has on the vowel and see if a length distinction is maintained in production. In order to answer these questions, I elicited a series of sentences with a target noun³ in sentence-final (5a) or sentence-medial (5b) position from three native Blackfoot speakers.

- (5) Elicitation sentence examples (animate nouns)⁴
- a. *Ámo anistápssiwa pííta* < noun in devoicing environment
 amo anistápssi-wa pííta-wa
 DEM be.AI-3.SG eagle.ANIM.SG
 ‘this is an eagle’
- b. *Ámo pííta nitsináán* < noun outside of devoicing environment
 ámo píitta-wa n-itsináán-yi
 DEM eagle.ANIM.SG 1.SG-possession-OBV
 ‘this eagle is my pet’

³ It should be noted that all nouns in Blackfoot end in a vowel due to required morphological endings.

⁴ This study was originally part of a collaborative effort first reported in Windsor & Cobler 2013 which I expand upon and update here where possible.

Using a Welch two-sample t-test with 56 tokens in final position and 60 tokens in medial position, it was found that the amount of devoicing in final position was significantly greater than those in medial position: $[t(91.207) = -6.0408; p < 0.001]$.⁵ Particularly interesting for the present analysis is that when the noun did not appear in final position, its final vowel was almost entirely voiced with very few exceptions. When the noun appeared in final position it was found to devoice approximately the final $\frac{1}{3}$ of the overall vowel regardless of phonemic length (between 27%-44%) when averaged across speakers.⁶

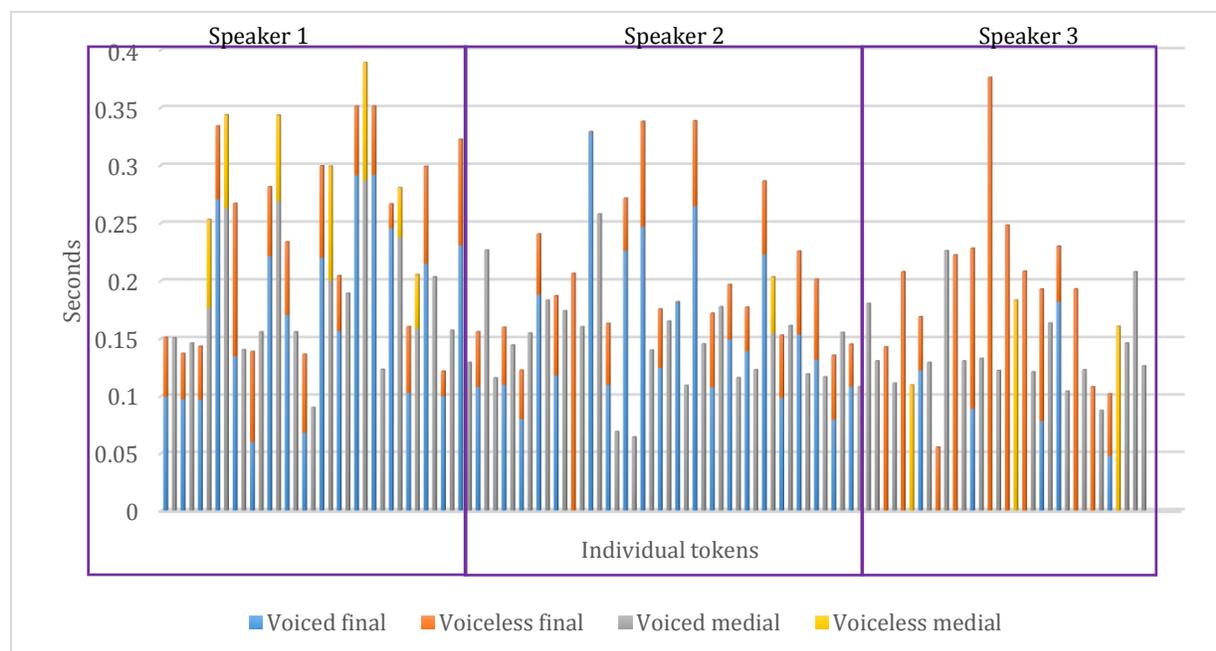


Figure 1: Devoicing by sentence position (Windsor & Cobler 2013)

Figure 1 above shows that, despite some inter-speaker/inter-generational variability, the observed pattern is robust. The blue and orange columns show a combined total of vowel length, per token, in utterance final position with the orange portion representing the devoiced portion of the vowel. The grey and yellow columns show a combined total of vowel length, per token, in medial position with the yellow portion representing the devoiced portion of the vowel. As provided above, the amount of devoicing by utterance position is significant ($p < 0.001$).

A second finding of this study is that, while Frantz & Russell (1995) and Frantz (2009) are undoubtedly correct that devoicing eliminates a perceptual contrast between long and short vowels in this position, the articulatory phonetic/phonological contrast is maintained.

⁵ Only tokens in sentences which were syntactically identical to the carrier sentence were used in this test ($n=116$).

⁶ It should be noted that Speaker 3 has a condition which affects his respiratory system and, therefore, his ability to produce voiced sounds. Despite this, the same pattern of voicing by position was found for this speaker as well.

Across speakers, when position within the utterance is not considered, the average length of a phonemically long vowel was found to be 0.27 seconds and the average length of a phonemically short vowel was 0.12 seconds. This shows that even in a devoicing environment, those vowels which have a reduction of phonation do maintain their phonemic length, and thus maintain their phonological/articulatory contrast.

The next logical question in this study is whether devoicing is something that happens to vowels, or if it affects consonants as well. I address this question in the next section.

2.2. Consonant aspiration

Probably all modern Blackfoot speakers are at least bi-lingual, additionally speaking English, and the two language phonologies' remain largely separate. English speakers often produce word-initial /p/, /t/, and /k/ with accompanying aspiration. This is not done in Blackfoot which, according to Frantz (2009:4), causes English speakers to perceive these sounds as [b], [d], and [g] respectively. This, in addition to the fact that all sonorants are voiced and all obstruents are voiceless, supports the analysis of Elfner (2006:11), who states that "Blackfoot lacks voicing or aspiration contrasts; all of its obstruents are voiceless with little or no aspiration[.]" However, it seems that there is positional variability with regards to how much aspiration is found on an obstruent in Blackfoot.

In the original study summarized in the previous section, Windsor & Cobler (2013) additionally collected utterances with imperative verbs ending in the final morpheme *-t* (IMP.SG) as a control to see if this phenomenon was the result of a rule/constraint which targeted vowels, or if there was an edge effect which applied regardless of the segment in final position.⁷ We elicited a small control group of utterances (n=14) which consisted solely of an imperative verb (6a), and with the same verb removed from the right edge by the addition of a direct object (6b).

(6) Elicitation sentence examples (imperative verbs)

- a. *Matoííkskimaat!*
 mato-ííksimaa-t
 go.to.do-hunt.game.AI-IMP.SG
 'go hunt!'
- b. *Matoííkskimaat* *áwakaasii!*
 mato-ííksimaa-t áwakaasii-yi
 go.to.do-hunt-game.AI-IMP.SG deer.OBV
 'go hunt deer!'

⁷ Word final consonants in Blackfoot are almost exclusively limited to the morphological markers, *-t* 'IMP.SG' and *-k* 'IMP.PL'. Other apparent instances of word final consonants such as the 'we.excl' ("we exclusive" – we but not you) suffix *-hpinnaan* is actually *-hpinnaana* but sometimes written without the final <a> due to the fact that "the final a of [these morphemes] is a predictable addition after an otherwise word-final consonant, rather than part of these morphemes per se" (Frantz 2009:23). The same is true for other final morphemes such as final *-hp* transitive inanimate marker for 1st/2nd person singular or the various final [w]s or final [n]s of the transitive animate verbal paradigm.

Similar to the main study of vowel devoicing, we found that, in final position, consonants displayed an average of 9.7x the length of aspiration and 2.7x the length of closure duration over their phrase-medial comparators.

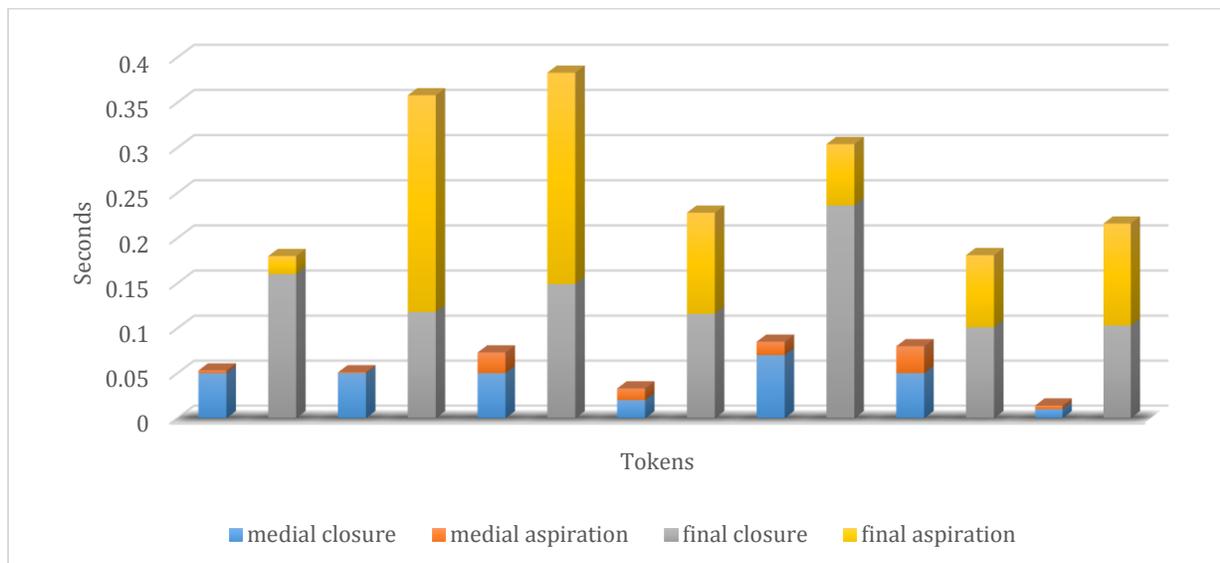


Figure 2: Duration of stop closure and aspiration by position (Windsor & Cobler 2013)

The results of this small control suggest that in final position, the closure duration of consonants lengthens while the air pressure builds and the vocal folds abduct which is realized as aspiration on the consonant when the stop is released. The question now is how do consonantal aspiration and vowel devoicing relate to one another, if they do at all. This is the subject of the next section in which I argue that a single process underlies both of these realizations.

2.3. Phonological specification and phonetic implementation

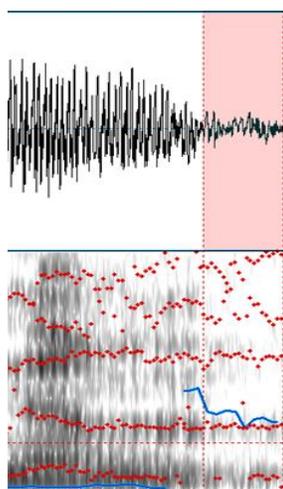
The fact that vowel devoicing and consonant aspiration in Blackfoot occur in the same environment suggests that there is a unified explanation for the two seemingly separate processes. Here, I argue that the cause of both vowel devoicing and consonant aspiration is the epenthesis of the feature [SG] to mark the edge of a prosodic domain.⁸ To do this, we will first consider the phonetic implementation of aspiration.

To achieve aspiration on final consonants, as discussed above, there needs to be a supra-glottal constriction in the vocal tract to build up sub-glottal pressure. When the vocal folds are abducted, air is released past the obstruction and the consonant is produced with an additional burst of turbulent noise. For example, if the tongue tip contacts the alveolar ridge and, at the time of release, the vocal folds are abducted, the result is a [t^h]. Similar to

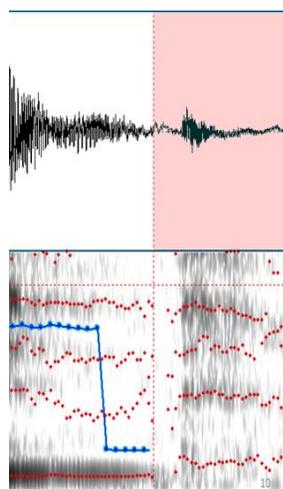
⁸ I assume here the domain for [SG]-epenthesis is at right edge of a phonological phrase (φ); however, for reasons of space, I will not provide the arguments for this here – see footnote 1.

this, in order to devoice a vowel, the vocal folds must again be abducted to prevent phonation. In terms of the articulatory mechanisms, these two processes are only differentiated by the oral articulators; for consonants, aspiration follows the release of the articulatory gesture and results in high frequency noise which is visible in the spectrogram, similar to [h]; for vowels, the oral gesture remains but some voicing is lost. This difference can be seen in the following two images of a Blackfoot final vowel (7a) and final consonant (7b).

(7) a. Spectrogram of vowel devoicing b. Spectrogram of consonant aspiration



Apasstamiinaamma 'apple'



Piit! 'enter!'

In (7a), the final portion of the /a/ vowel in *apasstamiinaamma* 'apple' is selected on the right. As can be seen in the spectrogram, although faint, the formants of the /a/ persist even though phonation has ceased. Crucially, there is no high frequency noise on this segment. Contrastively, in (7b), we see the occlusion and release burst of the final /t/ segment in *piit* 'enter' which is accompanied with high frequency noise resulting from the aspiration of this segment.⁹

Although the articulatory gesture that aspiration follows may differ, causing the differences in realization, both consonantal aspiration and vowel devoicing is achieved through vocal fold abduction. Vocal fold abduction is arguably the physical realization of the phonological feature [SG].

Beyond the physiological similarities between aspiration and devoicing and the fact that they occur in the same environments, one final piece of evidence that these two seemingly separate processes are underlyingly the same comes from duration. One could argue that if the same process is effecting consonants, short vowels, and long vowels, then

⁹ Oberly (2008:125), discussing Southern Ute, states that it is possible to detect a devoiced vowel by the aspiration which appears where the first and second formants would have appeared if the vowels were voiced. I am grateful to one of my reviewers for pointing out this reference to me.

the length of the effect (duration of devoicing/aspiration) should be similar across all three types of segments found at the right edge. This prediction is, in fact, borne out.

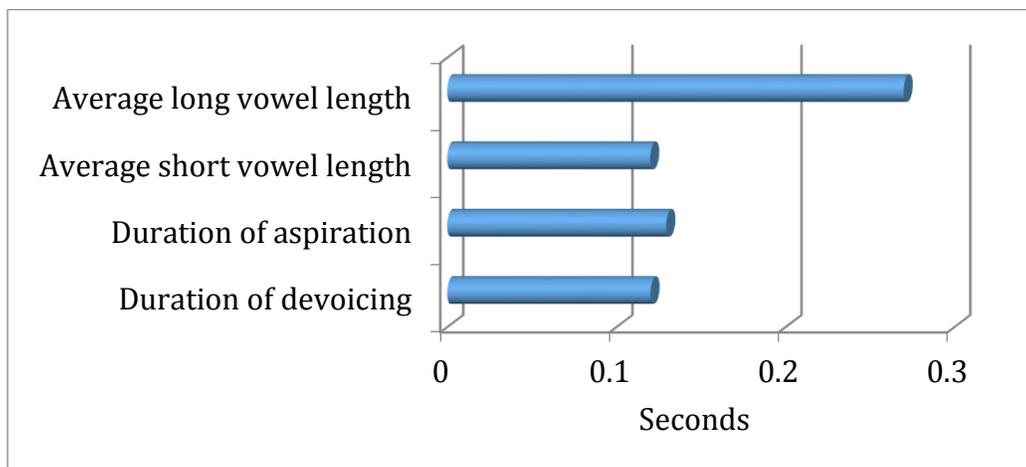


Figure 3: Average aspiration durations

Windsor & Cobler (2013) provide the above figure as a comparison between the average duration between consonant aspiration and vowel devoicing using utterance final vowels and consonants from a single speaker. This shows that the average duration of vowel devoicing in this environment is 0.1202 seconds and the average duration of aspiration is a strikingly similar 0.1295 seconds. These preliminary results —combined with the similarity in environment for the sound change and articulatory processes— provide evidence that there is a single underlying phonological process which has multiple phonetic realizations.¹⁰ If this analysis is accurate, then we can explain the multiple phonetic realizations of [SG] based on the segment affected. Under this analysis, the phonological component would epenthesise a [SG] feature to the right edge of a φ to overtly demarcate that edge. This feature is realized on whichever segment is aligned with the edge of the φ , whether it is a vowel or a consonant. For the purposes of the present discussion, I will use the descriptive constraint ENHANCE-R φ to describe this process. The phonetic component then interprets the phonological output by attaching aspiration to consonants and devoicing vowels.

(8) ENHANCE-R φ (Windsor 2012)

Overtly demarcate the right edge of a prosodic phrase (φ) by epenthesising a [SPREAD GLOTTIS] feature to the segment aligned with that prosodic boundary (Align [SG] with the right edge of a φ)

¹⁰ See Zsiga 2000; Kiparsky 2006; deLacy 2006; Blevins 2006a, b; Keyser & Stevens 2006; or Stevens & Keyser 2010, for discussion of the variable phonetic realizations of phonological specification.

(9) Derivation of Blackfoot phrases

Input	/...i:ʔni:/ 'buffalo'	/...pi:ta/ 'eagle'	/pi:t/ 'enter!'
ENHANCE-R \varnothing	[i:ʔni: ^h] \varnothing	[pi:ta ^h] \varnothing	[pi:t ^h] \varnothing
Phonetic realization	[[i:ʔni: ^h]]	[[pi:ta ^h]]	[[pi:t ^h]]

The analysis provided above shows how the phonetic component instantiates a single phonological feature —[SG]— in different, but regular and predictable ways. It has the advantage of explaining why vowels and consonants are both affected by a process which requires abduction of the vocal folds; why these processes are triggered in the same prosodic environment, and why the length of aspiration and devoicing are similar. The only remaining problem is how does a language which is typically analyzed as lacking any laryngeal features utilize [SG] as an active prosodic boundary marker. This is the subject of the next section.

3. Contrast

The Contrastive Hierarchy (Dresher 2009) is a theory of segmental phonology which contends that a feature which does not contrast within a language is not active within the phonology of that language. This theory is built off of the long standing view originally expressed by Saussure in 1916 (*qtd. in* Dresher 2009:1) that the “sound of a word is not in itself important, but the phonetic contrasts which allow us to distinguish that word from any other.” Dresher expands upon that notion by recognizing that phonemes cannot merely be categorized by what they sound like, but also what they contrast with. Thus, we might look up a feature matrix for the sound [p] and learn that it, among other features, is traditionally viewed as being specified for [–VOICE] as opposed to an [m] which is traditionally viewed as being specified for [+VOICE]. In Welsh where [p] contrasts with [b], and [m] can alternate with [m̥], this analysis seems correct. However, given that there are no voicing contrasts in the Blackfoot consonant series, this means that it is highly unlikely that Blackfoot [m] is actually specified for [VOICE] at all. This raises the question that, in a language which is not traditionally considered to make a contrast on the feature [SG], such as Blackfoot, what evidence is there for phonological epenthesis of [+SG]¹¹ at the right edge of a \varnothing rather than relegation of the explanation of Blackfoot aspiration to the phonetic implementation of a phonological category?

From a phonetic standpoint, one could make the case —contra what was argued in the previous section— that vowel devoicing and aspiration are decidedly different phonetic processes taking place in a single environment – the edge of a phonological category. Because [SG] does not seem to be contrastive anywhere else in the language, there is good reason to doubt an analysis that relies on [SG] as a phonological feature. If we look at the

¹¹ I remain agnostic on whether phonological features are privative or binary, but will largely treat them as binary in this section for consistency with the Contrastive Hierarchy method that I am assuming here.

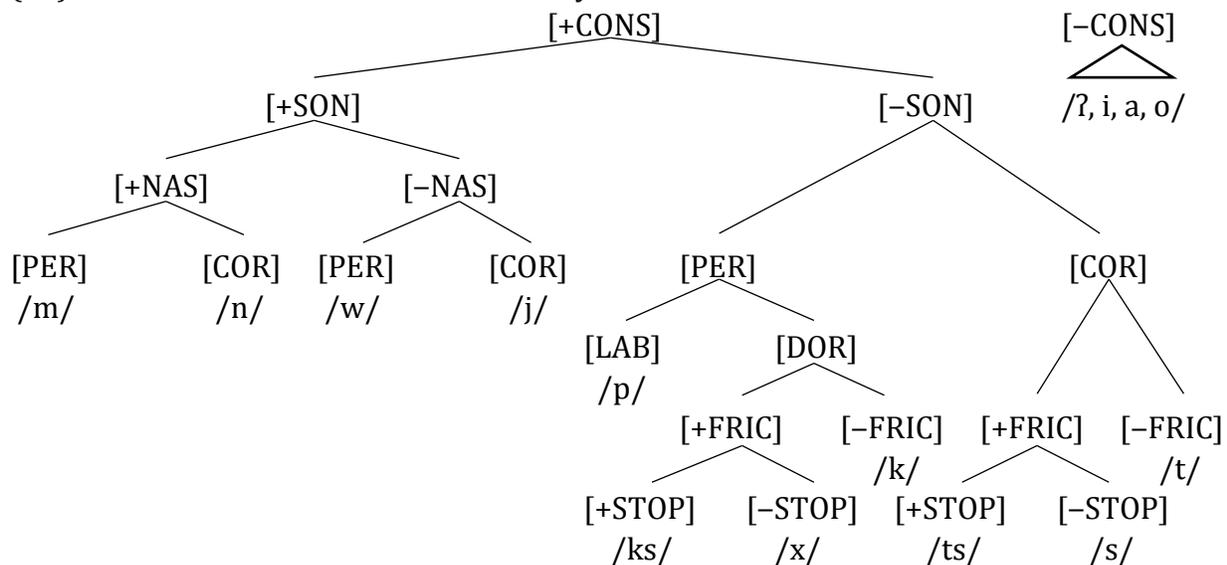
phonemic inventory of Blackfoot, we can then divide these phonemes out based on featural contrastiveness (length will be dealt with separately). I repeat the commonly assumed phonemic inventory of Blackfoot provided in (2) here as (10) for convenience.

(10) The commonly assumed Blackfoot phonemic inventory (Elfner 2006:12)

	Labial	Coronal	Dorsal	Glottal
Stops	p p:	t t:	k k:	ʔ
Fricatives		s s:	x	
Affricates		ts t:s	ks k:s	
Nasals	m m:	n n:		
Glides	w	j		

Vowels
i i:
o o:
a a:

(11) The Blackfoot contrastive hierarchy¹²



At first glance, this contrastive hierarchy seems reasonably satisfactory; segments contrast in whether or not they are consonantal, the consonantal segments contrast for sonority (we can reasonably assume a constraint prevents non-sonorous sounds from being contrastive in nasality (*i.e.*, *[-SON], [NAS])), and then location —peripheral or coronal, with peripheral then contrasting between labial and dorsal specifications— followed by a contrast for frication, and finally for a stop feature. Thus, the phoneme /m/ would only be specified as a [PERIPHERAL, NASAL, SONORANT, CONSONANT] segment, but the affricate /ks/ would be specified as a [STOP, FRICATIVE, DORSAL, PERIPHERAL, NON-SONORANT, CONSONANT] segment. This hierarchy successfully divides all of the phonemes assumed in Elfner (2006) and crucially does not require any laryngeal features to do so – specifically [SG]. From here,

¹² Because the contrast between singleton consonants and geminates relies on moraic structure, not phonological features, geminates are not included as part of this division algorithm.

so-called redundancy rules achieve the fact that sonorant consonants are voiced and non-sonorants are voiceless. This achieves the descriptive fact given by Elfner (2006:11) who states that “Blackfoot lacks voicing or aspiration contrasts; all of its obstruents are voiceless with little or no aspiration, and all of its sonorants are voiced.” In fact, the only reason to be suspicious of this hierarchy is because of the distribution of the velar fricative. The fact that [x] is the only non-sonorant consonant which cannot appear as long may make it suspect, but this is not damning evidence in and of itself. A proponent of this hierarchy could also point out that the glides and glottal stop likewise cannot appear as long, and that must first be explained. First, we will consider glottal stop.

One thing that should be immediately taken into consideration is the fact that glottal stop patterns in various ways across languages: Glottal stop has a tendency to pattern with approximants in some languages, stops in others, and as an unspecified epenthetic consonant in yet others still. Windsor (2012) discusses how glottal stop and schwa —as the least specified segments— alternate with \emptyset in French (*cf.* Côté 2008).¹³ Kavitskaya (2002: §3.3.1) discusses the wide range of possible /ʔ/ phonologies. She discusses how Clements (1990) refines Catford’s (1977) definition of approximants as lacking turbulence in the oral cavity, thus making /ʔ/ an approximant by definition. She shows how this is borne out in Karok (Bright 1957) where /ʔ/ patterns with glides as the set of consonants which cannot be geminated. However, in Kwakwala (Zec 1988, 1995), /ʔ/ patterns with stops in that coda-/ʔ/ does not attract stress. In fact, Kavitskaya cites personal correspondence with Keren Rice who suggests that in Proto-Athapaskan, the /ʔ/ is the only non-moraic coda. Finally, she gives an example from Ladefoged & Maddieson (1996) who describe a Papa New Guinea language, Gimi, as having a contrast between approximant-/ʔ/ and stop-/ʔ/. So, how does /ʔ/ pattern in Blackfoot? Immediately, one can see the descriptive similarities between Karok and Blackfoot – that /ʔ/ patterns with the glide series as a set of non-geminable consonants (Kavitskaya 2002:87). However, according to Frantz (2009) glides and /ʔ/ partake in different phonological rules. Though there are rules that govern both semivowel (glide) and /ʔ/ loss/reduction, there are additional rules that show /ʔ/-assimilation and /ʔ/-metathesis which the other approximants do not participate in. Strikingly, on this point, Frantz (2009:156-7) describes the phonological rules of semivowel and glottal reduction:¹⁴

(12) Semivowel reduction: $G \rightarrow \emptyset / _ + G$
 kitanistawaaw + yináyi → kitánistawaayináyi ‘you_{2p} said to him_{4s}’

(13) Glottal reduction: $' \rightarrow \emptyset / _ '$
 (á' + o'tooyiniki → áo''tooyiiki)¹⁵ áo''tooyiniki → áo'tooyiniki¹⁶ ‘when you arrive’

¹³ See also Shaw *et al* (1999:12 and references therein) for a discussion of this lack of specification on schwa and glottal stop in Salish, and van Oostendorp (2000) for a discussion of these segments in Dutch.

¹⁴ Where G = glide and ' = [ʔ]

¹⁵ After the effects of the glottal metathesis rule which applies for maximal feeding (Frantz 2009:157).

¹⁶ After the effects of the accent spread rule.

However, [ʔ] and glides can occur in adjacency in Blackfoot:

- (14) [ʔ]-G adjacency
- a. aʔpiksík:aʔjiwa ‘s/he walked’ (Eflner 2006:51)
 - b. ikoxpiʔwa ‘it swelled’ (Eflner 2006:51)

Glottal stop in Blackfoot also seems to be unlike the majority of Blackfoot obstruents in that, according to Eflner (2006), it and [x] are the only singleton consonants which can occupy coda position. The difference between these two segments is that [x] is found exclusively in post-vocalic, pre-consonantal position, and [ʔ] is normally found in coda position before vowels, glides, and any consonant other than another glottal stop. So it seems that [ʔ] is simply a segment which, like in Rice’s Proto-Athapaskan analysis cited above in Kavitskaya (2002), is simply a consonant which cannot project a mora, which means it can appear in coda position without causing a gemination to occur – but it is not restricted solely to codas (although it is most frequently found there), unlike [x].

It is a theoretical possibility that even though [ʔ] does not pattern with glides in Blackfoot, [x] does. However, as we shall see, such an analysis would be difficult to maintain. According to Catford’s (1977) definition of approximants (given in Kavitskaya 2002:87) as having the airstream become turbulent when they are voiceless, it is possible that [x] patterns with the approximants in Blackfoot, which is why it cannot appear as long. Eflner (2006) gives a possible historical reason for [x]’s distribution in Blackfoot, suggesting that it may have arisen through a process where codas were neutralized to [x] before obstruents. This would explain why the distribution of [x] is limited to post-vocalic, pre-obstruent position in modern Blackfoot. Approximants on the other hand, are found exclusively in onset position (phonemically), and are deleted word-initially or following a consonant that is not [ʔ] (Frantz 2009). Further, [x] does not participate in any of the reduction or deletion rules that the approximants of Blackfoot do. From an Evolutionary Phonology standpoint (Blevins 2006), this distribution could be the result of, ultimately, historical accident, which merely puts [x] in complementary distribution with the approximants [w] and [j]. I contend that this gives us reason to re-examine what the actual nature of [x] is in modern Blackfoot and see if there is another principled phonological reason for its distribution.

Reis Silva (2008) argued quite convincingly that what is traditionally considered to be a velar fricative in the Blackfoot literature is more accurately described as a slight frication at the end of a vowel resulting from the pre-aspiration of a following consonant. The slight frication, typically transcribed as [x] or [ç] (depending on the adjacent vowel), can be explained by the fact that pre-aspiration typically presents with an oral constriction which is “fricative in nature” (Silverman 2003 *qtd in* Reis Silva 2008:7). This interpretation of the slight frication found (post)vocalically and pre-obstruent in Blackfoot allows us to make a meaningful contrast between singleton unaspirated consonants, geminate unaspirated consonants, and pre-aspirated consonants:

(15) Three-way aspiration distinction in Blackfoot (Reis Silva 2008:9)¹⁷

	SR	Written form	Gloss
a.	[mʊ ^ɣ xw ^ɥ tʊ:kis]	mohtóókis	'ear'
b.	[mutʊokis]	mótookis	'kidney'
c.	[mutʊksis]	mottoksis	'knee'
d.	[mʊ ^ɣ xw ^ɥ kin]	mohkín	'necklace'
e.	[mʊʊkuan]	móókoan	'stomach'
f.	[mʊkʊis]	mókkoyis	'animal fur'
g.	[apatʊ ^ɣ xw ^ɥ tsi]	apatohtsi	'back'
h.	[mʊ:tsiss]	mo'tsís	'hand/arm'
i.	[mʊ ^ɣ xw ^ɥ ksis]	mohksisís	'nose'
j.	[ʊ:kʊʔsiksi]	oko'siksi	'her children'

In the above example, forms a, d, g, and i show pre-aspirated stops/affricates, b and e show unaspirated singleton consonants, h and j show unaspirated affricates, and c and f show unaspirated geminates. If we take as fact that [SG] is contrastive in Blackfoot, we can then revisit the contrastive hierarchy given for the language and see if that resolves the problem of [x]:

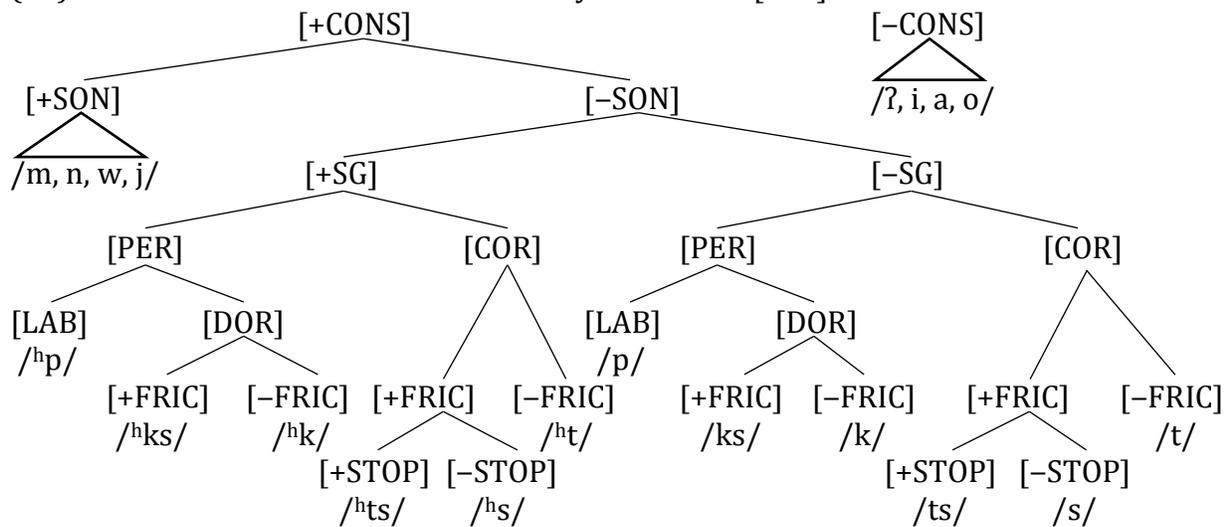
(16) The revised Blackfoot phonemic inventory

	Labial	Coronal	Dorsal	Glottal									
Stops	p ^h p p:	t ^h t t:	k ^h k k:	ʔ	<table border="1"> <thead> <tr> <th colspan="2">Vowels</th> </tr> </thead> <tbody> <tr> <td>i i:</td> <td></td> </tr> <tr> <td></td> <td>o o:</td> </tr> <tr> <td></td> <td>a a:</td> </tr> </tbody> </table>	Vowels		i i:			o o:		a a:
Vowels													
i i:													
	o o:												
	a a:												
Fricatives		s ^h s s:	x										
Affricates		ts ^h ts t:s	ks ^h ks k:s										
Nasals	m m:	n n:											
Glides	w	j											

In this revised phonemic inventory, the pre-aspirate series has been added to the non-sonorant stops/affricates and fricatives (appearing as bold in the above diagram), and the velar fricative has been removed (appearing as greyed out in the above diagram). Crucially, this inventory can still be achieved by computing a contrastive hierarchy (Dresher 2009). The revised contrastive hierarchy, however, has better explanatory power in that it better explains the distribution of the geminates, the patterning of [ʔ], and predicts the realization of the affricate series.

¹⁷ The SR of these forms are phonetic outputs. I am unaware of anyone who argues labialization is a contrastive feature in Blackfoot, and would likely exist on these forms only as overlap gestures from the preceding rounded vowel. Reis Silva uses a superscript [x] to indicate pre-aspiration. An example using /s/ contrasting with /^hs/ can be seen in *aaasi* 'be a mile' [a:asi] and *aaahs* 'elder relation' [a:a^hs] (cf. *maaahsi* 'her paternal aunt' [ma:a^hsi]).

(17) The Blackfoot contrastive hierarchy revised for [\pm SG]



In the above diagram, I truncate the hierarchy of the sonorant consonants for reasons of space, I do not see any reason to alter the hierarchy given for these phonemes from the diagram which appeared in (11). This hierarchy makes use of two redundancy rules, one which was used in the hierarchy given in (11); that [-SON] consonants are not contrastive for [NAS] (*[-SON], [NAS]), and that [+SON] phonemes are not contrastive for [SG] (*[+SON], [SG]). Under this hierarchy, there are no unanswered questions based on exceptional phonemes. Any phoneme which may appear as a coda —and is capable of associating with a mora— may appear as geminate. As argued above, there are languages where glottal stop is the only consonant not able to associate with a mora, and Blackfoot seems to fall into that category – therefore, we do not expect geminate glottal stops, especially given the rule that in a sequence of two adjacent glottal stops, one deletes (Frantz 2009). Further to that, since glides in Blackfoot cannot appear in coda position, we understand why they cannot appear as long. Finally, this analysis of Blackfoot has the additional advantage of explaining why the dorsal affricate in the language is [ks] and not [kx] – which would be expected if velar fricatives were phonemically available in the language.

The one final argument one might give for not accepting the phonological treatment of consonants being specified as [+SG] in Blackfoot is the idea that they seem to be restricted to word-medial positions. Since word-final consonants in Blackfoot are largely restricted to a small set of morphological endings (i.e., *-t/-k* ‘imperative.SG/.PL’) we would not expect to necessarily find pre-aspirates in this position, but why can they not appear in word-initial onset position? Of course, this raises the question of perceptibility – how would you recognize a word-initial pre-aspirate if you had no preceding vowel by which to gauge the pre-aspiration? In large part, I would argue that that perceptual explanation provides an adequate answer to the question, however there is at least one dialect of Blackfoot where pre-aspirates may appear in word initial position. One of my consultants consistently

produces the words for ‘soup’ and ‘chair’ with an initial pre-aspirate, epenthesising a vowel to the beginning of the word in order to make the contrast perceptible:

(18) Word-initial pre-aspirates Blackfoot¹⁸

	Written form	Pronunciation 1	Pronunciation 2	gloss
a.	<i>(a)koopí(sí)</i>	[ko:pi]	[ǰ ^h ko:pi]	‘soup’
b.	<i>(a)sóópa’tsis(i)</i>	[so:paʔtsis]	[ǰ ^h so:paʔtsis]	‘chair’

I take this as evidence that pre-aspirates are not restricted to word-medial position, though they may be rare in initial position due to the relative lack of salient cues that a word-initial consonant is pre-aspirated. The above examples provide one repair strategy to allow word-initial pre-aspirates to be recognised. Given the salience of such an item, and the relative infrequency of the words it appears on, however, it is not surprising that this pattern is found mainly among older speakers of the language. Nevertheless, this does provide evidence for [SG] as a contrastive feature in Blackfoot.

Since we understand [SG] to be contrastive in Blackfoot, then we are not forced to relegate phrase-final aspiration to phonetic implementation. This is a feature that the phonological component of Blackfoot has access to, and can make use of.

4. Conclusion

In this article I have provided evidence that the feature [SPREAD GLOTTIS] is active and contrastive in the phonology of Blackfoot. This evidence comes from the fact that phrase-final phenomenon which devoices vowels targets all segments, and has different phonetic implementations depending on the segment associated with the edge; that aspiration and vowel devoicing share the same articulatory gestures and phonetic length; and, that assuming aspiration is phonetic implementation rather than phonological specification fails to predict the distribution of what has been previously analyzed as the velar fricative, /x/.

There are three important contributions from this article: i. That the articulatory gesture for short and long vowels in final position remains contrastive, ii. an explanation for why vowels in final position devoice, and iii. evidence for the reconfiguration of the Blackfoot phonemic inventory based on contrast. This analysis crucially makes use of the Contrastive Hierarchy (Dresher 2009) as a method for discovering phonologically contrastive/active features in a language. Together with evidence presented in Reis Silva (2008) that Blackfoot contains pre-aspirates, the contrastive hierarchy allows me to show ample evidence that [SG] is active in Blackfoot. This explains why vowel devoicing and consonant aspiration occur in the same environment and use the same articulatory process without relying on historical accident. Finally, this analysis also adds to the existing literature on phrase-final glottal

¹⁸ Frantz (2009) lists other possible forms which fit this pattern (with an optional initial <a>) such as *(a)sootsímaan* ‘parfleche’ or *(a)sottoan* ‘knife-scabbard’.

insertion, providing typological validation of these studies (see Blevins 2008 or Watters 2010 and references therein).

4.1. Directions for future research

The research presented here offers both theoretical and experimental evidence for the conclusions reached. However, some of the experimental evidence stems from what amounts to preliminary or pilot studies thus far. Further experimentation is still needed to confirm the results of these preliminary studies such as eliciting and analyzing equal tokens of final short vowels, long vowels, and consonants with a consistent syntax in order to provide enough data for meaningful statistical analysis of these tokens.

Additionally, Understanding the prosodic constituency of Blackfoot and how this relates to the syntax (as used for elicitations) is the subject of ongoing research. I have suggested here that the environment for [SG] epenthesis in Blackfoot is the right edge of a phonological phrase, but I have provided no evidence that the correct environment is not the right edge of the utterance in the current article. However, preliminary results from utterance medial elements such as demonstratives and adjectives suggest that neither utterance nor phonological word boundaries are the environment for aspiration.

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