Mind your /ti/'s and q's: A subsegmental approach to affrication in Quebec French

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Introduction

Introduction

- **Affrication** in Quebec French (QF): Canonically, /t, d/ before high front vocoids pronounced with fricative-like release, transcribed [ts, dz] or [t^s, d^z]
- Previously noted complications:
  - Also a site for high vowel deletion (HVD) & other lenition processes (e.g., Cedergren & Simoneau 1985)
  - /d/-devoicing (partial or total) (Bento 1998)
  - High vowel devoicing (total), with frequency scale /y/ < /i/ (< /u/) (e.g., Gendron 1966)
  - Sociolinguistic factors (Bento 1998)
- Partial vowel devoicing seemingly unreported, however...

Context

- Pilot study:
  - Collective class experiment, fall 2019
  - Reading task of /t, d/ + /i, y/ sequences in different morphological settings
  - High frequency of partial vowel devoicing
- Follow-up experiment soon underway (upon ethics approval)
- In the meantime: qualitative look at a corpus

A question of representations

- /ti/ $\longrightarrow$ [t^{s}i], etc. seen without controversy as creating a complex or contour segment [t^{s}]
- What about partial vowel devoicing? [t^{sh}i]? [t^{s}hi]? [t^{s}i̥i]? What belongs to what?
- For now, assumed to create 2 complex segments (e.g., affricate + preaspirated vowel)
- This talk explores the consequences for the representation (Q Theory) and the formalization (ABC+Q) of such mappings

Main questions (for today)

Q. Does *partial* vowel devoicing co-occur with affrication in naturalistic speech?

A. Yes, but not as frequently as complete vowel deletion or devoicing. Seems less frequent in younger population.

Q. What insights do Q and ABC+Q theories have to offer?

A. Processes can target and affect subsegments, motivated by phonetic affinities – which can feed each other. We can produce partial assimilations in an OT framework.

Outline

1. Introduction
2. Affrication
3. Q Theory
4. Methodology
5. Results & Discussion
6. Conclusion

Background: Affrication

Typology

- Assibilation more generally (/t/ $\longrightarrow$ [s], [t^{s}], [t$\int$]) most frequently targets coronal stops before high front vocoids (Hall, Hamann & Zygis 2004)
- Trigger is always to the right of the target (Clements 1999, Kim 2001)
- Implications (Hall & Hamann 2003):
  - Voiced stops as targets imply voiceless stops as targets, but not vice-versa
  - Vocalic triggers imply semi-vocalic triggers, but not vice-versa

Phonetic motivation

- Closure of high vowels creates conditions for turbulence (Jäger 1978)
- Friction release of stops is longer before high than non-high and/or non-front vocoids (Ohala 1983, Clements 1999, Kim 2001)
- Assibilation cannot occur in vowel + stop sequences because aerodynamic criteria of frication are not met before stop closure (Kim 2001, based on Stevens 1998)
- Affinity between coronal place of articulation and vowel anteriority may favour assibilation before /i, y/ but does not discount /u/ as a trigger (Kim 2001)

Phases

- Hall, Hamann & Zygis (2004) distinguish 'burst friction' (BF) and 'aspiration' (A) as parts of larger 'friction phase' in assibilation, as in Fig. 1

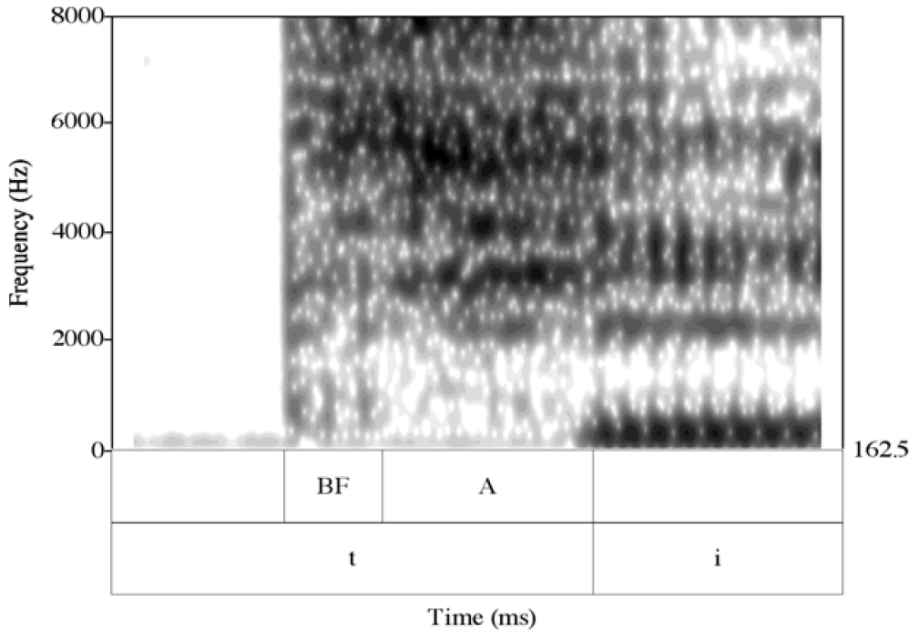


Fig. 1: An example from German (Hall, Hamann & Zygis 2004: 192)

BF vs. A (Hall, Hamann & Zygis 2004)

- Burst friction necessarily precedes and is shorter than aspiration; "generated at supraglottal constriction and shows a spectral prominence in the frequency range from 3500 to 7000" due to closure made by coronal stop (pp. 192-193)
- Aspiration "generated at the glottis and shows a stronger concentration of energy in the higher frequency region but also formant like peaks in lower frequency regions" and "overlaps with friction generated at the constriction of this vocoid" (p. 193)
- Aspiration considered here as equivalent to [s] portion of affricates, distinct from voiceless subsegment of V

Affrication in QF

- Articulated with contact between tongue predorsum and postalveolar/prepalatal region and lowering of tongue tip towards lower teeth (Charbonneau & Jacques 1972)
- Categorical within words, variable between words (e.g. Dumas 1987)
- Present & non-stigmatized in QF except for Gaspésie & Côte-Nord
- Less common in Acadian French except in PEI (King & Ryan 1989) and Northwest New Brunswick (Cichocki & Perreault 2018)
- Acadian variants include palatalized [dʒ] and aspirated [t^h]

Q Theory

Essentials

- Addresses the perceived inadequacy of traditional segmental models to account for contour segments (e.g., pre-nasalized and (post-)aspirated stops, diphthongs, affricates, contour tones, etc.)
- Divides the classic segment [Q] into maximally three subsegments [$q^1q^2q^3$]
- Segments may be homogenous (e.g., [$a^1a^2a^3$]) or heterogenous ([$a^1i^2i^3$])
- Similar segments may be distinguished by subsegmental prominence but not absolute (phonetic) duration

An example (Garvin, Lapierre & Inkelas 2018)

- Post-oralized vs. pre-nasalized stops in Panará
- /m/ $\longrightarrow$ [m$^{\text{p}}$] before oral vocoids
- /p/ $\longrightarrow$ [$^{\text{m}}$p] after nasal vowels
- Nasal phase duration of former significantly greater than that of the latter
- Q theoretical representations: [$\text{m}^1\text{m}^2\text{p}^3$] vs. [$\text{m}^1\text{p}^2\text{p}^3$]

Implementation (OT)

- Combined with Agreement by Correspondence (ABC) Theory (e.g., Walker 2000) to give ABC+Q Theory (Inkelas & Shih 2013)
- Subsegmental interactivity allows for incomplete assimilations, as in assibilation $(t^1t^2t^3) \longrightarrow (t^1t^2s^3)$, as well as /d/ and vowel devoicing (partial or total) in affrication
- Constraints:
  - CORR requires indexation of similar (sub)segments
  - QQ or qq-IDENT requires co-indexed (sub)segments to be identical
  - Traditional markedness & faithfulness may also be included
- Gestures are generally labeled as either vocalic (V) or consonantal (C)

An example

	/V(ã ã ã)+C(k k k)/	CORR$_i$-q+q	IDENT$_i$-qq(nas)	IDENT-IO-c-nas
a.	V(ã ã ã)+C(k k k)	-1		
b.	V(ã ã ã$_i$)+C(k$_i$ k k)		-1	
☞ c.	V(ã ã ã$_i$)+C(ŋ$_i$ g g)			-1
d.	V(ã ã ã$_i$)+C(ŋ$_i$ ŋ ŋ)			-3

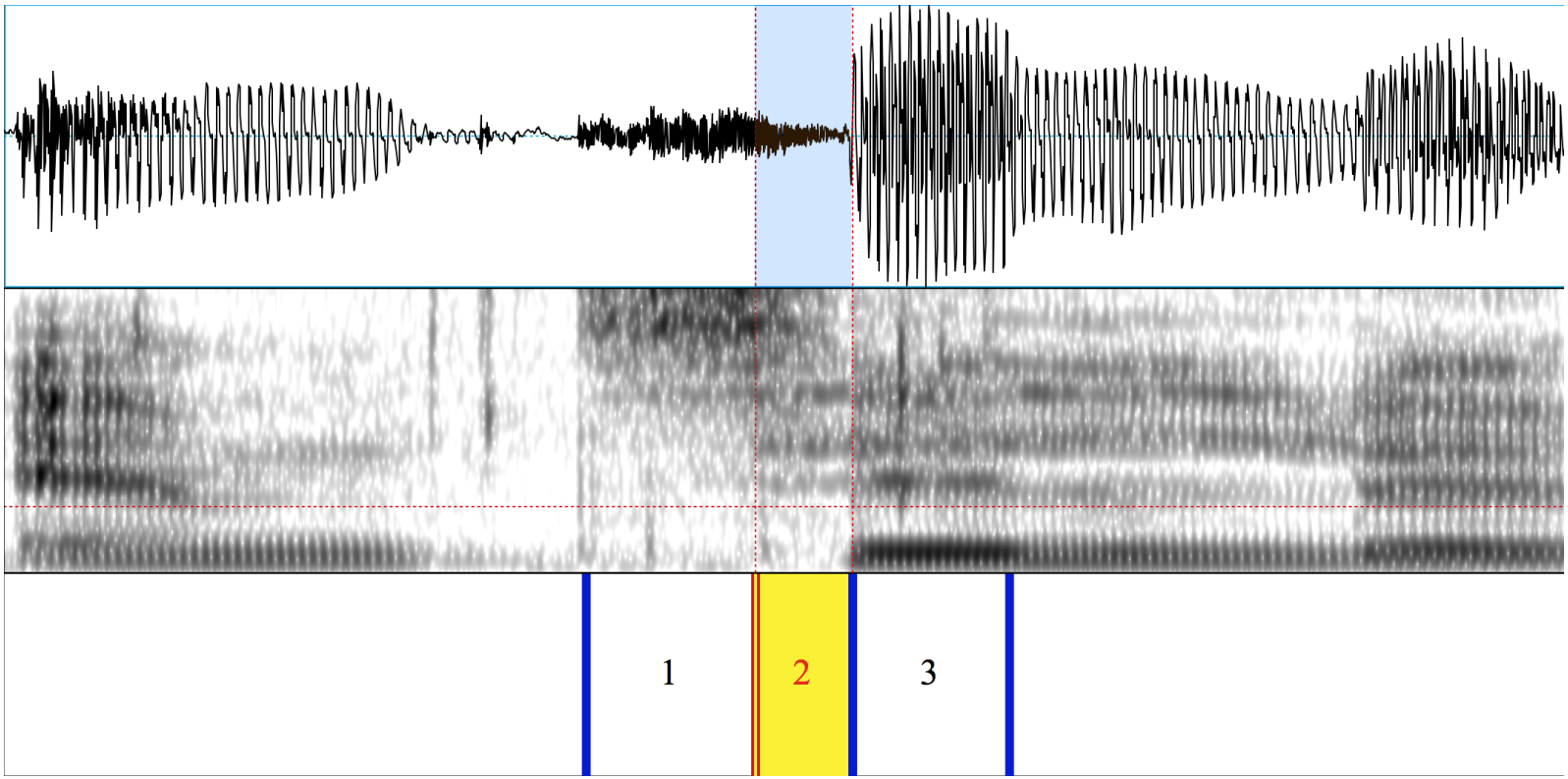
Fig. 2: Pre-nasalization in ABC+Q (Inkelas & Shih 2016: 6)

Methodology

Pilot corpus study

- Gathered from Hochelaga-Maisonneuve corpus (Blondeau et al. 2012), style of informal, semi-guided sociolinguistic interviews
- 7 native speakers of QF:
  - 3 F, 4 M
  - All middle class
  - Age range 25–56
- 10-15 word-final /ti/ sequences extracted per person (87 total)
- Tagged for burst, aspiration, voiceless vowel (lower energy & more structured than aspiration) and vowel

Reproduced example



Limitations

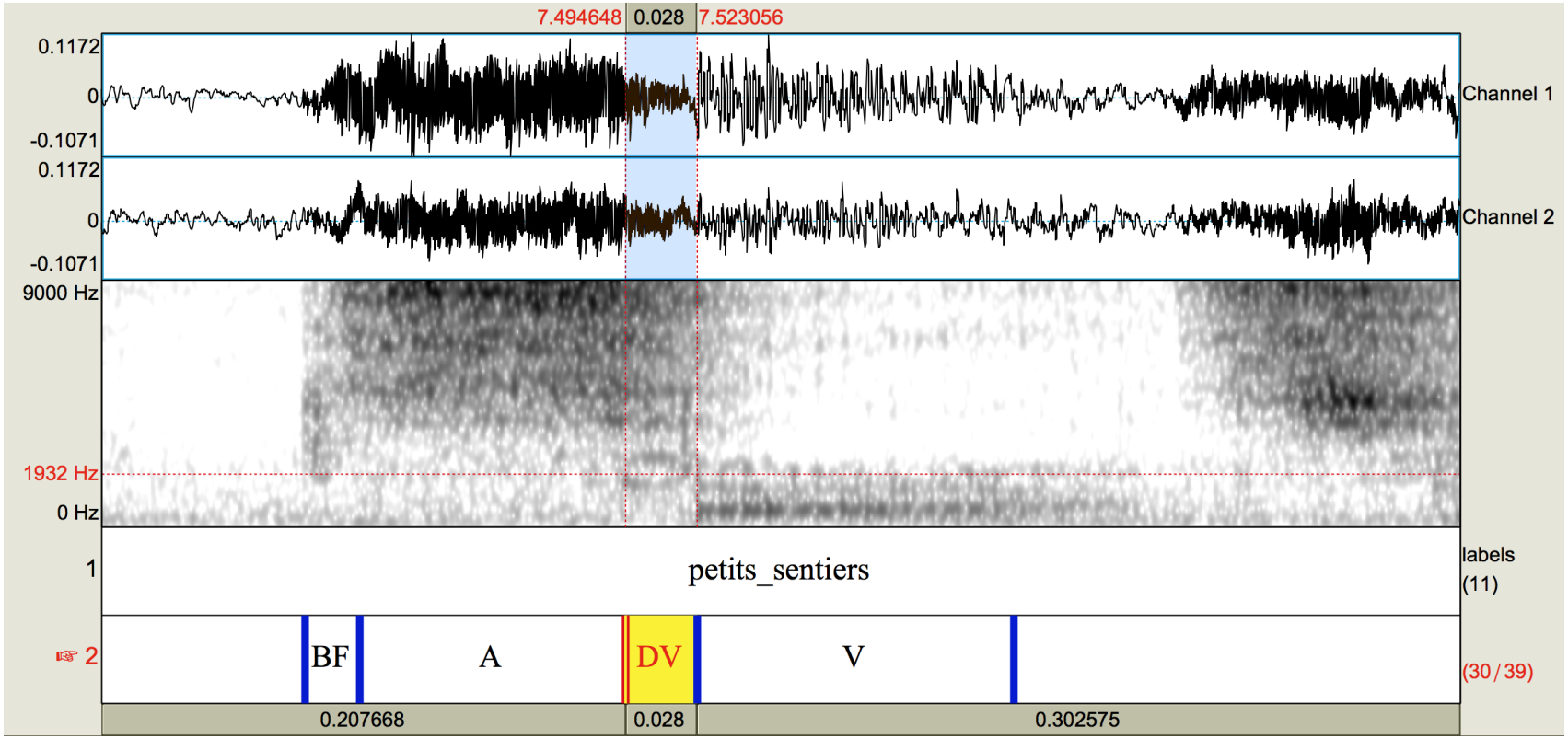
- Recording quality not at phonetic study standards, uneven from interview to interview
- Ambient noise & interventions of interviewer
- Participant age could not controlled for within socio-economic classes targeted

Results & Discussion

Tendencies

- Regardless of type, first phase (BF) much shorter than second (A)
- Majority of /ti/ sequences, especially pre-stop, realized without any vocalic gestures, including voiceless V
- When V is realized, additional third phase of voiceless V tends to appear, often shorter than, but maximally as long as second (aspiration) phase
- Difficult to separate phases 2 & 3 with current quality of data

Example (M38)


7.494648
0.028
7.523056
0.1172
0
-0.1071
Channel 1
0.1172
0
-0.1071
Channel 2
9000 Hz
1932 Hz
0 Hz
1
petits_sentiers
labels
(11)
2
BF
A
DV
V
(30 / 39)
0.207668
0.028
0.302575

Analysis

- Two similarity conditions (informal):
  - [TURB]: Coronal stop release ↔ high front vocoids
  - [F.VOI]: Fricatives ↔ high front vocoids
- **Why separate?** Assuming (partial) V devoicing depends on assibilation but not vice-versa (remains to be confirmed); CORR constraints with separate indices achieves this
- ID-qq(cont) motivates assibilation; ID-qq(voi) motivates devoicing

Formalization

/C(t t t)V(i i i)/	CORR$_i$ [T.TURB] 10	ID-qq (cont) 10	ID-qq (voi) 10	CORR$_j$ [TURB] 0.62	ID-IO (cont) 0.29	ID-IO (voi) 0	H	e^H	p
a. C(t t t)V(i i i)	-1						-10	0	0
b. C(t t t$_i$)V(i$_i$ i i)		-1					-10	0	0
c. C(t t s$_i$)V(i$_i$ i i)				-1	-1		-0.91	0.4	0.35
d. C(t t s$_{i,j}$)V(i$_{i,j}$ i i)			-1		-1		-10.29	0	0
e. C(t t s$_{i,j}$)V(i$_{i,j}$ i i)					-1	-1	-0.29	0.75	0.65

Fig. 3: Toy example in Maximum Entropy Grammar (Hayes & Wilson 2008) assuming, among vowel-ful realizations, 65% assibilating *and* partial devoicing, vs. 35% only assibilating

Conclusion

Summary

- QF affrication in natural speech appears to be either:
  - /ti/ $\longrightarrow$ [ts], i.e., deletion or 'fricativization' of the vowel (in line with Cedergren & Simoneau 1985)
  - /ti/ $\longrightarrow$ [t^{s}i̥i]
- More data required to determine frequency effects, as well as durational information
- Q Theory already captures assibilation aspect of affrication, particularly well-advantaged to capture suggested regularity of additional phase of a partial voiceless vowel
- ABC+Q models these effects in an optimality theoretic framework, on the basis of phonetic factors and q-q assimilation

Acknowledgments

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