CHAPTER SEVEN

NOW SAY 'AH': INTERNAL FACTORS OF SHIFTING AND THE ENGLISH LOW VOWEL SPACE

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1. Introduction

This essay investigates the history of the English low vowel space from its earliest roots to present-day varieties, observing how Labov's (1994, 2010) vowel shifting framework accounts for changes ranging from the hypothetical to those that can be observed and tested today in fine phonetic detail. Starting with the reconstructed low vowels of Proto-Indo-European and Proto-Germanic, certain identifiable changes may have involved switches in vowels' relative peripherality according to Labov's main shifting and exit principles. In attested forms of Old English and Middle English, these principles also account for the cycling of various vowel classes through the [æ~a~ɑ~ɒ] space. Since Early Modern English, short /æ/ has lengthened in many present-day varieties, resulting in phonemic BATH-TRAP splits in Southern England and the Northeast United States as well as other phonetically-conditioned patterns across North America. The wholesale lengthening of BATH/TRAP has also propelled the Northern Cities Shift, in which the fronting/lowering of LOT/FATHER and THOUGHT seemingly contradict Labov's original unidirectional principles; Labov (1994) posits a third shifting principle governing front-back movements to account for this. The ongoing Canadian Shift, in which /ɛ/ and /æ/ lower and retract in Canadian English, has been observed and described in several locales and across successive generations, revealing

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the trajectory of /æ/ and /ɛ/ through comparable apparent-time studies. A close consideration of this shift reveals that it can only conform to the shifting principles if /æ/ is defined phonologically as non-peripheral despite its phonetically peripheral location in F1/F2 space. Though Labov (2010) explicitly endorses defining peripherality on phonetic grounds, his stipulation that the boundary between peripheral and non-peripheral tracks is absent in the low vowel space leaves open the possibility of a phonetically motivated account of peripherality based on durational cues, an underexplored aspect of Canadian English.

2. Labov's Vowel Shifting Framework

In *Internal Factors* (Labov 1994) and *Cognitive and Cultural Factors* (Labov 2010)—the first and third volumes of *Principles of Linguistic Change*—as well as the *Atlas of North American English* (Labov, Ash & Boberg 2006), William Labov lays out a framework that aims to establish a universal set of unidirectional principles that can account for the diachronic changes observed in the vowel systems of the world's languages. Though he accepts that "there are no directions of vowel shifting that are forbidden to speakers of human language… some directions are taken far more often than others". While we typically think of English as having long/short and tense/lax subsystems (i.e., the bimoraic /u:/ being set apart from monomoraic /ʊ/ by its longer duration and tenser/more rounded articulation), Labov (1991, 1994, 2010) has argued that in considering diachronic change, it is more appropriate to consider vowels' relative peripherality within the articulatory space. When plotting the vowels of most standard varieties of Modern English (ModE) on a plot of the F1/F2 acoustic space, the long/tense vowels tend to be located at the periphery of the vowel space, while their short/lax counterparts are closer together in the center.

Labov (1991, 1994; distilled in Labov, Ash & Boberg 2006) argues that whether vowels are located in the peripheral or non-peripheral 'tracks' determines their gradual movement over time, and from a large body of historical evidence compiles two main principles that govern vowels undergoing chain shifts (Figure 7-1):

Principle I: Peripheral nuclei rise
Principle II: Non-peripheral nuclei fall

If only these principles existed, it would seem that all peripheral vowels would collapse as /i:/ and /u:/, while all lax vowels would become

/a/. Labov therefore observes two ways, deemed exit principles, by which vowels can switch between the peripheral and non-peripheral subsystems in order to avoid merger:

Low Exit Principle: Low non-peripheral vowels become peripheral
High Exit Principle: One of two high peripheral morae in long vowels becomes non-peripheral

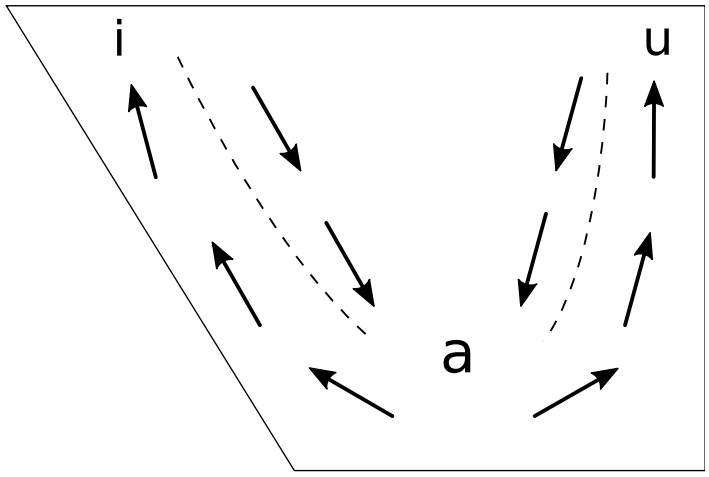

Figure 7-1: Directions of movement in chain shifts along peripheral and non-peripheral tracks as outlined in Labov (1994, 2010) (Principles I and II)

According to Labov (1994, 121), these principles "combine to produce only a small number of repeated patterns". One key to applying these rules in explaining the cycling of vowel classes throughout the history of English and its progenitors is that "many apparent counterexamples… are accounted for by the fact that a set of short or lax nuclei had shifted to peripheral position," or vice-versa (Labov 1991, 7). Thus, though long/tense vowels are usually peripheral and short/lax ones non-peripheral, vowels change their expected behavior over time by "switching" their relative peripherality. Crucially to this discussion of the low vowel space, Labov (2010, 14) clarifies his chain shift diagrams to reflect the fact that "peripherality is defined in terms of formant values for high and mid vowels, but not for low vowels". This means that there is a low "gap" in the division of the peripheral and non-peripheral tracks. As is discussed later, Labov (2010, 149) also stipulates that "tensing of low vowels is most likely realized as an increase in duration", proposing length as the operative phonetic correlate of the Low Exit Principle.

This paper will trace the history of the English low vowel space as a way of exploring the predictions of the above framework. In Section 2, the basic principles are first applied in characterizing changes from the

reconstructed Proto-Indo-European (PIE) vowel system to Proto-Germanic (PGmc), Old English (OE), and Middle English (ME). While the primary shifting principles seem to account well for historical sound changes, it is also important to compare their predictions to present-day vowel shifts observable in fine phonetic detail. In ModE, there exists a large degree of diversity in low vowel pronunciation. Section 3 outlines how synchronic differences in the distribution of the vowel classes represented by BATH, TRAP, FATHER, THOUGHT, and LOT can be explained by the divergent pathways they have taken since Early Modern English (EModE). The Northern Cities Shift (NCS), for instance, is characterized by LOT/FATHER fronting and THOUGHT lowering along the back periphery of the vowel space, in an apparent contradiction to the main principle that vowels only rise along peripheral paths. Labov (1994) therefore posits that in chain shifts, tense (peripheral) vowels move to the front along peripheral paths, and lax (non-peripheral) vowels move to the back along non-peripheral paths. Section 4 draws upon six apparent-time studies in order to fully detail the chronological steps comprising the retraction and lowering of BATH/TRAP (/æ/) and DRESS (/ɛ/) in Canada. In the Canadian Shift (CS), the low lax /æ/ fully lowers in the front vowel space before retracting. Section 5 argues that this retraction can be seen as compatible with Labov's principles if the phonological specification of /æ/ as a non-peripheral vowel overrides the fact that it is phonetically peripheral, though this is inconsistent with Labov's endorsement of a phonetic definition of peripherality. However, this issue with assigning peripherality to /æ/ is illustrative of Labov's (2010, 149) observation that "peripherality does not distinguish low vowels" as measured in the F1/F2 space. The role of relative duration in the operation of the CS remains unexplored, and may hold the key to identifying phonetic correlates of peripherality in the low vowel space.

Dialectologists find it useful to refer to vowel classes using a word representing a set of lexemes containing the same vowel. While Wells' lexical set (1982) suffices for the treatment of many contemporary shifts in English, Section 2 will use a modified lexical set in SMALL CAPS made up of words which can be traced back to a reconstructed PIE root (e.g. FATHER in lieu of the usual PALM, DEED in lieu of FLEECE); other relevant keywords will be introduced in Section 3. Keywords in these sections emphasize the etymological continuity of certain vowel classes and necessarily simplify the investigation of how sounds have cycled through the [æ~a~ɑ~ɒ] space. IPA symbols between slashes broadly denote phonemes at certain points in the evolution of English varieties; more specific phonetic and allophonic notation is presented between brackets.

In-text figures display movements affecting the low vowels in black, with other relevant vowel positions and movements colored grey.

3. From Proto-Indo-European to Middle English

In the vowel systems of OE, ME, and varieties of ModE, one or more low vowels in the space around [a(:)] have always been present, but in different lexical items in each period. For instance, OE *gāt* (GOAT) and ME *name* (NAME) at different points had low phonetic reflexes comparable to ModE FATHER (Lass 1976). Philologists have also been able to reconstruct a general picture of the key steps between PIE and OE, including PGmc, using the comparative method (Kroonen 2013; Minkova 2014; Ringe 2006); this allows for a consideration of approximate vowel quality and quantity in the era before attested textual evidence and orthoepic commentary. PIE was probably spoken about 6,000 years ago or earlier, while PGmc, the common ancestor of the Germanic languages, was likely spoken no earlier than 2,500 years ago (Ringe 2006). Accounting for the changes between them is therefore rather conjectural. However, despite lacking direct evidence as to vowels' exact pronunciations, Labov's principles give a framework within which we can model how the reconstructed systems might have moved.[2]

[2] Though PIE is noted for its extensive system of ablaut (cf. *sing~sang~sung)* and the North/West daughters of PGmc underwent umlaut (cf. *mouse~mice*), the present investigation is concerned only with retracing the diachronic movements of vowel classes themselves rather than synchronic morphophonological relationships between them.

Vowel class	PIE	PGmc	OE (West Saxon)	ME
MOTHER	*māter-[†‡]	*mōder-	mōdor [moːdər]	[moːðəɹ~muðəɹ]
OLD	*al-to-[‡]	*alda-	eald [æəld~ɑɬd]	[ɔːɬd]
FATHER	*pəter-[‡] *ph$_2$tér-[†]	*fader-	fæder [fædər]	[fæðəɹ~faðəɹ] > [faːðəɹ]
NAME	*nŏ̥-mn̥-[‡] *h$_1$néh$_3$mn-[†]	*namōn-	nama [nɑma]	[næmə~namə] > [næːm]
BATH	*bhə-to-[‡]	*baþa-	bæþ [bæθ]	[bæθ]
EIGHT	*oktō(u)-[‡] *oḱtṓw-[†]	*ahtau-	eahta [æəxtə]	[ɛːxt]
GOAT	*gh(a)id-[‡] *g^{h}ayd-[†]	*gait-	gāt [gɑːt]	[gɔːt]
DEED	*dhē-ti-[‡] *d^{h}éh$_1$-ti-[†]	*dēdi-	dǣd [dæːd]	[dɛːd]

Table 7-1: Etymology of key words representing vowel classes. Points at which these words contained long or short monophthongal low vowels are shaded (PIE sources: Watkins[‡] 2000, Ringe[†] 2006; PGmc and OE source: Kroonen 2013; ME sources: Lass 1976, Minkova 2014)

PIE had long and short vowels; most scholars agree that the long system contained */a:/ in words like MOTHER (Table 7-1).[3] One of the most significant shifts that occurred from PIE to PGmc was */a:/ becoming */o:/, as in PIE *māter- > PGmc *mōder. Because of this change, Gburek (1985, 141) contends that "Primitive Germanic... entered the historical age without /a:/". Perhaps catalyzed by this lack of a long low vowel, */e:/ underwent a split into */e:/$_1$ and */e:/$_2$ in the North and West Germanic languages; Gburek (1985, 141) reconstructs */e:/$_1$ as an open vowel, in opposition to the closer */e:/$_2$, whose stable place on the periphery "sufficed to keep the system in balance". Gburek (1985) also contends that */e:/$_1$ lowered first to /a:/ in PNWGmc before fronting to /æ:/ in OE, an opinion shared by Kroonen (2013). DEED therefore evolved as PIE *dhē-ti- > PGmc *dēdi- > PNWGmc *dād > OE dǣd. Figure 7-2, based on figures from Prokosch (1930) and Labov (1994), depicts these

[3] PIE reconstructions are taken from both Ringe (2006) and Watkins (2000), who disagree on details such as how to denote hypothesized laryngeal consonants (h_1, h_2, h_3 for Ringe, or just *h* for Watkins) that often emerged in daughter languages as vowels; where they disagree, both reconstructions are shown in Table 7-1. Unless otherwise stated, the Watkins (2000) reconstructions are used in-text for comparative purposes.

long vowel shifts. Principle I would account for the raising of */a:/ to */o:/ (Figure 7-2a), while */e:/$_1$ could have drifted back into the non-peripheral track if distinct from a peripheral */e:/$_2$, subsequently lowering according to Principle II and filling the gap in the low space (Figure 7-2b).

Few words can be reconstructed as having short PIE */a/, but some, such as PIE *al-to- (OLD), still have cognates in ModE. One exceptional lexeme, FATHER (PIE *pəter- > PGmc *fader-), developed */ə/ and then */a/ in lieu of an earlier laryngeal consonant (cf. *ph$_2$tér as reconstructed by Ringe 2006). A similar vocalization of a laryngeal begat the low short vowel in BATH (PIE *bhə-to- > PGmc *baþa-), and possibly also NAME. Kroonen's (2013, xviii) reconstruction of PIE *h$_3$nh$_3$-mén, the zero-grade form, as its source would support this, though Ringe (2006, 46) argues that "the *nam- of the actual PGmc form cannot have developed by sound change alone"; rather, he suggests that the direct form was leveled into the oblique forms, leading to a Pre-PGmC *nomn- > PGmc *namōn-. Watkins' (2000) reconstruction of PIE *nŏ-mn̥- also allows for this to be seen simply as an example of PIE */o/ lowering to PGmc */a/. A more straightforward example of this is EIGHT: PIE *oktō(u)- > PGmc *ahtau-. Principle II suggests that since */o/ fell, it was non-peripheral in relation to */o:/. The existing PIE */a/ (as in FATHER, BATH, and perhaps NAME) did not follow the Low Exit Principle, instead staying in place and absorbing the incoming */o/ set (Minkova 2014). Given the few items that can be reconstructed as having had */a/ in PIE, this may have been an impoverished phonemic set that exerted minimal resistance to the addition of incoming words.

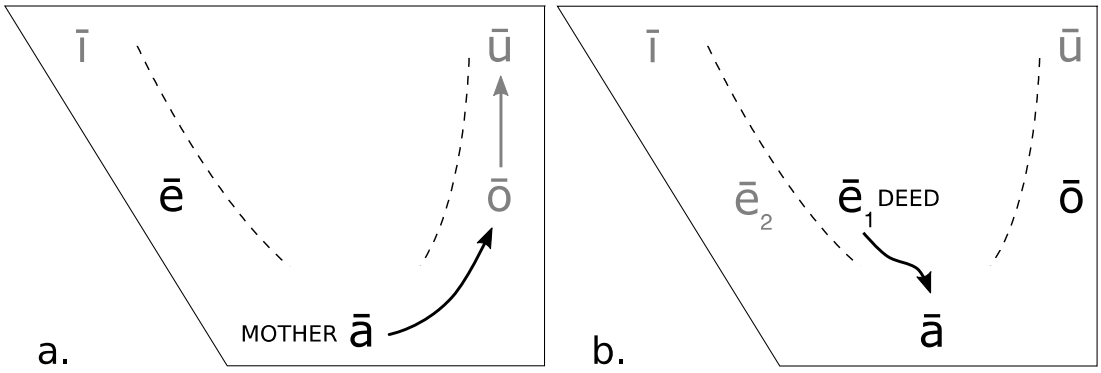

Figure 7-2: The PGmc shift. Stage (a) took place between PIE and PGmc, while (b) took place between PGmc and PNWGmc

The 'standard' West Saxon dialect of OE stands out among the daughters of PGmc in its preference for low vowels in the front and back instead of a

single central one. Despite PGmc having lost the */a:/ of MOTHER in its merger with */o:/, OE exhibits a long monophthong (reconstructed by Minkova 2014 as /ɒ:/) spelled as <ā> evolving from PGmc */ai/, as in GOAT: PIE *gh(a)id- > PGmc *gait- > OE *gāt*. This monopthongization of */ai/ as /ɒ:/, one instance of the Low Exit Principle, is comparable to ModE dialects (e.g. London, Australia, the U.S. South) that delete the glide from PRICE, removing it from the upgliding diphthong system. PGmc */a/ entered OE sometimes as /æ/ (BATH: OE *bæþ*) and sometimes as /ɑ/ (NAME, OE *nama*; it is less clear what the reflex was in OLD, OE *eald*). The alternation between /ɑ/ and /æ/ seems to have initially been allophonic, with /ɑ/ preceding certain sounds like nasals, but it was arguably phonemic in some dialects before later re-merging as /a~æ/ in ME (Davidsen-Nielsen 1984, Minkova 2014). EIGHT seems to have broken into a peripheral diphthong with the [æə] quality in Early OE, later raising via Principle I and monophthongizing as long /ɛ:/ (Minkova 2014).

In early ME, GOAT was raised from /ɒ:/ to /ɔ:/, following Principle I (Minkova 2014). As for the short vowels, /ɑ/ and /æ/ (re)merged into a reflex somewhere in the [a~æ] range (Lass 1976, Minkova 2014). From the end of the 12th to end of the 14th century, English underwent a general lengthening of vowels in the open syllables of disyllabic words, making NAME a long, peripheral vowel and drawing it into the /æ:/ space earlier vacated by DEED (Labov 1994, Minkova 2014). The verb *bathe*, for instance, was disyllabic and lengthened as a member of NAME following Principle I, while its etymological sibling *bath* was left with a non-peripheral short /a~æ/.

The Great Vowel Shift (GVS), the most significant shift leading up to EModE, was initiated by the high peripheral vowels undergoing the High Exit Principle: the first morae of PRICE (ME /i:/) and HOUSE (ME /u:/) became non-peripheral, lowering first toward [ʌ] and then down to [a] to produce the common ModE reflexes /ai/ and /au/. The classic view (Jespersen 1909) is that this led to a revolutionary, integrated chain shift involving the entire long vowel system; however, it has been suggested that the low vowel changes are better characterized as a later development relative to the c. 1400–1550 rotations of the high vowel space (Stockwell and Minkova 1988; Lass 1992). Figure 7-3 depicts just these low vowel changes, which Minkova (2014) estimates to have operated around 1550–1750: the GOAT vowel backed and/or rounded further to /o:/, and the long /æ:/ of NAME, the last long vowel to change, underwent Principle I and

raised towards /eɪ/ along the front of the vowel space.[4] FATHER, which had a short /a~æ/ before these shifts, lengthened and became a long, peripheral /a:/; this class, which avoided raising with NAME, contained only a small number of words, such as *palm, father, ma,* and *pa.* Other words such as BATH and TRAP did not lengthen at this point and remained with a short /a~æ/.

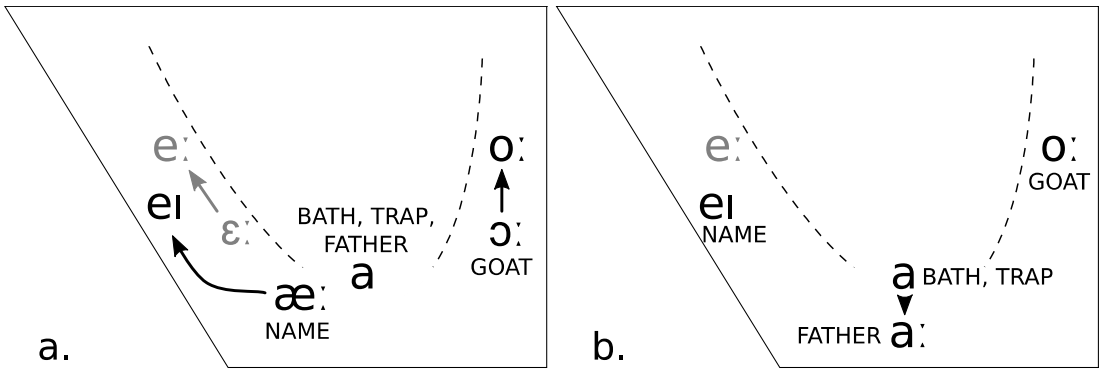

Figure 7-3: The low vowel changes associated with the Great Vowel Shift (a) and the low vowel duration split in its aftermath (b)

4. The Low Vowel Space(s) in ModE

Table 7-2 shows the approximate pronunciations of EModE words and their pronunciations in six present-day dialects. The THOUGHT class was initially composed of words which previously had ME /au/ or /ɒw~ow/ (*thaw*); this vowel monophthongized to /ɔ:/, establishing LOT /ɔ/ as non-peripheral and allowing it to undergo lowering in all dialects (Lass 1976). Going into the EModE period, very few words remained with a long /a:/. In most of North America, this impoverished FATHER class was augmented after LOT descended and unrounded in the late 17th to early 18th century; in some non-rhotic dialects such as RP and traditional Boston English FATHER was instead augmented by the START class (Boberg 2015; Lindsey 1984, Moulton 1984; Wells 1982). A host of other classes and subsets of classes then joined THOUGHT (Lass 1976, Labov 2010); these included some LOT words that lengthened initially before voiceless fricatives (*soft, lost, cloth*). In traditional NYC English (NYCE), THOUGHT entered the peripheral space and rose via Principle I, becoming

[4] Minkova (2014) details how the shift of /ɛ:/ to /e:/ and /æ:/ to /eɪ/ created a situation in which /e:/ and /eɪ/ stayed distinct until eventually merging; Figure 7-3 reflects this initial state.

[ɔə~ʊə] (Labov 1966), while some LOT words before voiced stops (*god, cob*) joined the FATHER-START class (Lass 1976). There exist a variety of alignments in contemporary New York speech: some non-rhotic speakers produce FATHER/LOT around [ɑ], distinct from a raised THOUGHT [ɔə~ʊə] and START [ɒə~ɔə] (as noted in Table 7-2), while other speakers may still have a distinct LOT [ɑ], FATHER-START [ɒ(ə)], and THOUGHT [ɔə~ʊə] (Lass 1976, Newman 2016).

Vowel class	EModE	RP	Std NAE	Boston	NYCE	NCS	CS
FATHER	fæðəɹ > faːðəɹ	fɑːðə	fɑðəɹ	faːðə	fɑðə	faðəɹ	fɒðəɹ
START	staɹt	stɑːt	staɹt	staːt	stɔət	staɹt	staɹt
NAME	nɑmə > næːm	neɪm	neɪm	neɪm	neɪm	neɪm	neɪm
BATH	bæθ	bɑːθ	bæθ	baːθ	beəθ	beəθ	baθ
TRAP	tɹæp	tɹæp	tɹæp	tɹæp	tɹæp	tɹeəp	tɹap
THOUGHT	θɒwt	θɔːt	θɒt	θɒt	θɔət	θɑt	θɒt
LOT	lɔt	lɒt	lɑt	lɒt	lɑt	læt	lɒt

Table 7-2: Evolution of low vowels from EModE (and Early ModE) to ModE varieties (Sources: Wells 1982, Moulton 1984, Minkova 2014)

In the 17th–18th centuries, some members of the short TRAP/BATH class began to lengthen in phonetically conditioned alternations, allowing them to enter the peripheral track (Minkova 2014). In the precursor dialect(s) of RP as well as Southern Hemisphere Englishes, /a~æ/ was first lengthened to [æː] preceding tautosyllabic voiceless fricatives; this BATH set merged with FATHER and retracted to /ɑː/ (Wells 1982, Lass 1976). Other TRAP words followed suit, such that now there exist near-minimal pairs such as *can* [kæn] vs. long *can't* [kɑːnt]. This BATH-TRAP split is a typical shibboleth distinguishing dialects originating in 18th-century Southern England (e.g. RP, Australian English, NZ English) from other varieties.

However, the more general phenomenon of a set of historically short /a~æ/ words lengthening and entering a peripheral track via the Low Exit Principle has also operated in many varieties of North American English, though with different consequences. In the case of Standard NAE and Canadian English, this has not produced a new phoneme, but only regular, phonetically-conditioned allophonic variation. The most common system is the raising of /æ/ before nasals, producing raised/tense/peripheral *can* [keən] as opposed to lax/short/non-peripheral *trap* [tɹæp] (Labov 2007). In NYCE, the split has become more or less phonemic, just as in RP,

differentiating BATH from TRAP (though see Kiparsky 1988, Harris 1989 for other opinions of its phonological nature). Just as in England, the original lengthened reflexes of /æ/ in North America were [æ:], but instead of retracting, the long vowel rose up the front periphery according to Principle I, reaching [eə], or even as high as [ɪə] for some allophones (Labov 2007).

In American cities located around the Great Lakes, including Chicago, Buffalo, and Detroit, BATH/TRAP is a merged set that has risen via Principle I to [eə]. This is the first stage of the Northern Cities Shift (NCS), a dramatic rearrangement of several vowels in concert (Labov 2007). Other vowels shifted to fill the 'void' left by the wholesale exit of BATH/TRAP from the [æ] space; LOT fronted toward [æ], THOUGHT descended toward [ɑ], and in turn BUT has retracted toward [ɔ] and BET toward [ʌ].

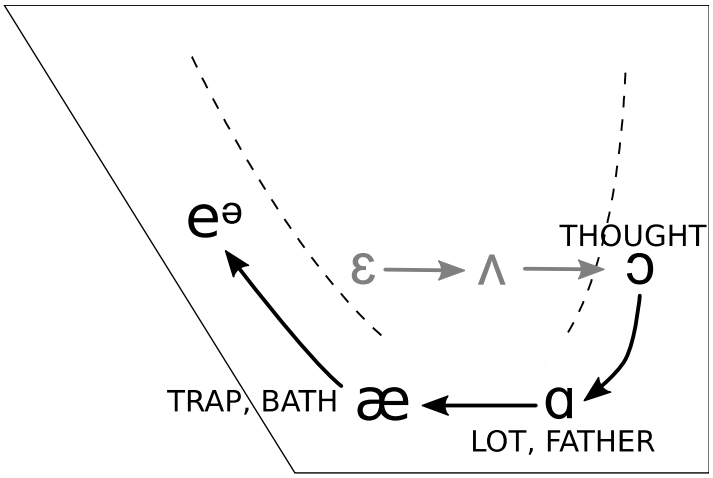

Figure 7-4: The Northern Cities Shift

Labov's (2007) description of the NCS, however, indicates that the lowering/fronting LOT and THOUGHT phonemes are in the peripheral track, which seems to contradict his original vowel movement principles (Figure 7-4). This is not trivial: the elegance of the principles rests on unidirectional track movements. Labov (1994, 200) noted this "counterevidence", adding a specific caveat:

> *Principle III:* In chain shifts, tense vowels move to the front along peripheral paths, and lax vowels move to the back along non-peripheral paths.

While the first clause regarding tense vowels moving front along the periphery is relevant to the NCS, the second clause seems to contradict the Low Exit Principle and its durational rather than qualitative operation; when the low lax /æ/ becomes the most peripherally articulated sound in the low front vowel space, how can it continue to move to the back along a non-peripheral path? The following section focuses on another ongoing shift in which exactly such a pattern has occurred.

5. A Closer Look at a Change in Progress: The Canadian Shift (CS)

The merger of LOT, THOUGHT, and FATHER, actively spreading throughout much of the United States, is already complete in Canadian English, with the vowel located around [ɒ] (Table 7-2). In contrast to Labov's (1991) original prediction that this low-back merger would result in a relatively stable "third dialect" of English participating in neither the NCS nor the Southern Vowel Shift, it seems to have initiated a pull shift as /æ/ retracts into the vacant low-central region of the vowel space. This has also occurred in the western United States, where it is called the California Shift (Eckert 2008, Grama and Kennedy 2009), and a lowering/retraction of the front short vowels is increasingly being reported in other locales such as Columbus, Ohio (Durian 2012), Southern Illinois (Bigham 2010), and Hawai'i (Drager et al. 2013). Roeder and Gardner (2013) suggest that the merger of LOT, THOUGHT, and FATHER changes the underlying phonology of the BATH/TRAP vowel, enabling the ensuing shift in phonetic space. From a theoretical standpoint, it is thus unsurprising that a similar front vowel shift would be observed across disparate areas in which the low-back merger is in progress or complete. In the following discussion of Canadian English, the BATH/TRAP, LOT/THOUGHT/FATHER, and DRESS classes are henceforth defined more specifically as /æ/, /ɒ/, and /ɛ/. Though retraction/lowering of the KIT vowel /ɪ/ has also been reported, this analysis will focus on the non-high lax vowels, whose movement has been more thoroughly described.

The CS was first recognized by Clarke, Elms, and Youssef (1995), who noted that /æ/, /ɛ/, and /ɪ/ seemed to be lowering together based on impressionistically coded data from the speech of mainly young Ontarians. They modeled this as a pull shift, with each vowel drawn into the space vacated by its neighbor. Subsequent investigations across Canada have confirmed the apparent-time movement of /ɛ/ and /æ/, but have disagreed as to the exact trajectory of the shift. Roeder and Jarmasz (2010) propose that the low-back merger (Figure 7-5a) created vacant space (Figure 7-5b),

setting the stage for the front vowels to shift back in concert, first both lowering and retracting (Figure 7-5c) and then continuing to retract (Figure 7-5d).

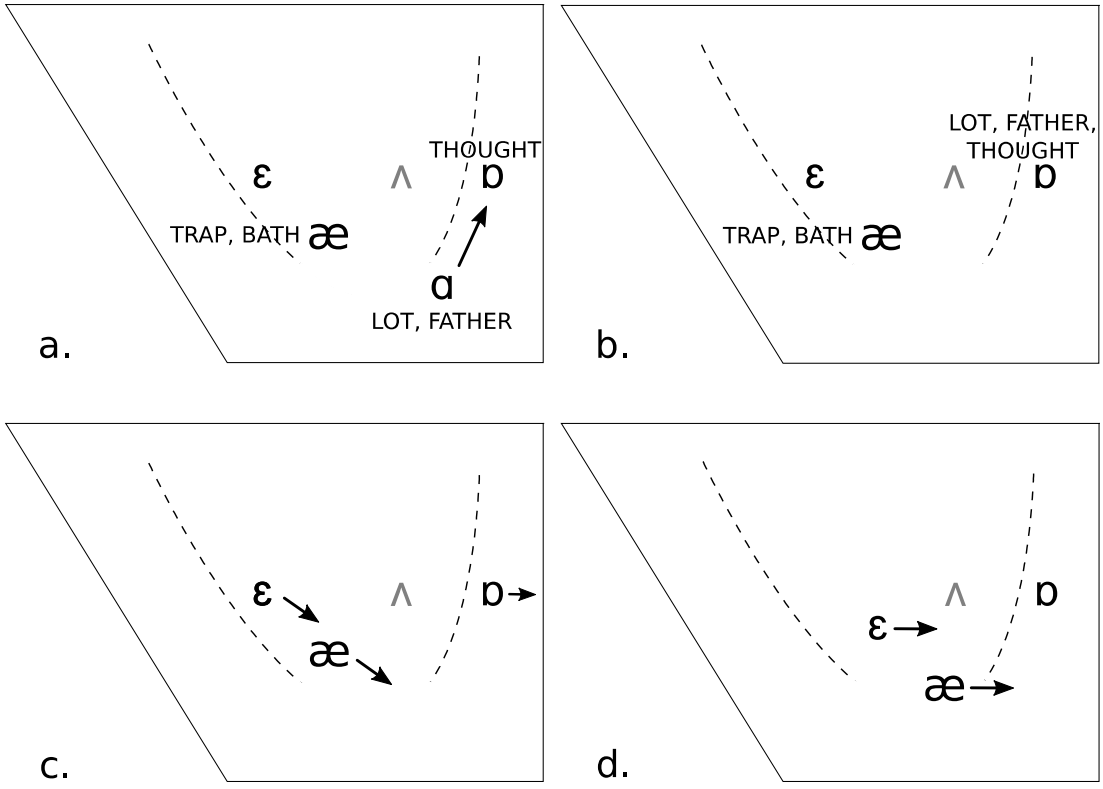

Figure 7-5: The Canadian Shift, as modeled by Roeder and Jarmasz (2010: 398)

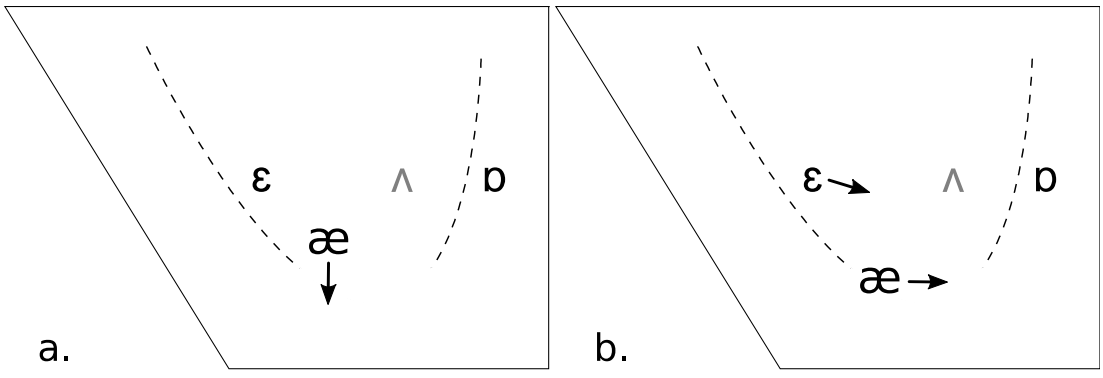

Figure 7-6: The Canadian Shift, as modeled by Boberg (2005: 149)

Boberg (2005) has suggested, on the other hand, that the CS is better described as a series of parallel retractions along the F2 dimension, with /æ/ and /ɛ/ both retracting after the lowering of /æ/ (Figure 7-6). According

to Martinet's (1955) theory of diachronic phonetic change, upon which Labov's principles are based, vowels' changing "margins of security" trigger the seemingly unified nature of chain shifts. If the vowels are retracting but not lowering, "the mental process underlying this development would

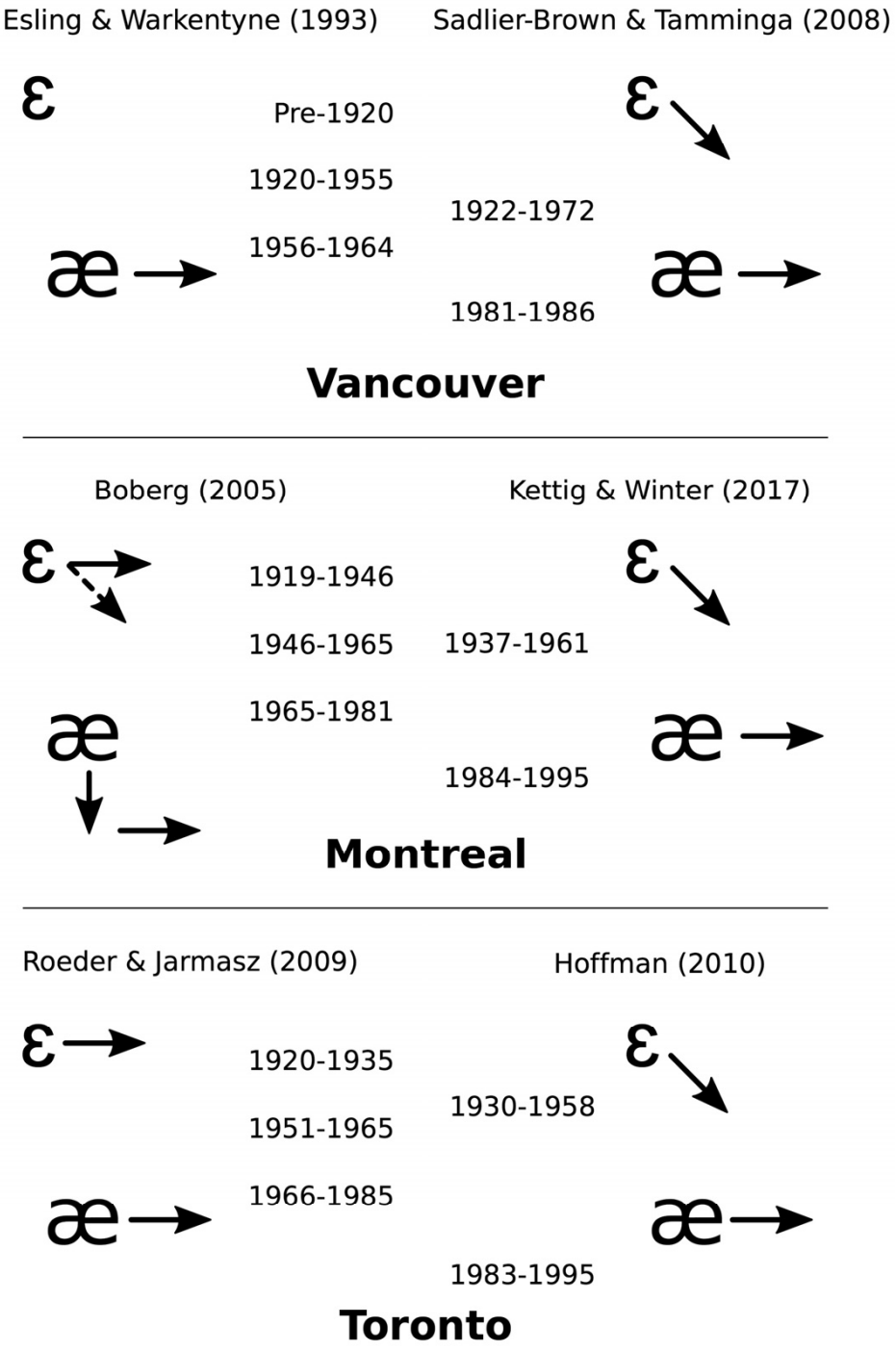

Figure 7-7: Apparent-time studies of the Canadian Shift, with generation groups' birth dates

not then be the maintenance of adequate margins of security between neighboring phonemes… but rather a kind of analogy that produces identical alterations in the production of phonologically similar vowels" (Boberg 2005, 136). If so, the lax vowels could be interpreted not as undergoing Labov's Principle II and lowering along a non-peripheral path as part of a chain shift, but instead backing, as Principle III asserts is possible along non-peripheral paths. Figure 7-7 compares six apparent-time studies (two carried out in each of Canada's three largest cities) across successive generations of speakers, showing that the CS does not fully conform to either of these models.

The earliest study to find evidence of the CS in fact predated Clarke, Elms, and Youssef's (1995) identification of a chain shift, and only in retrospect can lend clues about its early operation: Esling and Warkentyne (1993), comparing three generations of Vancouver speakers, noted that /æ/ was backing toward [a] in the youngest group, born between 1956 and 1964. Their older two groups, born before 1920 and between 1920 and 1955, patterned together in having fronter /æ/. Unfortunately, /ɛ/ was not investigated, so it is unknown whether any change in this vowel was apparent. Fifteen years later, and with participants representing significantly different generations, Sadlier-Brown and Tamminga (2010) found that /æ/ was still backing in Vancouver, with /ɛ/ both lowering and retracting. Their oldest group, born 1922–1972, is essentially equivalent to the youngest two groups of the previous study, while their youngest group, born 1981–1986, represents a new generation of speakers.

In Montreal, Boberg's (2005) apparent-time study found /æ/ to first be lowering before retracting, with /ɛ/ retracting with a trend toward lowering. Between his groups born 1919–1946 and 1946–1965, he found /æ/ to only be lowering without any retraction; /ɛ/ was not significantly different between these generations. However, in comparing these groups with his youngest participants, born 1965–1981, he found both /ɛ/ and /æ/ to be retracting, with no significant differences in height except for nearly-significant lowering of /ɛ/. Kettig and Winter's (2017) investigation of the English spoken by Jewish Montrealers found that between their 1937–1961 group—comparable to Boberg's (2005) middle group—and their participants born 1984–1995—younger than any of Boberg's (2005) participants—/æ/ was retracting but not lowering in apparent time, while /ɛ/ was retracting and lowering.

Finally, in Toronto, Roeder and Jarmasz (2009) found their two youngest groups of subjects, born 1951–1965 and 1966–1985, to be retracting /ɛ/ and /æ/ compared with their oldest group, born 1920–1935. Hoffman (2010) investigated different generations, with her older subjects

born 1930–1958 and the youngest informants born 1983–1995. She found young women to be leading the retraction of /æ/ in Toronto, while younger Torontonians as a whole were both retracting and lowering /ɛ/.

Year	Toronto (Metro)	Montreal (Metro)	Vancouver (Metro)
1941	900,000	1,192,235	393,898
1951	1,262,000	1,539,308 (558,256 English)	562,462
1961	1,919,000	2,110,679	790,741
1971	2,628,045	2,743,208	1,028,334
1981	2,998,947	2,862,286	1,196,831
1991	3,893,933	3,127,242	1,602,590
2001	4,682,897	3,426,350	1,986,965
2011	5,583,064	3,824,221 (599,225 English)	2,313,328

Table 7-3: Census data, populations of Canada's three largest cities (Statistics Canada 2011)

Examining apparent time studies in this way paints a more complete picture of how the CS is operating in different speakers and generations across Canada. Though Roeder (2012) argues that a "gravity" model of diffusion cannot account for the similarities between the vowel configurations of Toronto and Thunder Bay, Ontario (pop. 108,000), Trudgill's (1974) "cascade" model of language change is in fact useful for making sense of the differences observable in apparent-time studies across Canada's main urban centers. In shifts that encompass a large-scale speech community such as a nation, the cascade model predicts innovations to spread from a center to surrounding areas, jumping to other members of the central place hierarchy at a greater distance. In raw numbers, Montreal would seem to have been at the apex of Canada's place hierarchy until being overtaken by Toronto in the 1970s. However, taking just Anglophone populations into account, Toronto has clearly been Canada's main majority-English city throughout most of the 20th century; Vancouver, since World War II, has

come in second as Montreal's English-speaking population has remained around 600,000 for more than half a century (Table 7-3).

Considering the comparison of apparent-time studies with this cascade model in mind, a new characterization becomes necessary to account for the data regarding the diffusion of the CS (Figure 7-8). While /æ/ demonstrates no downward movement in the Toronto or Vancouver studies, Boberg (2005) captured its lowering between his two older Montreal generations. This raises the possibility that following the low-back merger (Figure 7-8a), the lowering of /æ/ was in fact the first step in the chain shift (Figure 7-8b), predating the earliest studies in the two leading English Canadian cities and only apparent in Montreal, further down the hierarchy. Sadlier-Brown and Tamminga (2008) also investigated the low vowels in Halifax, Nova Scotia (population 390,000) and found both downward and backward movement of /æ/, lending support for the hypothesis that smaller conurbations lag behind the vanguard cities in taking up this first stage of the CS. The Vancouver and Toronto studies therefore failed to capture the change in apparent time, for in those localities high on the place hierarchy it had already taken place.

In contrast, none of the earlier of the pairs of studies notes any initial downward movement of /ɛ/. The retraction of /æ/ and /ɛ/ (Figure 7-8c), with the movement of /æ/ possibly preceding that of /ɛ/ or with the two happening in tandem, was therefore the next step. Only after this began to occur did /ɛ/ start to lower (Figure 7-8d). Though the order in which these stages were *initiated* is argued to have proceeded in this way, these steps have overlapped, creating the diagonal movement found in apparent-time studies over the course of the shift. As /æ/ expanded its margins of security downward, it seems that the "pull" of /ɛ/ downward was not immediate; /ɛ/ instead first started retracting, gaining further distance from the front periphery before lowering. Scharinger and Idsardi (2014) have noted that this is a crowded space in North American English, and tokens of the short vowel phonemes routinely overlap in the height dimension; /ɛ/ may have be delayed in its lowering in order to maintain proper margins of security, while simultaneously participating in the shift analogically by retracting along with /æ/. Since Labov's Principle II allows for downward movement of lax vowels in the non-peripheral track and Principle III allows backing of non-peripheral vowels, the path of /ɛ/—clearly non-peripheral in contrast to peripheral/tense /ei/—is not especially problematic. In the future, however, its relationship with /ʌ/ should be monitored for evidence of merger, movement, or disambiguation based on other cues such as duration.

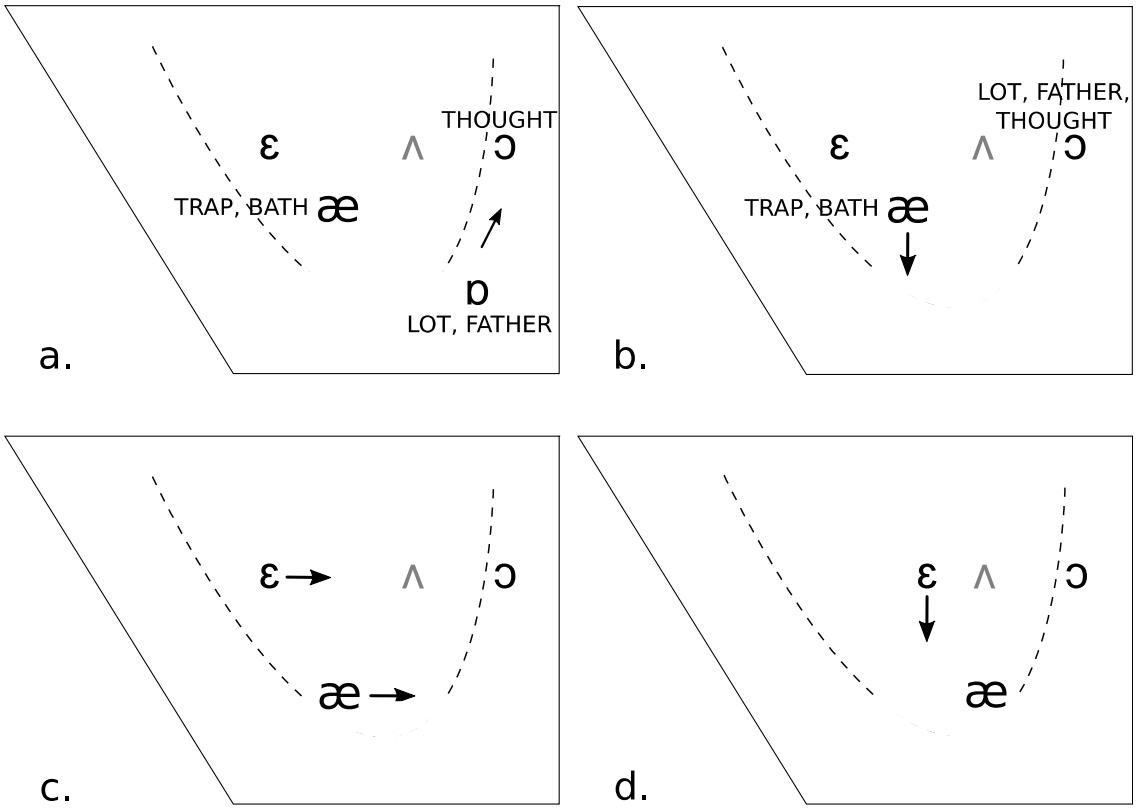

Figure 7-8: Progression of the CS

It is most notable that /æ/ initially lowered when triggered into a pull shift by the space left by LOT/FATHER/THOUGHT. This suggests that /æ/, the lowest of the lax vowels, first 'bottomed out' in the acoustic space before beginning to retract. Phonetically, it is therefore the lowest vowel in the Canadian English vowel space—so why does it still count as a non-peripheral vowel for the purposes of retracting according to Principle III? The following section explores how one possible solution to this may be found in a redefinition of peripherality, at least for the low space, in phonological rather than phonetic terms.

6. Defining Peripherality: On Phonological or Phonetic Grounds?

In introducing the historical examples he draws upon to establish his shifting principles, Labov (2010, 121) says that "[a]lmost all of these changes are phonological, and the governing principles to be discussed here are phonological in character". Though this might suggest that he intends peripherality to be defined on phonological grounds in order to function within a strictly phonological framework, he in fact uses phonetic

criteria in specifying that "peripherality is defined in terms of extreme values of F2… [and] extreme values of F1," (146), while "[t]he differentiation of tense and lax vowels in low position is not dependent on F1 values or degrees of opening, but appears to involve other features, primarily duration" (149).

Langstrof (2009, 438) argues in his analysis of the New Zealand English (NZE) short front vowel chain shift that "what counts in predicting the pathways of vowels in chain shifts are the phonetic properties of vowels rather than their phonological status". In the case of NZE, DRESS and TRAP are phonetically, but not phonologically, peripheral/tense in contrast with the shorter, non-peripheral KIT. DRESS and TRAP have behaved like peripheral vowels, historically rising according to Principle I, while KIT has undergone lowering and centralization as expected of a non-peripheral vowel. Labov (2010, 153) endorses this view: "From Langstrof's study of the raising of /e/ in the New Zealand chain shift (2006), we now know that this short vowel showed an increase in duration, indicating a shift to the tense class as it moved up along the peripheral track," confirmation that "there have never been counterexamples advanced to show tense vowels lowering in chain shifts".

In the case discussed in Section 4, it is demonstrated that /æ/, the lowest of the lax vowels, first "bottomed out" in the acoustic space before beginning to retract. Under a phonetic definition of peripherality, a lack of neighboring fronter or lower vowels would establish /æ/ as relatively peripheral. There does not (yet) seem to be evidence to suggest that it has undergone significant lengthening, which through history has often accompanied this shift, and /æ/ has not reversed course and risen along the front periphery (cf. the NCS). This would therefore represent a clash between the predictions of the Lower Exit Principle (in which /æ/ should lengthen) and Principle III (in which backing should only happen if /æ/ counts as a non-peripheral vowel).

If peripherality is defined phonologically, on the other hand, Labov's unidirectional principles hold more explanatory power for the CS evidence. Roeder and Gardner (2013) offer a phonological analysis of Canadian English vowels that specifies phonemes for features that are contrastive and treats only these contrastive features as active within the phonology. As such, TRAP/BATH is specified as [–Peripheral, –High, +Low] and the merged LOT/FATHER/THOUGHT as [+Peripheral, –High, +Low]; therefore, even if phonetically /æ/ is in a peripheral position within the vowel space, it is unable to function phonologically as a peripheral vowel because this is the only dimension along which it contrasts with /ɒ/. This is reflected in the classes' differing distributions: /ɒ/ is often found

word-finally (*law, paw*) while /æ/ is not (with the possible exception of the high-frequency word *yeah*). Defining /æ/ as non-peripheral on these phonological grounds allows its continued treatment as a lax vowel, bringing the CS into conformity with Principle III: tense vowels move to the front along peripheral paths, and lax vowels move to the back along non-peripheral paths.

So what accounts for the evidence from NZE requiring an analysis based on phonetic peripherality, but the present analysis of the CS suggesting better explanatory power using a phonological definition? Labov's (2010, 149) observation that "peripherality does not distinguish low vowels" may resolve this dilemma: since the "gap" in the lower division between the peripheral and non-peripheral paths (as depicted in Figures 7-1 to 7-8) indicates that low vowels are not distinguished by F1/F2, perhaps in place of phonetic cues such as relative lengthening, phonological distribution is relied upon to differentiate the peripheral/non-peripheral tracks at the lowest point in the vowel space. The NZE short front vowel shift explored by Langstrof (2006, 2009) took place much higher in the vowel space, accounting for its more typical phonetic cues to peripherality.

Labov (2010, 149) stipulates that "tensing of low vowels is most likely realized as an increase in duration". The present analysis crucially lacks data on the duration of the vowels involved in the CS; such evidence is not typically reported in descriptions of the shift. Future work on the CS—as well as the NCS and other vowel shifts affecting the low space—must more closely investigate the relative duration of the vowels involved. If /æ/ is still demonstrably short, the fact that it has continued to retract rather than follow its pre-nasal allophones and move to the front periphery (as in the NCS) is consistent with Principle III under a phonetic definition of peripherality, making a low space 'work-around' based on phonological features unnecessary. Such an assertion of 'shortness', though, would have to take into account the relative durations of /æ/, /ɛ/, /ʌ/, /ɒ/, and all of their respective allophones in order to ascertain which sub-systems they each belong to. Langstrof (2009) fruitfully brings vowel duration along with F1/F2 measurements to bear in characterizing the evolution of NZE; such an approach may prove especially relevant for defining the phonetic correlates of peripherality in the low vowel space.

7. Conclusion

This paper has investigated how Labov's principles of shifting can account for reconstructed and attested diachronic changes affecting the low vowel space all the way from PIE to ModE. The cycling of the vowels in MOTHER, GOAT, DEED, and NAME through the low space indicates patterns of change that have also produced synchronic variation in ModE vowel systems. In analyzing (pre-)historical changes for which linguists do not have access to direct phonetic evidence, the principles and their rules of operation provide a framework of unidirectional movements that can be used to illuminate commonly recurring patterns; changes from PIE to PGmc and thence OE and ME can easily be accommodated within this framework. In ModE, lengthening/peripheralization of certain /æ/ words in some dialects spurred phonemic BATH-TRAP splits, sub-phonemic allophonic variation, and in the case of the NCS, a chain shift that prompted Labov (1994) to add a third principle governing front-back movements in addition to the two primary principles of rising and falling.

The fact that Labov's principles seem to account well for movements around the low vowel space at many different stages in the history of English makes it all the more necessary to test his assertions on a variety of contemporary chain shifts. In closely evaluating the trajectory of the CS across Canada's three largest cities, it is shown that defining /æ/ as phonologically non-peripheral despite its location at the lower periphery of the articulatory space is necessary to make observed apparent-time movements compatible with Principle III. Though the behavior of /æ/ in the CS seems to be incompatible with a phonetic definition of peripherality, it is suggested that the gap between peripheral and non-peripheral tracks in the low vowel space does not necessarily create a "free-for-all"; shifting principles continue to govern front-back movements, but may rely on phonological specifications of vowel peripheralization in the absence of robust phonetic cues involving duration. However, the obvious caveat is that actual duration measurements have been absent from otherwise detailed reports of Canadian English. Given the role that lengthening has played in the many previous low vowel movements traceable over the past several millennia of our language, duration should be taken into account in order to construct a more detailed picture of the operation of Labov's shifting and exit principles.

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