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Phonetics and phonology of schwa insertion in Central Yiddish

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Central Yiddish (CY) has inserted schwas that occur between long vowels or diphthongs and certain coda consonants. In the most restrictive varieties, schwas are inserted only between long high vowels or diphthongs and uvular or rhotic codas (as in /biːχ/ → [biːəχ] 'book'), and between long high vowels or diphthongs and coronal codas, as long as the vowel is [+back] (as in /ʃuːd/ → [ʃuːəd] 'shame'). These patterns of insertion are both typologically unusual and synchronically hard to explain. In this paper, I argue that they can be traced back to the phonetic transitions between specific vowels and coda consonants: vowel-coda sequences that produce formant transitions through the mid-central acoustic vowel space are those that are most likely to exhibit schwa insertion. An analysis of 19th-century CY verse demonstrates that these inserted schwas were intended to count for purposes of poetic rhyme, suggesting that they are phonological schwas rather than exclusively phonetic transitions. This study thus adds to the phonological description and analysis of Central Yiddish, and provides novel predictions regarding the spreading of vowel epenthesis across different phonological environments.

Keywords: schwa; vowel intrusion; epenthesis; gestural timing; Yiddish; rhyme

1 Introduction

In all varieties of Yiddish, some schwas are non-alternating, whereas others participate in different types of alternation. First, there are words like [ˈχasənə] 'wedding,' whose schwas never alternate with another sound or with zero, as in (1):

(1)   [ˈχasənə] 'wedding' vs. [ˈχasənəs] 'weddings'

In a word like [ˈχasənə] 'wedding,' the schwas are obligatory; the word cannot be pronounced as *[ˈχasnə] or *[ˈχasən], even though such forms would be phonotactically licit.
    Second, Yiddish has schwas that alternate with full vowels, as in (2). In the word [ˈχidəʃ] 'surprise, novelty,' the schwa cannot be produced as a full vowel *[ˈχiduʃ]; in the word [χiˈduʃim] 'surprises, novelties,' the full vowel cannot reduce to schwa *[χidəʃim].

(2)   [ˈχidəʃ] 'surprise, novelty' vs. [χiˈduʃim] 'surprises, novelties'

Third, Yiddish also has schwas that alternate with zero in at least some forms, as in (3). In this example, 'storm' cannot be realized as [*ʃturm], and 'stormy' is not realized as *[ˈʃturəmiʃ], and thus a schwa-zero alternation occurs (Albright 2010).[1]

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[1] Though not discussed by Albright (2010), Isaac Bleaman has called my attention to the fact that orthographic [ˈʃturəmiʃ] is also attested, implying that some speakers have no schwa-zero alternation for this word. I will return to this point in Section 4.2.

(3)   [ˈʃturəm] 'storm' vs. [ˈʃturmiʃ] 'stormy' (but cf. [ˈʃturəmən, *ˈʃturmən] 'to storm')

The focus in this paper is on schwa-zero alternations that are productive in Central Yiddish (CY), the dialect traditionally spoken predominantly in Poland. Like all varieties of Yiddish, CY has schwas as in the examples in (1–3). Moreover, CY has schwas that are considered to be inserted optionally (Jacobs 1993; Jacobs et al. 1994; Jacobs 2005: Section 4.1.11). Unless otherwise stated, the description below of CY schwa insertion comes from Jacobs.

   At first glance, these inserted vowels have an eclectic distribution: they can occur between long high vowels and a uvular or rhotic coda consonant, as in (4). (Henceforth in this paper, CY inserted vowels will be underlined. The use of "*" is meant here to indicate that a particular form does not occur in the most restricted variety of CY described by Jacobs.[2])

(4)   [ˈbiːə̲χ] 'book' vs. [ˈbiːχər, *ˈbiːə̲χər] 'books' (Jacobs 2005: p. 104)

Additionally, the inserted schwas can occur between long high-back vowels or diphthongs [uː, ou] and a word-final coronal consonant in a simple coda, as in (5).

(5)   [buːd, ˈbuːə̲d] 'bathe-1/3.PRES.SG.' vs. [buːdst, *ˈbuːə̲dst] 'bathe-2.PRES.SG.'
         (Jacobs 2005: p. 106)

In this paper I argue that these inserted schwas can be traced back to formant transitions (between certain vowels and coda consonants) that look particularly 'schwa-like'; that is, when the first two formants transition through the mid-central acoustic vowel space from the vowel to the consonant. I show that, for some CY speakers, the inserted schwas are variable in their occurrence in ways that suggest they might still be phonetic transitions, rather than phonological entities. In the terminology by Hall (2003; 2006), they at first glance appear to be 'intrusive' or excrescent vowels that have no gestural representation of their own, but which occur as a result of the variable phasing of neighboring articulatory gestures. While vowel intrusion is typically thought to occur between consonantal gestures, I argue that the CY schwas were at an earlier point in the language (and may still be, in some varieties of CY) intrusive vowels that occur between a vowel and a coda consonant. The main claim that I wish to put forth in this paper is that, in CY, sequences which allow for schwa insertion are those that have phonetic transitions that pass through the mid-central vowel space; that is, those that fall within the acoustic domain of schwa.

   First, I provide some background information on Central Yiddish phonology. I then describe previous accounts of CY inserted schwas. In Section 3, I claim that the distribution of inserted schwas in CY can be explained in terms of acoustic theory and gestural phasing. In Section 4, I analyze innovative patterns of schwa insertion as cases of reanalysis of the phonetic transitions as phonological schwas, followed by spreading of the environments in which schwas may occur. Then in Section 5, I show that 19th-century CY poetry made use of these schwas for poetic rhyme, providing further support that they are phonological entities in some varieties. I conclude with broader implications for cross-linguistic patterns of vowel insertion and epenthesis.

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[2] All subsequent transcriptions for words in Central Yiddish reflect a CY pronunciation, rather than a Standard Yiddish one. Final obstruent devoicing is not marked; though frequently found in CY (Jacobs 2005: 115), its application varies by word type and environment, and is not relevant for the purposes of this study.

2 Background

Central Yiddish is the variety of Eastern Yiddish that was traditionally spoken in Poland and the Transcarpathian region of eastern Slovakia, eastern Hungary, and northwestern Romania (Weinreich 1992; Jacobs et al. 1994; Jacobs 2005). It differs from other dialects of Eastern Yiddish in part by the presence in CY of long monophthongs [iː, uː, aː], as well as the diphthong [ou ~ oː]. (Whether that vowel, which has neutralized to [oj] in other Eastern Yiddish dialects, is pronounced as [ou] vs. [oː] appears to be due to regional variation, as discussed below.) The vowel inventory of Central Yiddish is shown in Figure 1.

Short vs. long vowels contrast for the peripheral vowels: compare [zin] 'sun, sense' vs. [ziːn] 'son(s)', [ʃluf] 'sleep' vs. [ʃtruːf] 'punish', and [laχt] 'laughs' vs. [laːχt] 'light.' Long [uː] is rather rare before labials and velars due to historical shortening of the vowel in CY (Birnbaum 1923; 2016; Jacobs 2005: 107). The short high vowels have been transcribed as [ɪ] and [ʊ] (Birnbaum 2016), and are often slightly lower and centralized relative to their long counterparts (see Nove 2019 for acoustic data on Hasidic Yiddish, which is derived from CY spoken largely outside of Poland, in Transcarpathia). And in varieties of CY with long [oː] instead of [ou], short [o] and long [oː] also contrast in length, as in [broχ] 'disaster' vs. [broːχ] 'need.'

2.1 Schwas in Central Yiddish

The inserted schwas of Central Yiddish generally involve perceived 'breaking' of a monosyllabic word in a disyllabic one. There are two prior accounts of these schwas: the earlier account by Jacobs (1993; 2005: Section 4.1.11) is framed within rule-based phonology; more recently, Enguehard & Faust (2020) have provided an account within Government Phonology and Element Theory. In this section, I will first review the rules posited by Jacobs; then I discuss Enguehard & Faust (2020)'s analysis, and outline their limitations.

Jacobs (1993; 2005: Section 4.1.11) analyzes CY schwas using two rules. He calls the first one BREAKING: a schwa is inserted between a long high vowel and a coda rhotic (which varies between [r] ~ [ʁ] by speaker and region) or uvular [χ].

(6)   **CY Breaking:** a schwa is inserted between a long high vowel ([iː], as well as high offgliding diphthongs [ej, aj, oj, ou]) and a uvular or rhotic coda.

$$\emptyset \rightarrow [ə] \; / \; \begin{bmatrix} +\text{high} \\ +\text{long} \end{bmatrix} - [\; \text{r/ʁ}, \chi \;] \sigma$$

Thus, there is schwa insertion before coda [χ] in /biːχ/ → [ˈbiːəχ] 'book,' but not before onset [χ] in disyllabic /ˈbiːχər/ → [ˈbiːχər] 'books,' *[ˈbiːəχər].
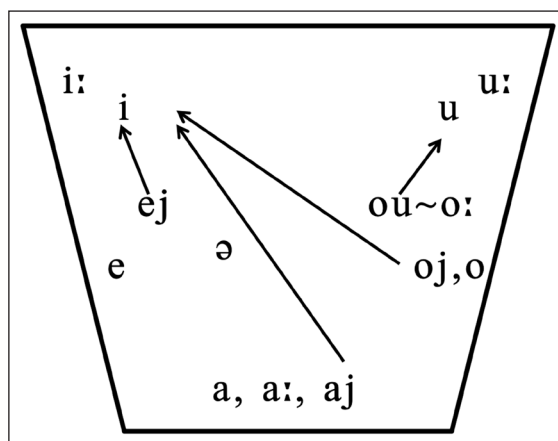

Figure 1: Central Yiddish vowel inventory.

Note that, according to Weinreich (1992: Section 1.233), inserted schwas are sensitive to word boundaries rather than syllable boundaries. The other source of inserted schwas that is particular to the Central Yiddish dialect is what Jacobs (1993; 2005: Section 4.1.11) calls Drawl: a schwa is inserted between a long high-back vowel ([uː] or diphthong [ou]) and a coronal coda, as in (7).

(7)   **CY Drawl:** a schwa is inserted between a long high-back vowel and a coronal coda.

$$\emptyset \rightarrow [\text{ə}] \ / \ \begin{bmatrix} +\text{high} \\ +\text{back} \\ +\text{long} \end{bmatrix} \_ [\ +\text{coronal}\ ]\sigma$$

Thus, /buːd/ → [ˈbuːə̯d] 'bathe-1/3.PRES.SG.', but /ˈbuːdn/ → [ˈbuːdn̩] 'to bathe', *[ˈbuːə̯dn̩].

Jacobs (1993; 2005) treats these alternations as a result of two distinct processes (Breaking and Drawl) because they act on different phonological environments. Moreover, Breaking is considered obligatory, whereas Drawl is optional but especially common in phrase-final position or slower speech rates. Another difference between the two environments of schwa insertion is that the schwa tends to be lower in quality (often [ɛ]) before rhotics and uvulars (i.e., for Breaking), whereas the inserted schwa before coronals (i.e., for Drawl) has the same quality as other schwas in the language. The rhotics in CY also appear to delete in coda position, but only after schwa lowering or 'coloring' has occurred: /fuːr/ → [ˈfuːɛ̯r] → [ˈfuːɛ̯] 'drive-1.PRES.SG. This apparent deletion of coda rhotics will be discussed more below in terms of *r*-vocalization, where the /r/ is realized as a vowel. For simplicity, I transcribe rhotics with consonantal [r] unless vocalization is relevant to the discussion.

   Another notable difference between the two types of CY schwa-zero alternations is that schwa insertion before rhotics/uvulars can occur when the coda is complex (8a), whereas before complex coronal codas, it cannot, as in (8b).

(8)   a.   CY schwa insertion before rhotics or uvulars may apply with complex word-final codas.
              fuːr/ → [ˈfuːə̯r] 'drive-1.PRES.SG.', and /fuːr-st/ → [ˈfuːə̯rst] 'drive-2.PRES.SG.'
        b.   CY schwa insertion fails to apply with complex word-final codas beginning with coronal consonants.
              /buːd/ → [ˈbuːə̯d] 'bathe-1/3.PRES.SG.', but /buːd-st/ → [buːdst] 'bathe-2. PRES.SG., *[ˈbuːə̯dst]

Unless specified otherwise, the data are from Jacobs, who analyzed the variety of CY from Sosnovce (also Sosneftse; in Polish, Sosnowiec). As we will see below, schwa insertion occurs in the most restrictive environments in this variety of CY; more innovative varieties will be reviewed in Section 4. One difference between Jacobs' transcription and the one used here is that the quality of the inserted vowel can differ from schwa in Sosnovce and other varieties; this will be discussed in more detail in Section 3.2. Jacobs transcribes the inserted vowel using symbols that closely reflect its quality, whereas here I use just schwa except in Section 3.2, where the inserted vowel's quality is relevant for the discussion.

   Although the rules described by Jacobs make the case for recognizing two distinct processes of schwa insertion, I claim here that they belong to just one phenomenon: insertion of a schwa-like vowel between particular vowels and coda consonants, whose transitions

Table 1: Summary of vowel-coda monosyllables that exhibit schwa insertion in Central Yiddish as it was spoken in Sosnovce. Schwa insertion before rhotics or uvulars is known as BREAKING; before coronal codas, it is called DRAWL (Jacobs 1993; 2005: Section 4.1.11). Note that, due to a historical change in which long [u:] shortened before velars (as well as labials; Jacobs 2005: 107), the sequence [u:g] is unattested in CY.

	_labial	_coronal	_velar	_uvular	_rhotic
[i:, ej, aj, oj]_	✗	✗	✗	✓	✓
[u:, ou]_	✗	✓	–	✓	✓
[a:]_	✗	✗	✗	✗	✗
[i, e, a, o, u]_	✗	✗	✗	✗	✗

are phonetically 'schwa-like,' passing through the mid-central region of the acoustic vowel space. In Section 3, I will further argue that the apparent differences between BREAKING vs. DRAWL fall out of the characteristics of the environments themselves. Moreover, for another variety of CY there is evidence that schwa insertion is optional in both BREAKING environments (before rhotics and uvulars) as well as in DRAWL ones (before coronals). Thus assuming that schwa insertion is a single process, a summary of monosyllables and the occurrence of schwa insertion is provided in Table 1.

Variable schwa insertion between coda consonants is also attested in Central Yiddish and other dialects of the language: Jacobs (2005: 121) mentions that CY has 'limited epenthesis' in such words as /ʃtark/ → [ˈʃtarə̯k] 'strong' and /milχ/ → [ˈmilə̯χ] 'milk' (see also the brief discussion in Weinreich 1992: Section 1.233). It mainly occurs in complex codas where the first consonant is a liquid or nasal (Schaechter 1986: 176–177). These cases of schwa insertion can probably be explained via the same articulatory mechanisms of vowel intrusion that Hall (2003; 2006) cites for other languages: they are variable and occur between consonants (especially sonorants) with differing places of articulation. Because these seem to typically fit the behavior of intrusive vowels across languages, and because much less is known about the variability in schwa insertion in complex codas compared to the vowel-coda sequences described above, these will not be discussed further in the paper.

2.2 Previous explanations of Central Yiddish inserted schwas

Until recently, the only phonological account of Central Yiddish schwa-zero alternations has come from Jacobs (1993; 2005), who appealed to rules like the kind described in (6) and (7) to account for where schwa insertion occurs; note that, in a rule-based framework, two separate rules are needed to account for the distributional differences between schwa-zero alternations before rhotics and uvulars on the one hand, and before coronals on the other hand. As for an explanatory account of these rules, Jacobs appeals to analogy and a phonological conspiracy against trimoraic syllables.

2.2.1 No trimoraic syllables, and historical analogy

To account for schwa-zero alternations that are present only in Central Yiddish (BREAKING and DRAWL), Jacobs (1993; 2005: Section 4.1.11) claims that CY disprefers trimoraic syllables, i.e. syllables containing a long vowel in a closed syllable. If schwa insertion involves 'breaking' of a single syllable into two syllables, then trimoraic syllables are avoided.

There are several issues with accounting for CY inserted schwas on the basis of a dispreference for trimoraic syllables. The first issue is that trimoraic syllables do occur in CY,

in environments in which Breaking and Drawl do not apply: for example, if /biːχ/ is realized as [ˈbiːə̱χ] 'book' to avoid a trimoraic syllable, it remains unclear why trimoraic syllables are allowed in syllables with long [aː], as in [raːχ, *ˈraːə̱χ] 'rich.' Another issue is that schwas occur with a simple word-final coronal coda, but not with a heavier complex one: trimoraic words can have schwa insertion, as in /buːd/ → [buːd, ˈbuːə̱d] 'bathe,' but the lack of schwa insertion is tolerated with an even heavier complex coda, as in /buːd-st/ → [buːdst, *ˈbuːə̱dst] 'bathe-2.pres.sg. Yet another issue is that a rule-based approach needs to specify the site of schwa insertion: why does schwa get inserted *before* the coda, as in /biːχ/ 'book' → [ˈbiːə̱χ], rather than somewhere else, as in *[ˈbiːχə]? Jacobs relies on analogy with other schwa-zero alternations in the Yiddish lexicon to account for the site of schwa insertion. We shall see that, in the current proposal put forth in Section 3, the site of schwa insertion falls out from the explanation of the phenomenon.

2.2.2 Schwa epenthesis in Government Phonology

In a recent analysis of CY inserted schwas, Enguehard & Faust (2020) explain schwa insertion in a variety of CY from Plotsk, Poland, within the framework of Government Phonology (Kaye et al. 1985; 1990). They use a particular version of the framework with Strict CV (Lowenstamm 1996; Scheer 2004), in which words are composed of phonological skeletons consisting of repeating CV units.

According to Enguehard & Faust (2020), schwa insertion occurs in words like [ˈʃuːəd] 'shame' when they are in phrase-final position because a pause entails the addition of another CV unit. (Recall that, according to Jacobs (1993; 2005: Section 4.1.11), schwa insertion before coronals is more likely to occur in phrase-final position.) Due to restrictions on licensing and government, when a pausal CV slot is added to a word like [ʃuːd] 'shame,' one of the V slots gets filled by default schwa, rather than by spreading of the preceding vowel.

To account for why the occurrence of schwa insertion depends on the quality of both the preceding vowel and following consonant, the authors appeal to Element Theory (Kaye et al. 1985; Backley 2011), which proposes that both consonants and vowels may bear distinct elements depending on patterns of acoustic resonance. Enguehard & Faust (2020) hypothesize that patterns of CY schwa insertion depend on which elements take precedence. In cases where schwa insertion occurs (as in [ˈvuːəs] 'what'), the (coda) consonant's element takes precedence over the preceding vowel's. But in cases where schwa insertion cannot occur (as in [ziːs, *ˈziːəs] 'sweet'), the vowel's element must take precedence over the consonant's.

Thus, under the Government-Phonology account proposed by Enguehard & Faust (2020), the occurrence or absence of schwa insertion depends on several phonological properties: the insertion of a pausal CV unit, licensing and government of V slots, the elements associated with particular vowels and consonants, and a proposed hierarchy of elements. This analysis can account for where schwa does or does not occur, but its main drawback is that the presence or absence of schwa insertion in a particular V-C sequence is synchronically arbitrary. A proposed phonetic explanation for the occurrence or absence of schwa insertion is consequently put forth in the following section, which could motivate Enguehard & Faust (2020)'s hierarchy of elements.

3 The role of phonetic transitions

I propose that the inserted schwas that occur in Central Yiddish developed historically from acoustic transitions between articulatory gestures. It is well known that, in vowel-consonant (as well as consonant-vowel) sequences, the vowel's formants transition towards certain target formant values, or 'loci,' for the upcoming consonant (Delattre et al. 1955;

Delattre 1969; Stevens 2000). These loci vary to some extent as a function of the vowel and manner of articulation of the upcoming sound; for example, fricatives tend to have stronger transitions from a preceding vowel than into a following vowel quality (Stevens 2000: Chapter 8); formant transitions into and out of uvular fricatives tend to be more symmetrical, but vary as a function of vowel (Delattre 1969; Alwan 1986; Gordon et al. 2002). Despite these sources of variation, formant transitions, especially those of F1 and F2, tend to be rather stable for different places of articulation. All lingual consonants except uvulars involve a low-frequency target F1 below 300 Hz, but the target F1 for uvulars is higher, around 400–500 Hz (Delattre et al. 1955; Stevens 2000; Alwan 1986). The target F2 for labials is quite low, generally causing a drop in F2 from a preceding vowel regardless of that vowel's quality (Delattre et al. 1955). For adjacent coronals, the F2 target is around 1800 Hz; this leads to a rise in F2 between a back vowel like [o, u] (whose F2 nears 1000 Hz) and a following coronal, but a fall in F2 between a high-front vowel like [i] (whose F2 exceeds 2000 Hz) and a following coronal. Between [i] and a velar, F2 typically rises towards a target nearing 3000 Hz (Delattre et al. 1955). The target F2 for uvulars varies by vowel; adjacent to [i, a] it is around 1200–1500 Hz, but can be much lower adjacent to [u], between 600–900 Hz (Delattre 1969; Alwan 1986; Gordon et al. 2002).

Based on these acoustic patterns, Figure 2 schematizes the expected formant transitions between high-front and high-back vowels and the consonant place of articulation in CY. It is notable that the environments that are reported to have inserted schwa in CY are those whose formant transitions look 'schwa-like': they pass through the mid-central part of the acoustic vowel space. This space will vary by speaker, but for adults of various languages generally spans 400–650 Hz for F1 and 1200–1800 Hz for F2 (Becker-Kristal 2010). Assuming that, for an adult male, a schwa's target F1 is around 500 Hz and its target F2 around 1500 Hz (Stevens 2000), then the environments expected to have schwa-like formant transitions are the following: [u:] (and other high-back vowels) before coronals, and all high vowels before uvulars and rhotics. Before uvulars, high-front vowels show a drop in F2 through the central vowel range, and both high-front and high-back vowels show a rise in F1 through the mid vowel range. In other words, schwa insertion between high-front vowels and uvulars is motivated by changes in both F1 and F2; between high-back vowels and uvulars the insertion is motivated mostly by the rise
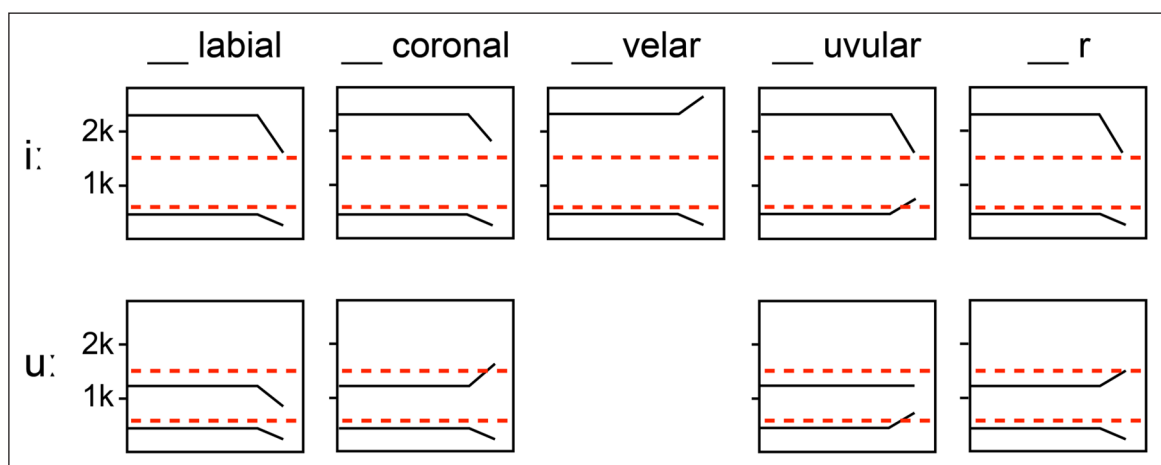

Figure 2: Modeled first and second formant transitions between long vowels [i:, u:] and codas of varying places of articulation. Expected first and second formant targets for schwa are represented by dashed lines. The rhotic [r] is separate because it often vocalizes to a schwa-like vowel in coda position. Note that, due to a historical change in which long [u:] shortened before velars (as well as labials; Jacobs 2005: 107), the sequence [u:g] is unattested in CY.

in F1 for the upcoming uvular. The tongue body lowering before a coronal rhotic (Barry 1997; Solé 2002) could also result in a rise in F1 through the mid-vowel range. But the formant transitions between a high-front vowel like [iː] and a non-rhotic coronal are not particularly schwa-like, since F2 falls from a value greater than 2000 Hz to one closer to 1800 Hz, which is at the higher end of the target F2 for schwa. Even if the F2 maximum for CY schwa is often higher than 1500 Hz (which is possible, as its quality is somewhat fronted), the F2 transition from [iː] to a coronal won't pass through the central part of the acoustic vowel space; it will only end around the schwa's maximum F2.

On the other hand, the transition between [iː] and a labial can be schwa-like, in that F2 is expected to drop substantially, potentially passing through the schwa's F2 range. However, labial consonants involve a lip constriction gesture that is independent of the tongue body gesture associated with the vowel. Consequently, lip constriction may begin relatively early during the vowel. (It is likely for this reason that CY exhibited widespread vowel shortening before labials; Jacobs 2005: 107.) If a vowel shortens before a labial, we don't expect the coordination between vowel and labial gestures to have a long transition.

But even if lip constriction begins late in the vowel, formant transitions are likely to be quick, given that the lips constitute a stiff articulator (Kuehn & Moll 1976; Roon et al. 2007). There is evidence of this occurring in the speech of a CY speaker from Radzyn.[3] A token of /tiːf/ 'deep' from in the left panel of Figure 3 shows that the F2 drop towards the labial happens fairly late and quickly, lasting for about 25% of the total vowel's duration. However, the F2 offset in this example is only about 1800 Hz. Thus, the F2 fall does not traverse through the mid-central acoustic vowel space; in contrast, a particularly fast F2 transition for a token of /giːχ/ 'fast' in the right panel of Figure 3 (also 25% of the vowel's duration) ends in a more central part of the acoustic vowel space, around 1600 Hz. This difference in F2 target between labials and uvulars can explain why schwa insertion is more common before the latter than the former.

Note that this account makes reference largely to the acoustic transitions, particularly their target frequencies, duration, and steepness. However, the account can also be reframed in articulatory terms: like intrusive vowels in general (Hall 2003; 2006), CY schwa insertion is likely between heterorganic gestures (that is, those involving distinct places of articulation, which produce the schwa-like transitions). Additionally, vowel intrusion between vowel-coda articulatory gestures has between described by Halle &
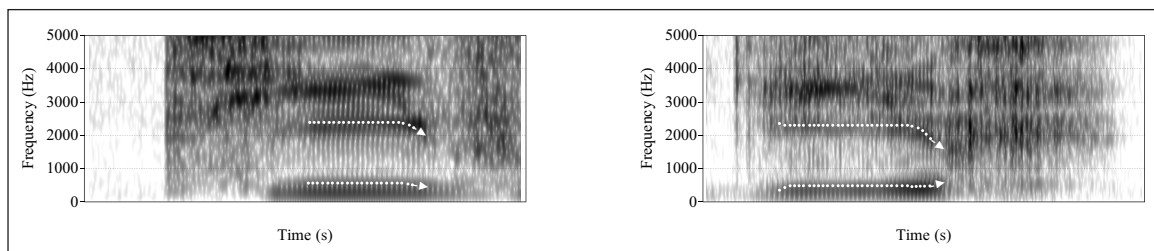

Figure 3: F1 and F2 during the vowel in a sample token of /tiːf/ 'deep' (left) compared to /giːχ/ 'fast' (right), both of which have formant transitions that last for approximately 25% of the vowels' durations. Note that, for /tiːf/ 'deep,' the F2 does not transition through the central part of the acoustic vowel space. The quick F2 transition for /giːχ/ 'fast' ends in a more central part of the acoustic vowel space.

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[3] Sample words shown in this section are derived from the audio recordings of Eleazar Butman (1910–1992), a native speaker of Central Yiddish who was born and raised in Radzyn (Radzyń Podlaski), Poland, and who settled in Canada in 1948. In the 1980s, Mr. Butman was recorded reading various short stories and books in Yiddish at the Montreal Jewish Public Library. The digitized recordings are stored online at the Yiddish Book Center, where they are freely downloadable.

Idsardi (1997); Krämer (2005); Gick & Wilson (2006) and Operstein (2010), the latter calling the phenomenon 'consonant prevocalization.' In acoustic terms though, it is more straightforward to account for the lack of schwa insertion between long high-front vowels and coronals: even though these gestures are heterorganic, the F2 transition that results between them does not pass through the central part of the acoustic vowel space.

In the remainder of this section, I outline how a phonetic explanation of CY inserted schwas also accounts for other patterns of their behavior; namely the consonants before which they are expected *not* to occur, why they are more likely to occur phrase-finally, and why coda complexity reduces the likelihood of their occurrence, especially before coronals.

3.1 Lack of schwa insertion after short vowels

The analysis presented in the previous section makes use of formant transitions to account for schwa intrusion. Assuming that short vowels have similar formants to their long counterparts, why don't they also undergo schwa intrusion? At first glance, this is especially surprising, because short vowels can have longer formant transitions (relative to the duration of the vowel) than long/tense ones (Pycha 2016). However, longer transitions affect vowel quality not just at the end of the vowel, but over the entire vowel duration; shorter vowels thus tend to have more centralized (i.e., schwa-like) targets (Lindblom 1963). This is perhaps why, across languages, vowel laxing tends to occur in closed syllables rather than in open ones (cf. Storme 2019). Relatedly, certain V-C sequences where schwa insertion occurs after CY long-high vowels are unattested or rare for short vowels. For instance, in CY and other varieties of Yiddish, short /i/ typically lowers to /e/ before uvulars and rhotics (Weinreich 1992: Section 1.2311), and short /u/ is extremely rare before coronals and unattested before uvulars or rhotics. And while short /o/ is widely attested before coronals and uvulars, its overall vowel quality, and not just its offset, is likely to be more centralized before a coda consonant. Schwa insertion therefore shouldn't occur with short vowels, because they centralize over their entire duration when in closed syllables. There is evidence for this in the CY spoken by the speaker from Radzyn, shown in Figure 4. The figure shows the F1 and F2 during the vowel in sample phrase-final tokens of /kol/ 'voice' (left) compared to /moːl/ 'mouth' (right). The short vowel of /kol/ 'voice' is more centralized, with a mean F1 of 538 Hz and a mean F2 of 1057 Hz. This token also has very steady formants leading into the alveolar lateral coda, suggesting that the vowel's formants are similar to the locus F1/F2 for the lateral. In contrast, the long vowel of /moːl/ is more peripheral, with a mean F1 of 477 Hz and a mean F2 of 818 Hz. In this token, the latter quarter of the vowel's duration is characterized by a rise in F2 leading into the alveolar lateral coda. While the F2 only reaches a target of about 1000 Hz for the lateral, the rise in this formant is more 'schwa-like,' going from a more peripheral to a more centralized frequency.
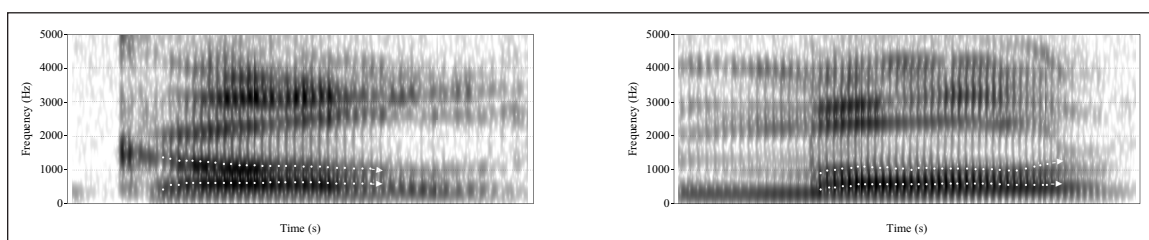

Figure 4: F1 and F2 during the vowel in a sample token of /kol/ 'voice' (left) compared to /moːl/ 'mouth' (right). Both appear in phrase-final position. The short vowel of /kol/ is more centralized and has steady formants leading into the alveolar lateral. The long vowel of /moːl/ is more peripheral, and over the final quarter of the vowel's duration, has a rising F2 leading into the alveolar lateral.

3.2 Inserted schwas differ in quality depending on the following consonant

Jacobs (1993; 2005: Section 4.1.11) states that the inserted schwa tends to be lower in quality (often [ɛ, ɔ]) before rhotics and uvulars, whereas the inserted schwa before coronals has the same quality as other schwas in the language. I argue that this reflects a general process of vowel lowering and retraction before uvulars in the language (Weinreich 1992: Section 1.2324). Further, rhotics and uvulars are characterized by tongue body lowering, meaning that an intrusive vowel will have a higher F1, the main acoustic correlate of tongue lowering, before a rhotics and uvulars compared to before coronals.

3.3 Inserted schwas are common phrase-finally and at slower speech rates

In the case of schwa insertion before coronals (DRAWL), Jacobs (1993; 2005: Section 4.1.11) states that the presence of schwa depends on speech style and tempo, with schwa insertion more common at ends of phrases. Both speech rate and phrasing have the effect of increasing the separation between two articulatory gestures by increasing the phase difference between the vowel and coda gestures. Coda consonants tend to be produced out of phase with the preceding vowel; i.e., their constriction begins after the vowel's (Sproat & Fujimura 1993; Krakow 1999; Hall 2018). Phrase-finally, as well as during slower speech rates, speech gestures lengthen and often take more time to reach their maximal constriction (Byrd & Saltzman 2003). In the case of CY, the longer articulatory transition between vowels and coda consonants at the ends of phrases would result in a longer formant transitions.

While phrase-final position increases the likelihood of an intrusive vowel, it does not guarantee one in the most restrictive varieties of CY. I follow Jacobs in assuming that the process is gradient rather than categorical, but claim this to be true even before rhotics and uvulars, at least for the speaker from Radzyn. Support for gradience can be found in Figure 5, which shows four phrase-final and accented tokens of three words /giːχ, gruːz, nuːz/ 'fast, grass, nose' uttered by the same speaker. Despite being phrase-final (and thus subject to final lengthening), tokens on the left have relatively short formant transitions that are inconsistent with their having a schwa: [giːχ] and [gʁuːs]. The tokens on the right are qualitatively similar in trajectory, but have much longer formant transitions, consistent with their having a schwa: [ˈgiːə̯χ] and [ˈnuːə̯s].
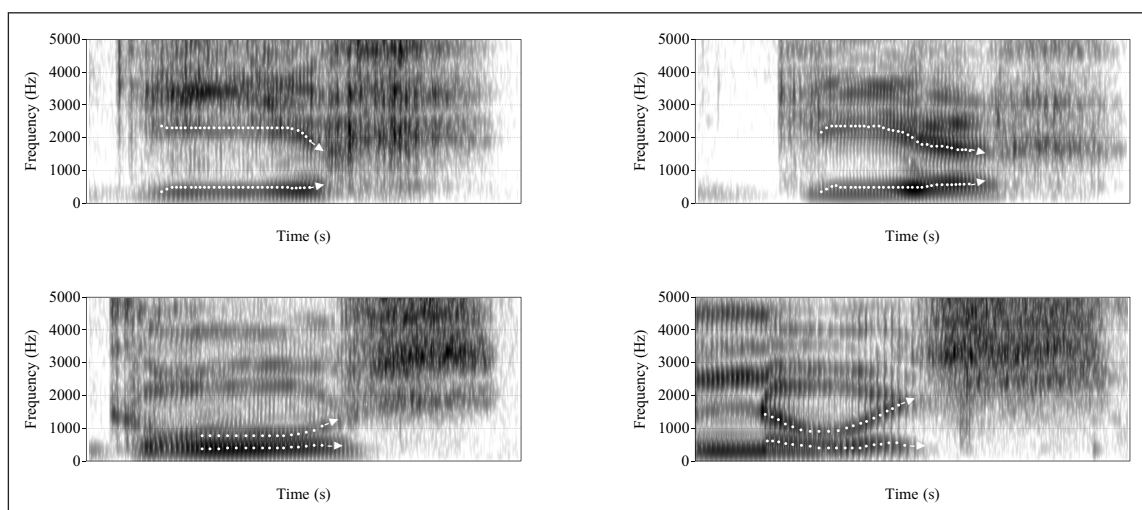

Figure 5: Sample phrase-final tokens of /giːχ/ 'fast' (top), phrase-final /gruːz/ 'grass' (bottom left) and phrase-final /nuːz/ 'nose' (bottom right). The tokens on the left have relatively quick formant transitions and are argued to have no perceived schwa intrusion. The tokens on the right have very long formant transitions (lasting nearly half of the vowel's duration) and perceived vowel intrusion.
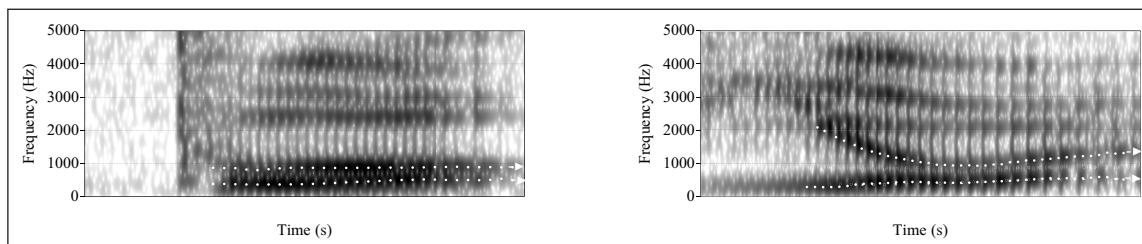
Figure 6: F1 and F2 during the vowel in a sample token of phrase-medial /puːr/ 'pair, few' with no perceived schwa insertion (left) compared to phrase-final /juːr/ 'year' with perceived schwa insertion and longer F1 and F2 transitions (right).

For the speaker from Radzyn, the behavior of schwa insertion before rhotics is clearly more variable than is described by Jacobs for Sosnovce CY. For this speaker, schwa insertion does not always occur between a long high vowel and a rhotic. Figure 6 shows the F1 and F2 during the vowel + rhotic in a sample token of /puːr/ 'pair, few' (left) and /juːr/ 'year' (right). The token of /puːr/ 'pair, few' is in phrase-medial position, and has no perceived schwa insertion, whereas the token of /juːr/ 'year' is phrase-final and is perceived as having a schwa.

Therefore, I assume that, at least in the most restrictive varieties of CY, schwa insertion before uvulars and rhotics is also a gradient phenomenon. Although schwa insertion is more likely to occur in phrase-final position (due to increased gestural distance between vowel and coda), it does not obligatorily occur in that environment. Phrase-final lengthening can also account for why Weinreich (1992: Section 1.233) claims that inserted schwas are subject to word boundaries rather than syllable ones, and why schwas don't insert before word-medial onsets; that is, why there is insertion before codas in forms like /biːχ/ → [ˈbiːəχ] 'book,' but no insertion before the same consonant when they occur as onsets, as in /ˈbiːχər/ → [ˈbiːχər, *ˈbiːəχər] 'books.' Following both Jacobs (1993; 2005: Section 4.1.11) and Enguehard & Faust (2020), I assume that phrase-final position is a crucial factor in predicting schwa insertion. Consequently, insertion should occur as close as possible to the end of a phrase, because phrase-final lengthening more strongly affects articulatory gestures that are closer to the phrase edge (Byrd & Saltzman 2003). Schwa insertion should therefore be more likely to occur before a phrase-final consonant than before a coda (or onset consonant) farther from the phrase boundary.

3.4 Inserted schwas are less common before complex codas

According to Jacobs (1993; 2005: Section 4.1.11), schwas only occur before coronal consonants if they are in a simple coda; that is, the coda cannot consist of more than one sound, as shown in (8b). This property of schwa insertion can also be explained in articulatory terms. It is well known that syllables (especially vowels) undergo *compression*, or compensatory shortening with increased complexity (Katz 2012). For instance, vowels before complex codas are generally shorter than vowels before simple ones, though this depends to some extent on the nature of the coda consonants (Byrd 1995; Katz 2012). Note that increased coda complexity does not necessarily change the phasing between the vowel and coda (Honoroff & Browman 1995; Hall 2018); vowels may shorten before complex codas, but the phasing between vowel and coda gestures is expected to remain fairly stable. Overall then, we might expect intrusive vowels not to occur where words are compressed due to gestural complexity.

However, schwa insertion does occur before a complex coda beginning with a rhotic, as in (8a). I assume that, in these cases, schwa insertion is nonetheless less frequent than before /r/ in simple codas, for the reasons explained above. But why would schwa

insertion occur at all before /r/ in complex codas, when syllable compression would disfavor its occurrence? There are two possibilities that come to mind. First, CY vowels tend to lengthen before /r/, regardless of whether it is realized as a coronal or uvular (Weinreich 1992: Section 1.2311). If pre-rhotic lengthening occurs regardless of coda complexity, then it might offset the compression effects that I hypothesize prevent the occurrence of long schwa-like formant transitions.

Another possibility relates to the fact that coda /r/ is said to 'vocalize,' i.e. it is realized as a schwa (or as lowered [ɛ]): /fuːr/ → [ˈfuːə, ˈfuːɛ] 'drive-1.PRES.SG.' If /r/ vocalizes to [ɛ], then there probably is no need to posit both schwa insertion before /r/ and subsequent /r/ vocalization: schwa-like transitions would be formed as the vowel moves from a high position towards the coda allophone of /r/ that is realized as schwa or [ɛ]. It is worth noting that in Radzyn CY, /r/ vocalization is attested but is optional. In Figure 6, only the token of phrase-medial /puːr/ 'pair, few' has [ʁ]: there is raising of F1 but not F2 before a sudden reduction in energy. In contrast, the token of phrase-final /juːr/ 'year' is realized as [ˈjuːə], with a final rise in both F1 and F2. That token also has no clear boundary between the vocalic sequence and the end of the word, further suggesting the absence of a coda consonant.

Neither of these possible explanations, however, explains why Jacobs claims schwa insertion is possible before complex codas beginning with non-rhotic [χ], as in /ziːχst/ [ˈziːəχst] 'search-2.PRES.SG.' Here too, I assume that schwa insertion is possible, but (due to syllable compression effects) less likely than in forms with a simple coda. Schwa insertion might be possible in such environments because of the ample lowering and retraction of the tongue. I was unable to find sample words having a long vowel followed by a complex coda that begins with a uvular. But between a high-front vowel and a simple uvular coda we do in fact see formant transitions spanning a large frequency range; e.g. the F2 transitions in the word [giːχ] 'fast' in the right panel of Figure 3. With additional coda complexity, as in /ziːχst/ 'search-2.PRES.SG.,' the formant transitions should still be large despite the occurrence of syllable compression.

4 The phonological status of inserted schwas in Central Yiddish

The claim that inserted schwas are explained by phonetic transitions leads to a question of importance to the phonology of Central Yiddish: are the inserted schwas just phonetic transitions, or are they also phonological entities? Given that my explanation for the occurrence of inserted schwas in CY depends on phonetics, in particular on acoustic theory and articulatory phasing, I will address this issue within the framework of Articulatory Phonology (AP: e.g., Browman & Goldstein 1986; 1992; Hall 2018). In AP, the basic units of phonological representation are articulatory gestures, and there is no clear divide between phonetics and phonology. Thus, what counts as mere 'phonetic transitions' rather than 'phonological entities' is framed in AP in terms of gestures: phonological entities are gestures, and phonetic transitions occur between them (Hall 2003; 2006). Inserted schwas in CY then are exclusively phonetic if they occur as phonetic transitions between the preceding vowel gestures and the following consonant's gestures; they are phonological if the schwas have their own assigned gestures.

Hall (2003; 2006) makes a distinction between intrusive vowels, which are phonetic transitions, and epenthetic ones, which have their own gestural representation in the phonology. She states that intrusive vowels tend to have the following properties: they tend to be schwas or (if a sonorant or guttural consonant is present) copy vowels; they tend to occur between heterorganic consonants; they tend to be optional or disappear at faster speech rates; and they don't serve to repair an illicit structure. The inserted schwas in CY have all these properties. Still, having such properties is not a certain diagnostic

of being exclusively phonetic transitions; what look like intrusive vowels may be phonological, for example if their occurrence is no longer predictable, or if their phonetic realization is identical to that of non-inserted vowels. For instance, Hall (2003) claimed that Dutch inserted schwas were intrusive, but Warner et al. (2002) subsequently argued, based on the acoustic similarities between non-inserted and inserted schwas, that inserted schwas are epenthetic. In that case then, it is likely that inserted schwas in Dutch first developed as intrusive vowels due to inter-gestural coordination, and later were 'phonologized,' meaning that language users reinterpreted a sequence like /CC/ as being a /CəC/ sequence, effectively neutralizing a former opposition between lexical items of form /CC/ vs. those of form /CəC/. Why such reanalyses might occur is often unclear and is part of the actuation problem (Weinreich et al. 1968). Nevertheless, phonologization of phonetic detail such as f0 and formant transitions, or vowel nasalization when adjacent to a nasal consonant, is widely used to account for phonetically-motivated patterns sound change (Hombert et al. 1979; Beddor 2009; Yu 2013; Harrington et al. 2019; see also Blevins 2004 and Hayes et al. 2004).

Another diagnostic for determining if inserted schwas are exclusively phonetic transitions is if they also occur in environments where they are not motivated on phonetic grounds. If these are found, then the inserted vowels should be considered phonological entities. There appear to be no such cases in Sosnovce and Radzyn CY, which means this diagnostic cannot be used to adjudicate between the two possibilities, at least for those varieties. It remains unclear then whether the inserted schwas in Sosnovce and Radzyn CY are phonetic transitions or phonological entities. However, cases of inserted vowels that are not motivated on phonetic grounds do exist in the descriptions of two other varieties of CY. I turn to these in the current section.

4.1 Innovative patterns of schwa insertion in the varieties spoken in Plotsk and Retín

According to Enguehard & Faust (2020), schwa insertion in Plotsk CY largely follows the distribution described by Jacobs (1993; 2005: Section 4.1.11), but there are some notable differences which imply that Plotsk CY is more innovative than in Sosnovce CY, based on Jacobs (1993; 2005: Section 4.1.11), and in Radzyn CY, discussed in Section 3 based on recordings from the Yiddish Book Center (see Footnote 3). Both Plotsk and Radzyn CY have [oː] rather than [ou], yet schwa insertion is unattested after [oː] in Radzyn but attested in Plotsk words like [aˈroːə̠s, ˈboːə̠χ] 'out, belly.' Schwa insertion for [oː] + coronal sequences could be accounted for based on formant transitions: just as between [uː] and a coronal coda, the second formant rises through the central vowel space from the low F2 target for [oː] to the higher one (around 1800 Hz) for the coronal. But for [oː] + uvular sequences in forms like [ˈboːə̠χ] 'belly,' F1 and F2 are expected to stay fairly constant between the target for the vowel and uvular; an explanation based on formant transitions would therefore not predict schwa insertion in this environment.

It is possible that Plotsk CY developed schwa insertion in [oː] + uvular sequences if the vowel was historically pronounced as [ou]. The vowel [oː] is probably more innovative, since a falling diphthong *[au] is reconstructed for the proto-language (Jacobs 2005: Section 4), and the change from *au→[oː] would likely necessitate a stage whereby the first element of the diphthong was raised and retracted in the vowel space, i.e. something like *ou. Assuming then that [oː] < *ou, the F1 could have risen between the [u] offglide of the earlier form of the vowel and the uvular, as expected. These transitions would have later been reanalyzed as belonging to schwa. But if the pronunciation of the vowel as [oː] predates the development of schwa insertion, then this would suggest that the variety has generalized inserted schwas to other environments that are not motivated phonetically. This is supported by the fact that schwa insertion is also attested between [ej] and

a coronal nasal ([ˈt͡sejən] 'ten/teeth': Guillaume Enguehard & Noam Faust, personal communication). Recall that in more restrictive varieties, we see no schwa insertion between long high-front vowels and coronals: [t͡sejn, *ˈt͡sejə̲n] 'ten/teeth.'

Retín Yiddish, spoken in the transitional zone between CY and Southeastern Yiddish (Isaac Bleaman, personal communication), was described by Jacobs (1993; 2005: Section 4.1.11) after Bin-Nun (1973). This variety also has less restrictive schwa insertion. In this variety and across eastern CY more generally (Jacobs et al. 1994: 394), inserted schwas no longer participate in schwa-zero alternations; instead, such vowels (which are realized as [ɒ] before uvulars) have generalized to other word-medial environments. Thus, in Retín Yiddish [ˈbiːɒχ] 'book' and [ˈbiːɒ̲χər] 'books' both have an inserted vowel (cf. the more restrictive CY pattern [ˈbiːχ, ˈbiːə̲χ] 'book' vs. [ˈbiːχər, *ˈbiːə̲χər] 'books' found in Sosnovce and Radzyn). Also in the Retín variety, schwas may occur between long high-front vowels and coronal laterals and (like in Plotsk CY) nasals; Bin-Nun (1973: 245) provides examples like [ˈziːə̲n, ˈmiːəl] 'son(s), mill,' where in more restrictive varieties no insertion occurs: [ziːn, miːl].

4.2 Generalization of schwa insertion across Yiddish dialects

In Yiddish varieties from Plotsk and Retín, inserted vowels also occur in environments where they are not expected on phonetic grounds. Why then do they occur? I hypothesize that inserted vowels in these varieties have spread from environments where they were historically schwa-like formant transitions to other environments where the formant transitions would have been less schwa-like. At the earliest stage, there are schwa-like phonetic transitions between phonological entities; at a later stage, the intrusive schwas are phonologized. Their phonologization means that the schwas have gestural representation, which causes neutralization between previously-opposing forms: for example, the earlier opposition of /iːχ/ and /iːəχ/ neutralizes to /iːəχ/. Later still, the epenthetic schwas generalize to morphological relatives and other phonological environments. For instance, in Retín Yiddish the inserted schwa (which lowered to [ɒ] before uvulars) spread from word-final position [ˈbiːɒχ] 'book' to word-medial onsets in morphologically-related forms like [ˈbiːɒχər] 'books.' Generalization to other phonological environments – regardless of morphological paradigms – has also occurred, as in schwa insertion between high-front vowels and coronal nasal codas in both Retín and Plotsk CY. These stages are schematized in Table 2.

There is independent support for phonetic transitions undergoing phonologization and spreading in the historical changes within the phonology of Yiddish in general (that is, in CY and other dialects, including Standard Yiddish). As shown in (3) in Section 1, Yiddish in general has schwa-zero alternations in words like /ˈʃturəm, ˈʃturəmən/ 'storm, to storm' vs. /ˈʃturmiʃ/ 'stormy'.[4] The schwas are assumed to be phonological because

Table 2: Schematic of the sound change from schwa intrusion to phonologization and generalization across varieties of CY. ⇓ = more innovative stages and varieties.

Stages in the phonology	Examples
Intrusion in certain VC sequences	[ˈbiːə̲χ, ˈbiːχər]
⇓	⇓
Phonologization of intrusive vowels	/ˈbiːəχ, ˈbiːχər/
⇓	⇓
Generalization to related forms	/ˈbiːəχ, ˈbiːəχər/

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[4] In this discussion on the phonology of Yiddish in general, rather than in CY in particular, the transcriptions are in Standard Yiddish pronunciation.

their occurrence cannot be explained by phonetic transitions alone; for example, if schwa would insert in [ˈʃturə̠m] 'storm' due to intrusion between heterorganic coda consonantal gestures, we would not expect intrusion in [ˈʃturə̠mən] 'to storm,' yet a schwa does occur in that form. If, however, schwa intrusion would occur in [ˈʃturə̠m] due to intrusion between heterorganic consonantal gestures regardless of syllable structure, we would indeed expect intrusion in [ˈʃturə̠mən], but also in *[ˈʃturə̠miʃ] 'stormy'. Thus, phonetic transitions alone cannot account for the distribution of schwas in the disyllabic morphological relatives of 'storm.' In fact, schwa insertion between /rm/ coda clusters is regarded as a historically complete process in the language (Albright 2010: Section 3.4), though likely one rooted in vowel intrusion because it developed between heterorganic complex codas. (Later borrowings such as /farm/ 'farm' from American English resulted in the reintroduction of /rm/ as a phonotactically licit coda, and thus in the opposition of /rm/ and /rəm/ sequences; see Jacobs 2005: 118.) So, the intrusive schwa would later have become phonologized to an epenthetic vowel, and spread in a way that the phonetics cannot account for clearly– namely to some morphological relatives of words with an epenthetic schwa. Eventually, generalization can be 'complete,' spreading to all related word forms. This diachronic process is schematized in Table 3; note that complete generalization to all morphological relatives is attested for 'storm' and its morphological relatives, based on non-standard orthographic conventions (Isaac Bleaman, personal communication). Assuming that at least some speakers of Yiddish produce a schwa-zero alternation for 'storm,' this can be understood as gradual generalization to the base form (Albright 2010).

   Note that it is unclear why both the phonologization of phonetic transitions ('intrusive' vowels) to inserted vowels, and their subsequent generalization, only occur in CY, rather than across all dialects of Yiddish. In earlier forms of Yiddish, base-driven leveling has been positing as a motivation for generalization of schwa throughout verbal paradigms Albright (2010); see also paradigm-based leveling of forms with and without schwa in German (Raffelsiefen 1995). Generalization to morphological relatives (including base-driven leveling) can account for the spreading of schwa, but not for why intrusive vowels would be phonologized in the first place, and not for why only CY among Yiddish dialects shows this kind of schwa insertion. Other varieties of Yiddish might not exhibit this kind of schwa insertion for various reasons; for example, they might have stronger temporal coordination between vowels and codas, or weaker phrase-final lengthening, both of which would result in shorter formant transitions. But given that the most restrictive varieties of CY show schwa insertion only in environments that are indeed phonetically motivated (by means of schwa-like formant transitions), I assume that phonologization

Table 3: Schematic of the Yiddish sound change from vowel intrusion in VC sequences to phonologization and generalization. ⇓ = change between historical periods of the language's phonology.

Stages in the phonology	Examples
Intrusion in coda /rm/	[ˈʃturə̠m, ˈʃturmən, ˈʃturmiʃ]
⇓	⇓
Phonologization of intrusive vowels	/ˈʃturəm, ˈʃturmən, ˈʃturmiʃ/
⇓	⇓
Partial generalization	/ˈʃturəm, ˈʃturəmən, ˈʃturmiʃ/
⇓	⇓
Complete generalization	/ˈʃturəm, ˈʃturəmən, ˈʃturəmiʃ/

(of phonetic transitions to schwa) and generalization (to environments where the schwas are less clearly motivated phonetically) could have occurred in what are now less restrictive varieties.

In sum, in the more restrictive pattern of CY schwa insertion (attested for speakers from Sosnovce and Radzyn), it is possible that what appear to be 'inserted schwas' are still exclusively phonetic formant transitions. Plotsk and Retín Yiddish have schwa insertion in those same environments, but additionally show inserted schwas in environments where they are not predicted phonetically. In these cases, there is clear support for their status as phonological entities.

5 Analysis of Central Yiddish poetic rhyme

I have argued above that phonetic transitions between vowels and coda consonants could be reanalyzed over time as schwas with their own phonological representation. Patterns of versification are sometimes used as arguments for inserted schwas being intrusive or epenthetic. Generally, one expects intrusive vowels, which lack a phonological representation, not to count towards patterns of poetic meter or rhyme. For instance, intrusive vowels in Scots Gaelic CVC$\underline{V}$C count as monosyllabic in poetry (Hall 2003: 95; cf. Hammond et al. 2014), and in Tashlhiyt Berber, obstruent-only syllables count as light for versification, even though with vowel intrusion the second obstruent could have functioned as a coda, potentially rendering the syllable metrically heavy (Ridouane 2008). But if a vowel does in fact count towards poetic structure, that vowel is generally treated as a phonological entity. In this section, I claim that further support that Central Yiddish inserted schwas are more than phonetic transitions comes from 19th-century CY poetry, where inserted schwas count for poetic rhyme.

5.1 The corpus

As a case study of poetic rhyme in Central Yiddish, I analyzed the novella in verse *Di geheymnise fun yener velt, oder der tkies-kaf* (*The Secrets of the Hereafter, or The Handshake Agreement*, Makman 1865). There is little available biographical information about the author, though he is considered by Shatski (1942) to be from Warsaw. The work was also published in Warsaw and portrays Jewish life in that city (Zinberg 1978: 194–196, 242), thus probably reflecting the Warsaw variety of CY. For several reasons, it is clear that the work was written in CY rather than in another dialect. First, the orthography reflects a CY pronunciation, unlike much 20th-century Yiddish poetry that was written in Standard Yiddish orthography even when written by CY speakers. For instance, words like [fun, un] 'of, and', which in Standard Yiddish are pronounced with an [u] and are spelled accordingly, are written in this poem with the letter representing the vowel [i], as they are pronounced in CY as [fin, in]. Second, the author uses CY-specific words, such as [et͡s] for the 2nd-person plural pronoun, which is [iːr] in other varieties (Jacobs 2005: 70). He also frequently uses Polish borrowings, such as [zdarzenjə] 'incident, event' (p. 29, < Polish *zdarzenie*); cf. Standard Yiddish [int͡sident, pasiruŋg, gəʃeəniʃ].

This work was chosen not only because it is written in CY, but because its rhyming structure is very strict, consisting mostly of perfect rhymes (which I describe below). With 2580 lines, is also rather long, ensuring that distributional properties of the rhyming structure are not skewed by a small sample size. While the meter could be interesting for questions about intrusive vowels, it was not analyzed in this study; the meter consists mostly of free iambs, where the number of iambs per line can vary. Further, unstressed final syllables often count as extrametrical for purposes of the meter. This implies that even if schwa insertion does occur, it is unlikely to do so at ends of lines for metrical reasons, as they would be ignored for the meter. Consequently, only the rhyme is analyzed below.

5.1.1 Transcription of rhyming words

Every word that was used to form a rhyme was logged, and its pronunciation in Central Yiddish was transcribed. Although the orthography is non-standard, it was straightforward to ascertain how the word would be pronounced in spoken CY today, which was taken to stand in as an approximation of how the word would have been pronounced when the poem was originally written. As a heritage speaker of CY who regularly speaks and reads in the language, I was familiar with the majority of words involved in the rhyme. The pronunciation of words that I was not familiar with was confirmed in consultation with a native speaker.[5] In the poem's orthography, /a/ and /aː/ were marked identically. Other vowel contrasts that were not marked orthographically included /o/ vs. /uː/, /e/ vs. /ej/ vs. many cases of [ə], /i, iː/ vs. some cases of [ə],[6] and /oj/ vs. /ou/. In these cases, as well cases of Hebrew-Aramaic borrowings that were written as they are in Semitic (as is the case even in Standard Yiddish today; Jacobs et al. 1994), I used my knowledge of the language to determine what the vowel quality would be in CY as it is spoken. Other cases of orthographical conventions that deviate from Standard Yiddish orthography include influences from written German that were frequently used in 19th-century written Yiddish: e.g. the word /ˈalə/ 'everybody' is in Standard Yiddish spelled with one letter corresponding to the lateral, whereas in the poem it is often spelled with two such letters, on analogy with written German *alle*.

For the most part, words had consistent orthographic representations throughout the poem. One important exception were words that may have an inserted schwa. For instance, the poet makes use of two line-final rhymes involving /tiːr/ 'door' with /ˈfriːər/ 'earlier', which has a non-inserted schwa. In one case (p. 50), the word for 'door' is spelled as if schwa insertion hadn't occurred; in the other case (p. 104), it is spelled with an inserted schwa. The reason for such inconsistencies isn't clear; it is unlikely due to poetic meter, which consists of free iambs (i.e., the number of iambs per line varies), and because rhyming lines often vary widely in terms of the number of feet they contain. Moreover, the two pairs of lines containing these rhymes are scanned in iambic trimeter. Thus adding an unstressed schwa to /tiːr/ does not change that scansion, because the inserted schwa (if it occurs) would be extrametrical with an iambic scansion. Possible reasons for the inconsistencies might be a reflection of the optionality of intrusive schwas in the poet's own dialect, or of other Yiddish orthographic conventions (based on varieties with no schwa insertion) that may have inconsistently influenced both poet and publisher.

5.1.2 Coding of rhyming words

Rhymes were coded as follows: first, I drew a distinction between EXTERNAL rhymes (those that occurred between the final words of two lines) and INTERNAL ones (those that occurred between the final word of the line and a word that appeared line-internally), and isolate lines; i.e., those whose final word were not found to rhyme with any other. Sample lines containing external and internal rhymes are shown in (9). Usually, external rhymes were adjacent (AABB) or alternating (ABAB, ABBA). Internal rhymes were rare, representing less than 6% of the rhymes.

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[5] The native speaker was born in Montreal, Canada, but her first language is CY, and she continues to speak the language daily. The speaker was not aware of the purposes of the study. So as not to be biased by a word's potentially rhyming counterpart, she was shown only the relevant line to confirm a word's pronunciation.

[6] Schwas, whether inserted or not, were variably marked with the same letter used for /e, ej/ and the same letter used for /i, iː/.

(9)   External and internal rhymes in Makman 1865: 19:
        iz ˈduːə̱s ˈefʃər ə **fejlər**,
        az ˈer ʃtajt ˈʃojn zeks ˈtouzn̩t ˈjuːr in **kejlər**,
        in ˈjejdəs **fas**, iz ˈgrojs viː a **gas**,

        'It may well be to a fault,
        that it [wine] remained 6000 years in a vault (lit. 'cellar'),
        and every tun (lit. 'barrel') is quite a large one (lit. 'is as big as a street')'
        [*Translation by M. Garellek*]

Next, I characterized the rhyme types as follows: a PERFECT rhyme was one where the rhyming words had identical stressed vowels and subsequent sounds (Katz 2015): e.g. /kluːr/ 'clear' and /juːr/ 'year' (p. 1) or /ˈlejzn̩/ 'read' and /gəˈvejzn̩/ 'been' (p. 1). As CY has coda obstruent devoicing (Jacobs 2005: p. 115), pairs of words differing in the voicing of the final obstruent (e.g. /houz/ 'house' and /aˈrous/ 'out,' p. 133) were considered perfect rhymes.

A FORCED rhyme involved words whose consonants or vowels were not identical: e.g. /ˈdrinən/ 'inside' and /gəˈkimən/ 'came' (p. 15) or /ʃiːl/ 'school, synagogue' and /ʃpiˈtuːl/ 'hospital' (p. 23). (Note that, the very rare cases of forced rhymes with different vowel qualities might also be considered sequences of isolate, i.e. non-rhyming, lines.) Most cases of forced rhymes involved one-feature differences between the non-identical sounds (e.g. [m] vs. [n]), and thus could be considered perfect rhymes if what counts as 'perfect' is defined less strictly. Still, I chose to code phonetically similar forced rhymes as forced (rather than perfect) to provide a more conservative analysis of the rhyming structure. The majority of forced rhymes involving differences in vowels were rhymes between short vs. long vowels (e.g., [i] ~ [iː], [a] ~ [aː]); I coded these as distinct NOLENGTH rhymes: e.g. /gəˈʃaːnt/ 'shone' and /ˈvant/ 'wall' (p. 18).

Crucially, I coded for SCHWARHYME: rhymes where licit schwa intrusion in spoken CY (i.e., intrusion between long high vowels and coronals, uvulars, and rhotics) would create a perfect rhyme. For instance, a word like /tiːr/ 'door,' which often undergoes schwa insertion [ˈtiːər] in CY, could be used to rhyme with words that have a non-inserted schwa, such as /ˈfriːər/ 'earlier,' where the schwa is obligatory and is also found in dialects of Yiddish without vowel intrusion; cf. Standard Yiddish /ˈfriər/. One such case also involved a consonant mismatch between /m/ and /n/: /ˈpʃuːəm/ 'crimes' rhymes with /uːn/, a verb particle. This example is included as a case of SCHWARHYME and not of FORCED RHYME C in Table 4, because the focus on the analysis to follow is on the former type of rhyme.

Table 4: Summary of rhyme types found in the poem.

RHYME TYPE	Explanation	Count (% of rhymes)
EXTERNAL	Rhyme between line-final words	1236 (94% of rhymes)
INTERNAL	Rhyme includes line-medial word	78 (6% of rhymes)
PERFECT	Rhyming words with identical nucleus+coda	1181 (90% of rhymes)
FORCED RHYME C	Forced rhyme with different consonant	26 (2%)
FORCED RHYME V	Forced rhyme with different vowel	6 (<1%)
NOLENGTH	Rhyme ignores vowel length	49 (4%)
SCHWARHYME	Schwa insertion makes a perfect rhyme	46 (3%)
SYLLABLEMISMATCH	Rhyming words have different number of syllables	3 (<1%)
IMPERFECT rhymes	Other imperfect rhymes	3 (<1%)

I also coded for SYLLABLEMISMATCH: rhymes that might be perfect if one unexpectedly inserts a schwa, or deletes a non-inserted one. I identified only three such cases: /farˈdajən/ 'digest' rhymes with /ˈvajn/ 'cry' (p. 88), /maˈʃiːn/ 'machine' rhymes with /ˈfliːən/ 'fly' (p. 127), and /aˈhiːn/ 'thither' rhymes with /ˈriːən/ 'rest' (p. 136). Note that these rhymes would be perfect either if schwas delete (/farˈdajən/ → [farˈdajn]), or if there is schwa insertion in an environment that does not permit insertion in spoken CY (/vajn/ → [ˈvaj‍ə‍n]).

Other types of rhyme mismatches were exceedingly rare, occurring in only 3 cases. These included one rhyme where stress needs to shift to form a perfect rhyme: /ˈeŋgland/ 'England' rhyming with /proteˈstant/ 'Protestant' (p. 58), and another rhyme (found twice) that involved dropping of an unstressed coda /n/: /alˈtanə/ 'arbor' rhyming with /gəˈʃtanən/ 'stood' (p. 103, 108). Clearly, these rhymes are composed of pairs of words that do in fact rhyme, though imperfectly.

5.1.3 Overview of rhyme types

In total, 1314 rhymes and 30 isolates were coded, corresponding to 2580 lines of the poem. The counts and percentages for all rhymes (excluding the 30 isolate lines) are summarized in Table 4. Forced or other imperfect rhymes are quite rare: about 90% of rhymes in the poem are perfect. Clearly then, the poet aimed for a rigid rhyming structure. Forced rhymes involving a vowel quality or consonant mismatch, as well as imperfect rhymes, make up less than 3% of rhymes. The bulk of forced rhymes involve those with words which differ in vowel length and words with schwa mismatches. I discuss each of these in turn.

Rhymes involving lines whose final words differed in vowel length, as in /vant/ 'wall' and /gəˈʃaːnt/ 'shone,' make up 4% of rhymes. Although they are the most common type of forced rhyme, vowel length is clearly relevant for the poetic rhyme: among rhymes involving words with long vowels, only about 12% are rhymes where vowel length is ignored.[7] It is unclear why Makman sometimes ignores vowel length for poetic rhyme, but similar cases are found in English poetry, such as in Shakespeare's Sonnets and poems by Alexander Pope. Proposed explanations for such cases include perceptual similarity between vowels of different length, whether a particular word has morphological relatives that differ in vowel length, 'eye rhymes' (where the orthography matches but not the vowel quality, as in rhyming English *love* and *move*), among others; see Hanson (2002) for a review. Eye rhymes could apply to most vowel length mismatches in Makman's poem; of the 49 rhymes that ignore vowel length, only three involve rhymes between /o/ ~ /oː/, where the short vowel is represented using a different letter than its long counterpart.

5.1.4 Rhymes involving schwa deletion or insertion

There are two types of rhymes involving the presence or absence of schwa: those coded as having a syllable mismatch (e.g. /farˈdajən/ 'digest' rhyming with /ˈvajn/ 'cry'), and those where schwa insertion – as it occurs in spoken CY – could make a perfect rhyme, as in rhymes between /tiːr/ 'door' (which in spoken CY can undergo schwa insertion to [ˈtiː‍ə‍r]) and /ˈfriːər/ 'earlier.' Roughly half of those rhymes involved words ending in a rhotic or uvular; the other half involved words ending in a coronal, as in /baləˈbuːs/ → [baləˈbuː‍ə‍s] 'owner' rhyming with /ˈtuːəs/ 'mistake.'

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[7] The number of rhymes ignoring vowel length could be lower if a less conservative coding were applied for a particular lexical item. The word /jiːd/ 'Jew, person' is usually (7 out of 9 times) paired with a word bearing a short /i/, like /git/ 'good, well.' This suggests that the poet may have intended for the word /jiːd/ 'Jew, person' to be pronounced as [jit], with a short vowel (as well as a devoiced coda obstruent).

Rhymes involving syllable mismatches due to the presence/absence of schwa also occurred with words that do not undergo schwa insertion/deletion in spoken CY. For example, /farˈdajən/ 'digest' cannot be pronounced without a schwa as *[farˈdajn], and /vajn/ 'cry' cannot be pronounced with one, as *[ˈvajən]. Perhaps unsurprisingly then, such rhymes are exceedingly rare, with only three cases attested. However, rhymes involving words like /tiːr/ 'door' – which in spoken CY can undergo schwa insertion to [ˈtiːə̯r] – and /ˈfriːər/ 'earlier' are much more common, occurring 46 times in the poem (about 3% of all rhymes).

Two explanations come to mind when accounting for such rhymes: either the words that could have inserted schwas (like /tiːr/) were meant to be pronounced as [ˈtiːə̯r] (i.e., the rhymes between /tiːr/ 'door' and /ˈfriːər/ 'earlier' are perfect), or the poet treated such words as schwa-less but still perceptually similar to words with non-inserted schwa (i.e., the rhymes between /tiːr/ 'door' and /ˈfriːər/ 'earlier' are forced due to their perceptual similarity). I argue that their frequent use in the poem suggests they are in fact perfect rhymes.

If rhymes between words like /tiːr/ 'door' with /ˈfriːər/ 'earlier' were forced rhymes, then one would expect them to be infrequent, because the poem's rhyming structure is so rigid. But such cases are not infrequent in the poem. There are 116 perfect rhymes involving words that could have an inserted schwa, but for which schwa insertion is irrelevant. For instance, with a pair of words like /kluːr/ 'clear' and /juːr/ 'year,' it doesn't matter for the rhyme whether schwa insertion has occurred on both words. But there are 46 rhymes where schwa insertion would result in a perfect rhyme, as in rhyming /tiːr/ 'door' with /ˈfriːər/ 'earlier.' Thus, when a rhyme is made with a word that is able to undergo schwa insertion in spoken CY, insertion is needed to make a perfect rhyme in about 28% of cases.

In sum, Makman (1865) made frequent use of inserted schwas for poetic rhyme, but only in environments where they occur in the least innovative varieties of spoken Central Yiddish (like those from Sosnovce and Radzyn). Such rhymes are therefore interpreted as being perfect rhymes between two words with a schwa. If the inserted schwas were still phonetic transitions in the poet's language, we might not expect them to count so readily for poetic purposes; as mentioned above, this has been argued to be the case for intrusive vowels in other languages.

An alternative interpretation is that schwa insertion does not occur; instead, perceptually-similar words are likely to be used for forced rhymes (Kawahara 2007; Katz 2015). Thus, it is conceivable that Makman (1865) rhymed words like /tiːr/ 'door' with /ˈfriːər/ 'earlier' not because the former was meant to be pronounced with an inserted schwa, but instead because he had knowledge that such monosyllabic words are perceptually similar to disyllabic words. I claim that this is unlikely, because such an interpretation cannot account for the very rare occurrence of other types of forced rhymes that involve words which differ in their syllable count. If perceptual similarity between words like /tiːr/ 'door' and /ˈfriːər/ 'earlier' explains the high frequency of such rhymes, why then are similar rhymes between words like /vajn/ 'cry' and /farˈdajən/ 'digest' – which also differ in terms of the presence/absence of schwa – so rare? Consequently, I argue that words with inserted schwas in spoken CY were used by Makman to make perfect rhymes with words that have non-inserted schwas. This provides further support for the idea that inserted schwas in CY are phonological entities.

6 Conclusion

Central Yiddish has schwa-zero alternations, where the schwa is argued to be inserted, as in /biːχ/ → [ˈbiːə̯χ] 'book' and /ʃuːd/ → [ˈʃuːə̯d] 'shame.' In varieties of CY where these alternations are most restricted, schwas occur only between certain long vowels

(or diphthongs) and coronal, uvular, or rhotic codas. This is unusual typologically and, at first glance, difficult to explain synchronically. Previous explanations by Jacobs (1993; 2005) required separate rules based on syllable overweight, which I have argued cannot completely account for where schwa insertion does and does not occur. A more recent explanation framed within Government Phonology and Element Theory put forth by Enguehard & Faust (2020) can account for the distribution, but the explanation requires positing a hierarchy of elements that is synchronically arbitrary.

In the analysis put forth here, I have argued that the inserted schwas are a result of phonetic transitions between vowel-consonant sequences. The particular sequences that allow for CY schwa insertion are those whose formant transitions are schwa-like, moving through the mid-central acoustic vowel space. Other patterns of CY schwa insertion – the fact that they are absent or less likely after short vowels, before complex codas, in faster speech rates or phrase-medially – can further be explained phonetically by patterns of gestural overlap and syllable compression.

A review of data from several CY varieties suggests that schwa insertion has generalized to other environments that are not predicted by phonetic transitions, implying that the inserted schwas are no longer exclusively phonetic material. Moreover, an analysis of 19th-century CY verse reveals that inserted schwas may count for the purposes of poetic rhyme. Taken together, this suggests that CY inserted schwas are phonological, and have been (in at least some varieties) for some time.

The diachronic path from phonetic transitions to phonologization and generalization that I claim applies to schwa insertion in CY mirrors that of schwa insertion and base-driven leveling of verbal paradigms in earlier stages of the language (Albright 2010), as well as other well-known sound changes across languages, such as tone development from consonant-vowel and vowel-consonant transitions (Hombert et al. 1979; Ratliff 2015). Just as those studies have led to predictions regarding which environments are most likely to be triggers of tonogenesis (e.g., voiceless obstruent-vowel sequences are expected loci for the development of high tones), the analysis put forth here makes predictions about where schwa insertion is likeliest to emerge first.

Vowel insertion between a vowel and coda consonant seems to be much rarer than between coda consonants (Hall 2003; 2006). Nonetheless it is attested, particularly when the coda consonant is a sonorant or pharyngeal (Halle & Idsardi 1997; Krämer 2005; Gick & Wilson 2006; Operstein 2010). Why might languages be less inclined to develop vowel insertion in V-C sequences than in complex codas? And why did a language like Central Yiddish come to have such vowel insertion, while other languages – indeed, even closely-related varieties of Yiddish – do not? These questions are worth investigating in future work, and a language like Yiddish provides ample proving ground to address them.

Abbreviations

CY = Central Yiddish, AP = Articulatory Phonology, PRES = present tense, SG = singular, PL = plural

Acknowledgements

Competing Interests

The author has no competing interests to declare.

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