Résumé

L’harmonie vocalique en français canadien est un phénomène variable selon lequel le relâchement des voyelles hautes dans les syllabes finales fermées se propage vers la gauche dans les syllabes ouvertes. On peut remarquer un cas d’opacité dérivationnelle dans des mots tels que [my.zi.kal] ‘musical’ où l’harmonie se manifeste malgré le fait que le déclencheur présumé d’harmonie, c’est-à-dire la dernière voyelle du radical, [i], est tendue et ne se trouve pas dans une syllabe finale ouverte. Poliquin (2006) prétend que ce cas ne peut être analysé sans une théorie qui comprend un élément cyclique. Cela pose un défi pour les théories parallélistes telle que la théorie de l’optimalité (TO). À cause de l’exclusion de la variation comme outil analytique, Poliquin ne peut que proposer des explications basées sur l’anormalité de la variation. En permettant à la variation de jouer un rôle plus central que celui de ré-hiérarchisation de contraintes, je peux améliorer l’adéquation descriptive d’une explication en TO de l’harmonie vocalique en français canadien.

Abstract

Vowel harmony in Canadian French (CF) is a variable phenomenon whereby laxing of high vowels in closed final syllables spreads leftward to high vowels in open syllables. A case of derivational opacity occurs in words like [my.zi.kal] ‘musical’ which show harmony even though the presumed harmony trigger, the stem-final [i], is tense and in a non-final open syllable on the surface. Poliquin (2006) argues that this case cannot be analyzed without a rule-based theory that includes a cyclic component, posing a challenge to parallelist theories of phonology such as Optimality Theory (OT). I argue that Poliquin’s exclusion of variation as an analytical tool limits him to proposing explanations based on the abnormality of variation. By allowing variation to play a more central role than that of constraint re-ranking, I can improve the descriptive adequacy of an OT account of CF vowel harmony and formulate quantitative, testable predictions about phonological theory.
Vowel harmony in Canadian French (CF) is a variable phenomenon whereby laxing of high vowels in closed final syllables spreads leftward to high vowels in open syllables. It manifests two cases of counterbleeding opacity, which are also variable. In a 2006 dissertation, Gabriel Poliquin argues that neither transparent nor opaque cases of vowel harmony in Canadian French can be analyzed without a rule-based theory that includes a cyclic component. In his view, this poses an insoluble problem for parallelist theories of phonology such as Optimality Theory (OT).

While Poliquin observes the variable nature of CF vowel harmony, his approach abstracts away from it through the assumption that each variant manifestation of harmony represents a separate grammar, and through the subsequent methodological decision to gather judgment data at the expense of observing production. I argue that Poliquin’s exclusion of variation as an analytical tool limits him to proposing explanations based on the abnormality of variation. By allowing variation to play a more central role, I can improve the descriptive adequacy of an Optimality Theoretic account of CF vowel harmony and formulate quantitative, testable predictions about phonological theory.

My argument proceeds as follows. First, I summarize Poliquin’s account of CF vowel harmony, focusing on those facts that seem to lie outside the reach of OT. Second, I identify the major approaches that have been taken to incorporate variation more integrally into phonological theory, and show how Poliquin’s work generally disregards these. Third, I apply a sociolinguistic perspective on variation to the CF data that involves (1) showing how floating and crucially unranked constraints make realistic quantitative predictions about attested harmony patterns; (2) proposing a constraint banning unlicensed harmony, based on the observation that the process triggering variable harmony is itself variable; and (3) positing output-to-output faithfulness to more than one variant. In addition, I show that an OT account makes different quantitative predictions about the relative frequencies of each variant than Poliquin’s rule-based account, suggesting that the relative merits of the two accounts are testable with production data.

Vowel harmony in Canadian French

In Canadian French, laxing of high vowels /i, u, y/ to /ɪ, ʏ, ʊ/ is extremely common in closed syllables. Lax high vowels can also variably occur in open syllables due to the leftward spreading of closed syllable laxing. Such harmony may affect only the adjacent
high vowel, only the leftmost high vowel, or all high vowels. In three-syllable words, all logically possible harmony patterns are therefore attested. When it comes to words with four high vowels, however, Poliquin finds in a judgment task that his twelve informants only accept four of eight logically possible patterns (2006, p. 10).

Table 1. Vowel harmony patterns in tetrasyllabics

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>No harmony</td>
<td>[i.ly.mi.nism]</td>
</tr>
<tr>
<td>Adjacent non-iterative harmony</td>
<td>[i.ly.mi.nism]</td>
</tr>
<tr>
<td>Non-local harmony</td>
<td>[i.ly.mi.nism]</td>
</tr>
<tr>
<td>Across-the-board harmony</td>
<td>[i.ly.mi.nism]</td>
</tr>
<tr>
<td>Not accepted</td>
<td>*[i.ly.mi.nism], *[i.ly.mi.nism], *[i.ly.mi.nism], *[i.ly.mi.nism]</td>
</tr>
</tbody>
</table>

A case of derivational opacity occurs in words like [my.zi.kal] ‘musical’, which shows harmony even though the high vowel which presumably triggered harmony (the [i] of the root form [myzik] ‘music’) is not in a closed syllable on the surface and cannot be lax (Poliquin, 2006, p. 101). A second case of opacity occurs in words like [mi.slyv] ‘letter’ where a final vowel is obligatorily long before a voiced fricative, yet seems to trigger harmony in a preceding open syllable (Poliquin, 2006, p. 100). Poliquin demonstrates that this opacity is productive through a judgment task in which informants accept opacity in both real and nonce words (2006, p. 134). He proposes a derivational...
account for harmony patterns, presenting five ordered rules that must apply cyclically at a stem level and at two subsequent word levels (2006, p. 227).

While Poliquin’s account is able to account for all cases of opacity and all and only the attested harmony patterns, he shows that this is not the case for any Optimality Theoretic account, including OT with targeted constraints, Sympathy Theory, OT with candidate chains, Stratal OT and Turbidity. While several accounts can model harmony patterns in trisyllabics, and one can cover the missive opacity facts, all the theories fail to account for the attested patterns of harmony in tetrasyllabics, and to model opacity of the musical type.

Of all the OT accounts reviewed by Poliquin, Turbidity (Goldrick, 2000) comes closest to explaining opacity, since it alone can account for missive-type opacity. Turbidity introduces a potential way to deal with opacity by allowing a segment to project features ‘covertly’ through the use of special RECIPROCITY and PRONOUNCE constraints (Poliquin, 2006, p. 309). The former specify that particular projected features must be pronounced, while the latter ensure that particular features are not disassociated to satisfy the related RECIPROCITY constraint (2006, p. 306). In what follows, I will use PRONOUNCE constraints to stand for a RECIPROCITY constraint and its related PRONOUNCE constraint.

Poliquin defines the following constraints as relevant for a Turbidity analysis. 5

(a) *[+HIGH, +ATR]/__σ: Vowels cannot be high and tense in closed syllables (2006, p. 256).
(b) *[+HIGH, -ATR, -LONG]/__Zσ: High vowels cannot be lax and short before a tautosyllabic voiced fricative (2006, p. 256). 6
(c) MATCH[-ATR]-L (LEFTMOST): Within a sequence of high vowels, if the word-final vowel is [-ATR], the leftmost vowel will be [-ATR] (2006, p. 265).
(d) MATCH[-ATR]-L (ADJACENT): Within a sequence of high vowels, if the word-final vowel is [-ATR], the adjacent vowel will be [-ATR] (2006, p. 265). 7
(f) PRONOUNCE[+ATR]/[-ATR]: In cases where a single vowel projects both [+ATR] and [-ATR], PRONOUNCE[+ATR] forces the [+ATR] feature to be pronounced, while PRONOUNCE[-ATR] requires that [-ATR] be pronounced (2006, p. 306).

5 I will follow Poliquin’s assumption of Richness of the Base throughout this paper. Although we both assume IDENT-IO[ATR] as an active constraint (Poliquin, 2006, p. 259), it will never be violated in any of the candidates we propose.
6 Although tensing and lengthening are two separate processes (Poliquin, 2006, p. 257), they will always co-occur in words like missive. For notational convenience, I have combined Poliquin’s two constraints into a single cover constraint.
7 This use of MATCH constraints draws on work by McCarthy (2003). In contrast to the SPREAD or AGREE constraint families, MATCH constraints are highly specific and define a prosodic domain within with segments which may or may not be adjacent will agree for a specific feature (Poliquin, 2006, p. 264).
(g) *[+HIGH, -ATR]: No high lax vowels (2006, p. 295).

The following ranking can account for missive-type opacity (Poliquin, 2006, p. 308):

\[
\text{PRONOUNCE}[^{+}\text{ATR}] \gg *[^{+}\text{HIGH}, ^{+}\text{ATR}] /_{\_}\text{Z} \gg *[^{+}\text{HIGH}, ^{+}\text{ATR}] /_{\_}\sigma \gg \\
\text{MATCH}[^{-}\text{ATR}], *[^{+}\text{HIGH}, ^{-}\text{ATR}] \gg \text{PRONOUNCE}[^{-}\text{ATR}], \text{IDENT-IO}[\text{ATR}].^8
\]

However, these constraints fail to account for derivational opacity of the musical type. As Poliquin points out, in order to account for opacity in musical, one would have to assume that the [i] in [my.zi.kal] projects the feature [-ATR] even though it is not pronounced. However, Poliquin sees no way to justify this, given that this vowel is in an open syllable (2006, p. 309). The assumption was justified for missive only because its final syllable was closed. Poliquin links the failure of Turbidity to account for opacity to its parallelist nature, insisting that the notion of the cycle would be necessary in order to account for musical (2006, p. 309).

In addition to the limitations of Turbidity, none of the OT accounts as outlined by Poliquin can account for exactly the attested patterns of harmony in tetrasyllabics. Specifically, re-ranking of the constraints MATCH-ADJACENT, MATCH-LEFTMOST, *[+HIGH, -ATR] and NOGAP will not be able to eliminate the candidate *[si.mi.Î·.tyd] under any ranking (2006, p. 273). In view of these shortcomings, Poliquin concludes that “classical OT” and its subsequent modifications are “inadequate” in accounting for CF vowel harmony (2006, p. 272).

**Variation in phonological theory**

Labov has argued that since Saussure, linguistic theories have been based on the assumed homogeneity of linguistic behaviour. Such theories abstract away from variation by considering it to be “free”: i.e., linguistically unconstrained and therefore theoretically uninteresting (1972, p. 186-187). While pioneering sociolinguistic studies have demonstrated the undeniable effect of extralinguistic constraints on variation (Labov, 1966, 1972; Trudgill, 1974), sociolinguists have also frequently observed linguistic conditioning factors, and some have attempted to model these constraints phonologically. A well-known example is Guy’s study of English t-/d-deletion in which he found that, independently of the social constraints on variation, deletion of word-final obstruent /t/ or /d/ consistently occurs more frequently in monomorphemic words (e.g., ‘mist’) than in polymorphemic words (e.g., ‘missed’) (1991a, p. 223). Given a speaker’s individual (socially determined) base rate of t-/d-deletion, Guy was able to successfully predict the rate of deletion in mono- and polymorphemic words (1991b, p. 12-13). Within an OT framework, both Nagy and Reynolds (1996) and Anttila (1997) have also shown some

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^8 Poliquin assumes Richness of the Base throughout his presentation, which means that although he assumes IDENT-IO[ATR] as an active constraint, it will never be violated in any of the candidates he (or I) will propose (2006: 259). I will follow this assumption, and also assume that [ATR] is not specified underlyingly.
success in modeling variation as the “statistical fingerprint” of a partial ranking on several winning candidates, in cases where a single winner cannot be determined (Anttila, 1997, p. 63). However, much of this research seems to have gone unnoticed by phonologists, as exemplified by Kager’s statement that variation may be governed by social factors, but not by “grammatical principles” (1999, p. 404).

Although there seems to be a tendency for sociolinguistic research and the development of phonological theory to occur in relative isolation of each other (Reynolds and Sheffer, 1994, p. 1), there is one area of increasing convergence. With the advent of Optimality Theory, several phonologists have moved toward the recognition that variation is more profitably modeled as part of a single grammar than as code-switching between several invariant grammars. This development seems to be due to the fact that OT can model variation with more ease and less theoretical apparatus than Lexical Phonology, which required the introduction of variable rules (Labov, 1972, p. 218). Since OT is already based on cross-linguistic variation in constraint ranking, modeling variation is simply a matter of constraint re-ranking within a single grammar. Variation may be modeled through completely separate rankings (Kiparsky, 1993 as cited in Reynolds and Sheffer, 1994, p. 3); through crucially unranked constraints (Reynolds, 1994); by allowing a certain constraint to float above a specified range of fixed constraints (Nagy and Reynolds, 1996); or by positing a certain amount of “disharmony” so that the ranking of constraints overlaps somewhat (Boersma, 1997, p. 45). In the absence of quantitative data, these approaches are arguably notational variants of one another. However, Anttila has pointed out that several fully ranked grammars are presumably less learnable than one partially ranked one (1997, p. 49). Kager notes that only a partially ranked grammar captures the connection between the variable outputs and the specific constraints that must be re-ranked to cause this variation (1999, p. 405). Finally, Stochastic OT demonstrates the learnability of rankings within a single grammar where domination is not of the strict, all-or-nothing kind (Boersma, 1997). The ease with which variation can be modeled in OT, combined with recent theorizing about learnability, thus gives strong support to sociolinguists’ old contention that a single variable grammar is theoretically preferable to several invariant ones (Labov, 1972, p. 187).

Poliquin’s dissertation describes a variable phenomenon which, as he himself points out, is clearly linguistically constrained, given speaker agreement about the unacceptability of certain logically possible tetrasyllabic patterns of harmony (2006, p. 10). However, Poliquin assumes that his task is to account for invariant, individual grammars, and he reports his data in a way that reinforces this assumption. For example, because Poliquin assumes that his judgment task provides sufficient proof for the status of each pattern of harmony as a “possible grammar” (2006, p. 43), he collects minimal production data and does not report on how the frequency of variants in production correlates with their frequency of acceptability. Moreover, Poliquin’s theoretical assumptions cause him to downplay the fact that two of his 12 speakers do accept tetrasyllabic variants other than the four “attested” forms (2006, p. 77). Poliquin considers this “speaker error” because these forms should not be “producible” given his
assumptions about the parameters necessary to account for the variation (2006, p. 77). In sum, Poliquin’s assumption that the observed variation in vowel harmony need not be modeled except as isolated and invariant grammars limits his access to explanations for the observed linguistic constraints on harmony. His suggestion that this may be a case of “nanovariation” in which speakers do not have enough data to be able to set their parameters for “iterativity and locality” (2006, p. 9) rests on the assumption that variation is abnormal and “paradoxical” (p. 42).

I take the view that accounting for a variable phenomenon must include both a way to model variant outputs, and a way to formally model the linguistic constraints on variation through a single, variable grammar. The fact that Poliquin attempts to do neither undermines his conclusion that OT cannot account for the CF facts. I suggest that including variation as an analytical tool makes it easier to develop an OT account for opacity in CF vowel harmony, and makes it possible to hypothesize about the linguistic constraints on vowel harmony in a way that a derivational account cannot.

In addition, the CF case is an interesting test case for phonological theory, because OT attempts to model the constraints on variation make different quantitative predictions than attempts to marry the variable rule with Lexical Phonology. As Guy has pointed out, the quantitative predictions that can be made in OT are limited to showing how many possible permutations of a given set of constraints can produce each variant form (1997, p. 138). Conversely, in the case of CF vowel harmony, a Lexical Phonology account cannot explain the relative frequency of different types of variation, such as the higher acceptability of the adjacent pattern of harmony over the non-local pattern (Poliquin, 2006, p. 68), since the Harmony rule never applies more than once in Poliquin’s cycle. However, OT can potentially make these linguistic conditioning factors fall out from the variable grammar.

Canadian French vowel harmony in a variationist perspective

I propose that by according a more central role to variation in the grammar, we can substantially improve the OT account of CF vowel harmony. Each of the elements in my account improves on Poliquin’s Turbidity account by according a more realistic role to variation. This allows it to account for musical-type opacity and to make a better quantitative prediction about tetrasyllabic harmony.

Accounting for tetrasyllabic harmony

Poliquin’s claim that it is impossible to account for all the patterns of harmony in tetrasyllabics is weakened when variation is recognized within a single grammar. Using crucially unranked and floating constraints, it is possible to rank the constraints relevant to harmony (NoGap, MATCH-LEFTMOST, MATCH-ADJACENT, and *[+HIGH, -ATR]) so that unattested candidates will only surface minimally, while the four “attested” patterns will be the most common. This may be preferable to a ranking in which the “unattested” patterns are always judged impossible, especially given the crucial fact that such forms
do surface minimally in the judgment task (Poliquin 2006, p. 73), as well as the absence of available information about the frequency of such “unattested” forms in production.

For demonstration purposes, I will consider two of many possible rankings: (1) the case in which all logically possible rankings of the four harmony constraints are equally likely and (2) the case where *+[HIGH, -ATR] floats, any ranking of the two MATCH constraints with respect to each other is equally likely, and NOGAP is ranked in between the MATCH constraints. In the former case, there are 24 logically possible rankings, while in the latter there are eight. Table 2 shows the number of rankings that allow each tetrasyllabic candidate to win, exemplified by the tetrasyllabic similitude ‘similitude’.

Table 2. Frequency of tetrasyllabic harmony variants on two different constraint rankings

<table>
<thead>
<tr>
<th>Variant*</th>
<th>Type of harmony</th>
<th>(1) All logically possible rankings of harmony constraints equally likely</th>
<th>(2) *+[HIGH, -ATR] floats, any ranking of MATCH constraints with respect to each other equally likely, and NOGAP floating between MATCH constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>si.mi.li.tyd</td>
<td>No harmony</td>
<td>8 (33%)</td>
<td>2 (25%)</td>
</tr>
<tr>
<td>si.mi.li.tyd</td>
<td>Adjacent non-iterative</td>
<td>4 (16.7%)</td>
<td>2 (25%)</td>
</tr>
<tr>
<td>si.mi.li.tyd</td>
<td>Non-local non-iterative</td>
<td>2 (8.3%)</td>
<td>1 (12.5%)</td>
</tr>
<tr>
<td>si.mi.li.tyd</td>
<td>Across-the-board</td>
<td>8 (33%)</td>
<td>3 (37.5%)</td>
</tr>
<tr>
<td>*si.mi.li.tyd</td>
<td>Adjacent, two iterations</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>*si.mi.li.tyd</td>
<td>Adjacent and non-local</td>
<td>2 (8.3%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>*si.mi.li.tyd</td>
<td>Non-local, two iterations</td>
<td>2 (8.3%)</td>
<td>1 (12.5%)</td>
</tr>
<tr>
<td>*si.mi.li.tyd</td>
<td>Only second vowel</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

Ranking (1), on which all 24 possible rankings of the four harmony constraints are equally possible, represents an improvement over the model in which any parameter setting for iterativity or locality is equally probable. Under ranking (1), with the exception of the non-local non-iterative pattern, the more acceptable patterns will also be

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9 Although there are only eight possible rankings, there are nine results here because on the ranking MATCH-L[-ATR] LEFTMOST >>*[HIGH, -ATR] >>NOGAP>>MATCH-L[-ATR] ADJACENT, both non-local harmony candidates won.
attested more frequently. The advantage of the second hypothesized ranking is that it predicts that the adjacent non-iterative pattern will be quite frequent, in line with its fairly high acceptability to speakers (Poliquin, 2006, p. 68).

It seems that, contrary to Poliquin’s assertion, there does exist an empirically testable and descriptively adequate way to account for transparent harmony patterns in OT. When variation is considered to occur within a single grammar, an explanation for the linguistic constraints on vowel harmony becomes available: the relative frequencies of the different patterns are related to the number of possible rankings that produce each variant. Poliquin’s assumption that each variant represents an independent grammar and that therefore the one “unattested” pattern will occur as frequently as any of the “attested” patterns (2006, p. 272) prevents him from considering this possibility.

**Accounting for derivational opacity**

In order to account for derivational opacity, I propose three modifications to the Turbidicity model as described by Poliquin. First, I posit that the harmonic trigger need not be word-final. I define the domain of harmony as any vowel that projects a [-ATR] feature, and all vowels to the left of this projecting vowel, thus allowing words in which the harmonic trigger is non-final to be well-formed. In an OT model, this is independently necessary to account for harmony in words like *uniquement* ([g60/g17/g81/g44/g78/g17/g80/g68]) where the initial vowel can be lax due to closed-syllable laxing in the second syllable (Poliquin, 2006, p. 26). Lexical Phonology can of course account for such cases by having harmony apply before suffixation of /-ma/.

There is independent evidence for assuming a non-word-final harmonic trigger. Both Poliquin and Dumas observe that high vowels in non-word-final closed syllables can be lax, although they note that laxing is less frequent here than word-finally (Dumas, 1976, p. 162; Poliquin, 2006, p. 26). Poliquin differentiates the two kinds of laxing by calling word-final laxing “obligatory” and other closed-syllable laxing “optional” (2006, p. 5), though without providing production or judgment evidence. However, there seems to be no reason why “optional” processes cannot condition others. Work by Fast (2003) on laxing in Canadian French, which involved acoustic analysis of 312 tokens of lax vowels from 24 speakers, showed significant differences in the degree of laxing in final closed syllables, suggesting that the distinction between obligatory and optional is somewhat artificial. I will therefore redefine the MATCH constraints as follows.

**MATCH[-ATR]-L (LEFTMOST/ADJACENT):** Within a sequence of high vowels, if the final high vowel is [-ATR], the leftmost/adjacent high vowel will be [-ATR].

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10 These data also suggest that laxing itself may be a gradient process, an issue that deserves further empirical research.
Note that if laxing rates are lower word-internally than word-finally, then a non-derivational account will predict lower rates of harmony in *uniquement* than in *illumine*, where the trigger is word-final. If quantitative data supported this prediction, this would constitute independent evidence in favour of a parallelist analysis in which the harmony trigger in *uniquement* was not word-final.

Second, in order to eliminate candidates in which a lax stem-final vowel optionally licenses harmony in the vowels to its left (e.g., *[my.zi.kal]*) and to ensure that lax vowels in open syllables may only occur as a result of harmony, I posit a constraint requiring lax vowels to be licensed. This constraint will be satisfied by *[my.zi.kal]* if and only if the second syllable projects a [-ATR] feature.

*UNLICENSED[-ATR]: A [+HIGH] vowel in an open syllable may not be [-ATR] unless it occurs anywhere to the left of a vowel that bears the feature [-ATR].

This constraint follows from the need to allow non-word-final harmony triggers, but is also independently necessary to account for the *missive* facts. In Poliquin’s discussion of Turbidity (2006, p. 308), he does not evaluate the candidate *[mi.si’ve]* (in which the second vowel projects only [+ATR]), which, given his constraints, should win though it has no turbid structure. *UNLICENSED[-ATR] will eliminate this candidate, thus preserving the explanatory adequacy of the Turbidity account.

Third, in order to prevent a candidate like *[my.zi.kal]* (with no covert structure) from winning, I posit faithfulness to the feature [ATR] in the base/truncated form through the constraint MAX-BA[ATR] (cf. Kager, 1999, p. 264). Poliquin notes the possibility of invoking positional output-to-output (OO)-faithfulness, such that a candidate *[my.zi.kal]* would be faithful only to the first syllable of base form *[my.zik]*. He rightly points out that this would be difficult to motivate (2006, p. 310). However, given the constraints already introduced, any candidate with a lax [ɪ] will be eliminated by PRONOUNCE[+ATR]. Candidates with lax [ɛ] will survive if and only if the [-ATR] feature is licensed by being to the left of another [-ATR] feature. Together, these facts will conspire so that of the candidates that are faithful to a base form, only *[my.zi.kal]* and *[my.zi.kal]* (with [i] projecting covert [-ATR]) will survive. MAX-BA[ATR] must be ranked above the harmony constraints to ensure that the *[my.zi.kal]* candidate (projecting only [+ATR]) does not eliminate all the other remaining candidates.

Given that harmony is always optional, there are actually two related base forms to which the speaker could be faithful: *[my.zik]* or *[my.zik]*. For my purposes it will be sufficient to evaluate this constraint as if speakers are being faithful to a related form whose initial syllable may be either [+ATR] or [-ATR] but whose final syllable is lax, i.e. *[mY.zIlk]*; the results will be the same. I will use bold uppercase to denote archiphonemes whose specification for [ATR] is irrelevant to this discussion.
The following ranking allows all and only the attested patterns of harmony for *musical* to be obtained:

\[
\text{PRONOUNCE [+ATR], *[+ATR]/ __C]o, MAX-BA [mY.zik], *UNLICENSED [-ATR] >> *[+HI, -ATR], MATCH-L [-ATR] ADJACENT, NOGAP, MATCH-L [-ATR] LEFTMOST >> PRONOUNCE [-ATR], IDENT-IO [ATR].}
\]

Tableau 1 illustrates the results of this ranking. Since *+[ATR]/ __C]o, NOGAP, and IDENT-IO [ATR] are never violated, and violations of PRONOUNCE [-ATR] can never be critical, these constraints are not evaluated in the tableau. In addition, for typographical convenience, I represent only one possible ranking of the harmony constraints. While candidate (b) wins on this ranking, candidate (a) will win on other rankings of the harmony constraints.

**Tableau 1: Vowel harmony in *musical* ‘musical’**

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<tbody>
<tr>
<td>a</td>
<td>-    +</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>+    -</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>+    -</td>
<td></td>
<td>+</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>d</td>
<td>-    -</td>
<td></td>
<td>+</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>+    +</td>
<td></td>
<td>+</td>
<td>*</td>
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<tr>
<td>f</td>
<td>-    +</td>
<td></td>
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<td>*</td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>-    -</td>
<td></td>
<td>+</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>h</td>
<td>+    +</td>
<td></td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

While this ranking accounts for derivational opacity, it has several clear disadvantages.

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11 Projected features [+ATR] and [-ATR] are abbreviated as + and -, respectively.
12 Recall that the PRONOUNCE constraint also stands for the related RECIPROCITY constraint. For this candidate, it is RECIPROCITY that is violated.
First, the use of MAX-BA[ATR] predicts that the penultimate syllable of transparent tetrasyllabics will project a covert [-ATR] due to faithfulness to a related form. However, this will occur only when there is a related form to which to be faithful.

Second, and more seriously, if MAX-BA applies to tetrasyllabics it will result in unattested patterns and prevent attested ones, regardless of its ranking. For *illuminisme* ‘illumination’, faithfulness to any form of the related base *illumine* ‘illumine’ will involve at least faithfulness to a final lax vowel. However, this will eliminate forms like [i.ly.mi.nism] where the correspondent vowel is tense. If we assume this vowel projects covert [-ATR], the candidate will satisfy MAX-BA but be eliminated due to an additional violation of lower-ranked PRONOUNCE[-ATR]. Tableau 2 shows how this process eliminates the attested non-harmonic and non-local candidates, while allowing two unattested candidates to survive. (I have collapsed all the harmony constraints into one, since their ranking is irrelevant here, and am not showing all the eliminated candidates.)

Tableau 2. Elimination of attested tetrasyllabic candidates through MAX-BA

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In short, the OO-faithfulness constraint that was needed to eliminate the candidate [my.zi.kal] (with no turbid structure) causes the model to fail to account properly for tetrasyllabic harmony. The intuition in cases of opacity that speakers can obtain the covert [-ATR] specification through faithfulness to a related base form makes exactly the wrong prediction for transparent tetrasyllabics. There are a few potential caveats, however.

First, Poliquin states that only eight tetrasyllabic words exist to his knowledge in CF. Of the five examples that he lists (*similitude*, *syphilitique*, *inhibitif*, *illuminisme*, *inhibitrice*) (2006, p. 73), only two have a related trisyllabic base form: *syphilitique* is related to *syphilis*, and *illuminisme* to *illumine*. MAX-BA would only be relevant to the latter forms. Unfortunately, we do not have access to the data showing which words stimulated which acceptability judgments.
Second, the infrequency of tetrasyllabics lends some credence to Poliquin’s idea that the grammar may still be stabilizing. In order to show that tetrasyllabics formed a negligible part of the input to adults, Poliquin searched a corpus of adult spoken French and found eight different tetrasyllabic words. While he does not provide data, he notes that some of these words may have occurred with high token frequency (2006, p. 50). Thus, it may be possible that one of the frequent tetrasyllabics is one where MAX-BA would be irrelevant, and that speakers somehow based their acceptability judgment by analogy on this form.

Conclusion

Overall, it seems to be the case that a Lexical Phonology account can cover the CF harmony facts more easily and elegantly than any OT account, as long as it only has to account for one grammar at a time. However, by increasing the role of variation in verifying or refining phonological theory, I have substantially improved the possibility of accounting for the CF data in an OT framework. I proposed constraints that were based on the assumption of the normality of variation, such as an OO-faithfulness constraint that considers faithfulness to several possible variants. I also showed that crucially unranked or floating constraints can give a realistic approximation of attested tetrasyllabic frequencies when one takes into account the number of rankings that can produce each candidate. In addition, my modification to allow the harmonic trigger to be non-word-final was possible partly because I did not assume, as Poliquin does, that optional laxing cannot trigger harmony. Finally, throughout the paper I made quantitative, testable predictions, emphasizing that if production data had been available, both an OT and a Lexical Phonology account could be empirically tested. The possibility remains that a constraint-based account, despite its awkwardness, would better match actual production frequencies. My proposal is therefore a demonstration that with different assumptions about variation, a more descriptively adequate account is possible.

References


