

Polish o-Raising and Phonological Explanation

Eugene Buckley
University of Pennsylvania

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1. Phonologists who have worked with Kenstowicz's 1994 textbook are familiar with the example of Polish o-Raising (pp. 74–78), discussed in detail also by Bethin (1978) and Gussmann (1980). I argue that while a synchronic analysis can be constructed to “explain” various aspects of the process, the **primary locus of explanation for the pattern is historical**, and in the modern grammar many of these aspects are best treated as **lexicalized**.

2. The general pattern of Raising is that the vowel /o/ becomes [u] before a **voiced word-final consonant**. This is true even if the final consonant is an obstruent that is voiceless on the surface; more on this below. The raised vowel is **written** <ó>, and is pronounced identically to <u>. Other spellings: *ą, c, ch, cz, ć, ę, ł, ó, rz, sz, ś, y, ź, ż* = [oN, ts, x, č, tɕ, eN, w, ñ, ž, š, ɕ, ʝ, z, ź].

a.	<i>moj-a</i>	<i>mój</i>	‘my’ (FEM., MASC.NOM.SG.)
b.	<i>pokoj-u</i>	<i>pokój</i>	‘peace’ (GEN.SG., NOM.SG.)
c.	<i>stodoł-a</i>	<i>stodół</i>	‘barn’ (NOM.SG., GEN.PL.)
d.	<i>mol-a</i>	<i>mól</i>	‘moth’ (GEN.SG., NOM.SG.)
e.	<i>pol-e</i>	<i>pól</i>	‘field’ (NOM.SG., GEN.PL.)
f.	<i>por-a</i>	<i>pór</i>	‘time’ (NOM.SG., GEN.PL.)
g.	<i>morz-e</i>	<i>mórz</i>	‘sea’ (NOM.SG., GEN.PL.)
h.	<i>woz-u</i>	<i>wóz</i>	‘cart’ (GEN.SG., NOM.SG.)
i.	<i>brzoz-a</i>	<i>brzóz</i>	‘birch’ (NOM.SG., GEN.PL.)
j.	<i>słow-o</i>	<i>słów</i>	‘word’ (NOM.SG., GEN.PL.)
k.	<i>krow-a</i>	<i>krów</i>	‘cow’ (NOM.SG., GEN.PL.)
l.	<i>godz-ę</i>	<i>gódź</i>	‘agree’ (1SG.IMP.F., IMPER.)
m.	<i>bob-a</i>	<i>bób</i>	‘bean’ (GEN.SG., NOM.SG.)
n.	<i>robi-ę</i>	<i>rób</i>	‘do’ (1SG.IMP.F., IMPER.)
o.	<i>chorob-a</i>	<i>chorób</i>	‘sickness’ (NOM.SG., GEN.PL.)
p.	<i>brod-a</i>	<i>bród</i>	‘beard’ (NOM.SG., GEN.PL.)
q.	<i>wrog-a</i>	<i>wróg</i>	‘enemy’ (GEN.SG., NOM.SG.)
r.	<i>drog-a</i>	<i>dróg</i>	‘road’ (NOM.SG., GEN.PL.)

3. Before a **voiceless consonant**, the alternation is (normally) not found.

a.	<i>szop-a</i>	<i>szop</i>	‘shed’ (NOM.SG., GEN.PL.)
b.	<i>kot-a</i>	<i>kot</i>	‘cat’ (GEN.SG., NOM.SG.)
c.	<i>cioci-a</i>	<i>cioc</i>	‘aunt’ (NOM.SG., GEN.PL.)
d.	<i>otok-u</i>	<i>otok</i>	‘circumference’ (GEN.SG., NOM.SG.)

4. And (in the standard dialect) there are no examples of raising before a **nasal consonant**.

a.	<i>dom-u</i>	<i>dom</i>	‘home’ (GEN.SG., NOM.SG.)
b.	<i>stron-a</i>	<i>stron</i>	‘side’ (NOM.SG., GEN.PL.)
c.	<i>obron-a</i>	<i>obron</i>	‘defense’ (NOM.SG., GEN.PL.)
d.	<i>koni-a</i>	<i>koni</i>	‘horse’ (GEN.SG., NOM.SG.)

5. We can understand the failure of raising before a nasal as an effect of **vowel nasalization** — nasalized vowels are often lowered (cf. Hajek 1997), and there is ample historical Polish evidence of confusion between [ɔ] and [o] in nasal contexts (Stieber 1973). But the failure before voiceless consonants is more mysterious, and why **raising before voiced consonants** in the first place?

Historical origin

6. Historically, this alternation began as a relation between **vowel length** and voicing in a following consonant — an extremely widespread association, and well known in English. Specifically, loss of a final yer vowel triggered **compensatory lengthening**, and this process was prevented by a following voiceless consonant. By the early 16th century, Polish lost distinctive vowel length, in most cases merging the long and short versions of the same vowel. But **long /ō/ merged with /u/**, resulting in an alternation in height rather than length (Stieber 1973; Carlton 1990).

a. *inherited situation*

Some case forms with YER vowel [ɨ]	por-ɨ	por-a	dom-ɨ	dom-u
Others with normal vowel such as [a, u]				

b. *around 1000*

Loss of weak yer vowels	pōr	pora	dōm	domu
Compensatory lengthening before voiced C				

c. *by around 1350*

Secondary qualitative distinctions (e.g. long mid is higher than short mid)	pōr	pōra	dōm	dōmu
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d. *beginning after 1450*

Elimination of length distinction	por	pōra	dom	dōmu
Preservation of quality: $\bar{o}, \bar{ɔ} \rightarrow o, ɔ$				

e. *beginning after 1600*

Vowel merger: $o, u \rightarrow u$ and $ɔ \rightarrow o$	pur	pōra	dom	domu
Except $o \rightarrow o$ before a nasal				

7. An alternative explanation (Dunaj 1966) relies on **accent shift** from the yer that deletes; see also Bethin (1978:46). Either way, what began as a natural length alternation has, due to a similarly natural vowel merger, become an odd raising rule. Such phonologizations are very common.

8. An additional complication, one that has made these facts of particular interest to phonologists, is the further effect of **word-final devoicing**, which arose perhaps in the fourteenth century (Stieber 1973:115f). As mentioned, Raising applies even though a final obstruent loses its voicing.

a.	<i>kot-a</i>	<i>kot</i>	[kot]	‘cat’ (GEN.SG., NOM.SG.)
b.	<i>brod-a</i>	<i>bród</i>	[brut]	‘beard’ (GEN.SG., NOM.SG.)
c.	<i>mol-a</i>	<i>mól</i>	[mul]	‘moth’ (GEN.SG., NOM.SG.)

9. A standard analysis (Kenstowicz 1994:77) will make use of **rule ordering to relate these two phenomena**: the devoicing of final obstruents and the raising of /o/ in a final syllable before a voiced consonant. (Gussmann 1980:124 includes reference to a following yer vowel.)

$$\begin{bmatrix} -\text{cons} \\ +\text{back} \\ -\text{low} \end{bmatrix} \rightarrow [+\text{high}] / \text{---} \begin{bmatrix} +\text{cons} \\ +\text{voiced} \\ -\text{nasal} \end{bmatrix} \#$$

a.	<i>Underlying Representation</i>	/ kot /	/ brod /	/ mol /
b.	<i>o-Raising</i>	—	brud	mul
c.	<i>Final Devoicing</i>	—	brut	—

10. The o-Raising rule is not “natural”, as Kenstowicz (1994:78) acknowledges. Thus, it is not deemed necessary to explain **why Raising should take place in this context** — i.e. why voicing conditions a change in height, and why nasals are excluded. That much is assigned to **history** (cf. also Kenstowicz and Kisseberth 1977:64).

11. Although the **cause** of the relationship between Raising and Devoicing is taken to be historical, the rule-ordering analysis does attempt to capture the **fact** of a formal relationship in synchronic terms by means of the Raising rule and its reference to [+voiced]; but **its origin lies in history as well**. Further, a look at the facts shows that there are many **exceptions** to this supposed relationship, calling into question just what needs to be “explained”.

Lexicalization

12. Quite unexpectedly based on the Raising rule, some vowels followed by **voiceless consonants** do raise. In the last two cases both raised and unraised outputs are attested by various sources.

a.	<i>stop-a</i>	<i>stóp</i>	‘foot’ (NOM.SG., GEN.PL.)
b.	<i>kop-a</i>	<i>kóp</i>	‘heap’ (NOM.SG., GEN.PL.)
c.	<i>robot-a</i>	<i>robót</i>	‘work’ (NOM.SG., GEN.PL.)
d.	<i>sobot-a</i>	<i>sobót</i>	‘Saturday’ (NOM.SG., GEN.PL.)
e.	<i>cnot-a</i>	<i>cnót</i>	‘virtue’ (NOM.SG., GEN.PL.)
f.	<i>wrot-a</i>	<i>wrót</i>	‘gate’ (NOM.SG., GEN.PL.)
g.	<i>powrot-u</i>	<i>powrót</i>	‘return’ (GEN.SG., NOM.SG.)
h.	<i>rosn-ę</i>	<i>rós-ć</i>	‘grow’ (1SG.IMP.F., INFIN.)
i.	<i>os-a</i>	<i>os ~ ós</i>	‘wasp’ (NOM.SG., GEN.PL.)
j.	<i>sierot-a</i>	<i>sierot ~ sierót</i>	‘orphan’ (NOM.SG., GEN.PL.)

13. Conversely, some native words ending in a **voiced consonant** do **not** undergo Raising. It is especially common for words ending in a liquid, as discussed further below.

a.	<i>batog</i>	‘cowhide (whip)’
b.	<i>skrob</i>	‘scrape’ (IMPER.)
c.	<i>chodź</i>	‘walk’ (IMPER.)
d.	<i>tor</i>	‘rail’
e.	<i>kaczor</i>	‘drake’
f.	<i>kąkol</i>	‘corn cockle’
g.	<i>gruczoł</i>	‘gland’
h.	<i>woź ~ wóz</i>	‘carry’ (IMPER.)
i.	<i>smródź ~ smródź</i>	‘make stench’ (IMPER.)

14. **Consonant clusters** present another complication. Although it is the voicing feature of the final member of the cluster that generally determines whether the rule applies (a–e), Brooks (1975:72) states that there is no alternation when first member is a nasal or one of the consonants [z, j, l, ł, r], though of course all of these are voiced segments (f–h).

a.	<i>bobr-a</i>	<i>bóbr</i>	‘beaver’ (GEN.SG., NOM.SG.)
b.	<i>siostr-a</i>	<i>sióstr</i>	‘sister’ (NOM.SG., GEN.PL.)
c.	<i>plot-łem</i>	<i>plót-ł</i>	‘wove’ (1SG.MASC., 3SG.MASC.)
d.	<i>prośb-a</i>	<i>prośb</i>	‘request’ (NOM.SG., GEN.PL.)
e.	<i>groźb-a</i>	<i>groźb ~ groźb</i>	‘bulkhead’ (GEN.SG., NOM.SG.)
f.	<i>klomb-u</i>	<i>klomb</i>	‘flowerbed’ (GEN.SG., NOM.SG.)
g.	<i>drozd-a</i>	<i>drozd</i>	‘thrush’ (GEN.SG., NOM.SG.)
h.	<i>czołg-u</i>	<i>czołg</i>	‘tank’ (GEN.SG., NOM.SG.)

15. But notice **exceptions** even to this rather complex statement.

- | | | | |
|----|-----------------|---------------|----------------------------------|
| a. | <i>wioz-łem</i> | <i>wióz-ł</i> | ‘carried’ (1SG.MASC., 3SG.MASC.) |
| b. | <i>spojrz-ę</i> | <i>spójrz</i> | ‘look’ (1SG.PERF., IMPER.) |

16. Typically the importance of such exceptions is minimized. Gussmann (1980:115) claims that “[t]hese exceptions can in no way obscure the basic regularity of the raising”; he marks non-undergoers as exceptions to the rule, and writes a special rule for unexpected undergoers such as *stóp*. But such irregularities are exactly what we should expect if, in fact, Raising has become a **property of specific vowel tokens** rather than a fact about the grammar as a whole.

Analysis

17. In addition to the basic features of the vowel (as mid and back), the Raising rule in 9 includes **reference to three essential factors**:

- Vowel is in final syllable
- Consonant is voiced
- Consonant is not nasal

18. Which factors are really still part of the Raising process? Certainly location in the **final syllable** remains relevant, since that determines **when the rule applies** in the relevant stems.

19. A side note: In **diminutives**, the stem-final vowel is sometimes raised, even though it is not word-final. Gussmann (1980:119) relates the major generalizations to the gender of the noun (raising as the norm for feminine and neuter). I suspect it is actually a matter of **syllable structure**: the vowel of the stem-final syllable in the diminutive shares [±high] with the vowel in the non-diminutive stem form that shares the property of having that vowel in an open or closed syllable. (A residue of irregular cases must be listed under any account.)

- | | | | | |
|----|---------------|------------|----------------|----------------------------------|
| a. | <i>lo.d-a</i> | <i>lód</i> | <i>lo.d-ek</i> | ‘ice’ (GEN.SG., NOM.SG., DIM.) |
| b. | <i>wo.d-a</i> | <i>wód</i> | <i>wód-ka</i> | ‘water’ (NOM.SG., GEN.PL., DIM.) |
| c. | <i>po.l-e</i> | <i>pól</i> | <i>pól-ko</i> | ‘field’ (NOM.SG., GEN.PL., DIM.) |

20. Returning to the Raising rule: The featural properties of the consonant are less obviously important than location in the word. We have seen that the historically crucial property of **voicing has counterexamples in both directions** — voiceless with alternation, voiceless without alternation. And the inclusion of [–nasal] is necessary only in connection with the feature [+voiced], to exclude that subset of voiced consonants.

21. Why this difference? With the advent of word-final **Devoicing**, the voicing criterion of Raising lost its relevance — particularly if we accept a surface-oriented approach such as Optimality Theory (Prince and Smolensky 1993). But there was never a change in the **final-syllable location**, so that much has remained consistent and an active part of the speaker’s representation of the process.

22. I propose that once final devoicing had obscured the context for the application of Raising, eligibility to undergo the process became an **arbitrary property of certain vowels**. A way of marking this distinction is by **selective use of underspecification** (cf. Kiparsky 1993, Inkelas, Orgun, and Zoll 1994, Buckley 1994).

23. Vowels that are **stably [u] or [o]** have an explicit value for [high] (or a value that is reliably provided by default); vowels that **alternate between [u] and [o]** are unspecified, and that value is determined by rule or constraint.

a.	stable /u/	[+high]	e.g. <i>król-a – król</i> ‘king’	= /krul/
b.	stable /o/	[–high]	e.g. <i>gol-a – gol</i> ‘goal’	= /gol/
c.	alternating /O/	[high]	e.g. <i>mol-a – mól</i> ‘moth’	= /mOl/

24. These representations are combined with a **feature-filling process** that prefers [+high] in a word-final syllable, otherwise [–high].

25. For historical reasons, underspecified /O/ tends to be located in **particular contexts**, i.e. before an underlyingly voiced (non-nasal) consonant. But this lexical approach correctly predicts exceptions to this tendency, and that borrowings will be assimilated in various ways, partly determined by resemblance to existing words and other factors unrelated to voicing. This approach is also very much in line with the notion of **Lexicon Optimization**, whereby stable feature values are underlyingly specified in order to minimize input–output discrepancies (Prince and Smolensky 1993, Inkelas 1995).

26. And now, of course, **rule ordering** with Devoicing is unnecessary. This approach also eliminates the ordering problem presented by the inclusion of a **clitic** in the “word” domain for the rule, e.g. *pomógł* ‘helped’, *pomogł=em* ‘I helped’ (Booij and Rubach 1987): feature-filling occurs relative to the larger word, without an issue of ordering before Devoicing.

27. This use of underspecification might be termed “opportunistic” (Steriade 1995:116). But the increasing development of exceptions suggests that **this is what learners actually do**; in fact, we should expect them to be eminently opportunistic, using any means at their disposal to create representations that permit them to mimic the patterns in the language they hear. Selective specification of features to reflect the behavior of particular vowels is a simple means of encoding these patterns while still using basic building blocks of the grammar. If phonology is intended to model the behavior of language learners, then this use of underspecification may be exactly right.

Loanwords

28. Borrowings into the language confirm the **idiosyncratic nature of the process**. Some do not undergo the alternation. This is especially true for **masculine** nouns, borrowed in the citation form without a suffix, i.e. as a **surface violation** of the Raising generalization (Bethin 1978:49).

a.	<i>snob</i>	‘snob’
b.	<i>gol</i>	‘goal’
c.	<i>buldog</i>	‘bulldog’
d.	<i>pistol</i>	‘pistol’
e.	<i>cenzor</i>	‘censor’
f.	<i>epizod</i>	‘episode’
g.	<i>rapsod</i>	‘rapsody’
h.	<i>wirtuoz</i>	‘virtuoso’

29. Some loanwords show the alternation, especially **feminine and neuter** nouns in which the borrowed citation form has a suffix, and the raised vowel occurs in the derived suffixless genitive plural (Steele 1973, Bethin 1978).

a.	<i>mod-a</i>	<i>mód</i>	‘fashion, mode’ (NOM.SG., GEN.PL.)
b.	<i>od-a</i>	<i>ód</i>	‘ode’ (NOM.SG., GEN.PL.)
c.	<i>pagod-a</i>	<i>pagód</i>	‘pagoda’ (NOM.SG., GEN.PL.)
d.	<i>proz-a</i>	<i>próz</i>	‘prose’ (NOM.SG., GEN.PL.)
e.	<i>doz-a</i>	<i>dóz ~ doz</i>	‘dose’ (NOM.SG., GEN.PL.)
f.	<i>tog-a</i>	<i>tóg ~ tog</i>	‘toga’ (NOM.SG., GEN.PL.)
g.	<i>konwoj-u</i>	<i>konwój</i>	‘convoy’ (GEN.SG., NOM.SG.)

30. The last example, *konwój*, shows that even when the source form has final-syllable [o] on the surface, it can still be assimilated to the Raising pattern. This word provides evidence that **resemblance to existing words in the lexicon** is an important factor in such assimilation: notice the asymmetry in numbers of words listed by Grzegorzczkova and Puzynina (1973).

FINAL SEGMENTS	–woj	–wój	–oj	–ój
WORD COUNT	2	22	12	97
EXAMPLES	both are obscure: <i>woj, podwoj</i>	<i>swój</i> ‘one’s own’ <i>twój</i> ‘your’ <i>rozwój</i> ‘development’ <i>zwój</i> ‘roll, coil’	a third are exclamations: <i>oj,</i> <i>ojoj, ojoj, ahoj</i>	<i>bój</i> ‘fight’ <i>mój</i> ‘my’ <i>pój</i> ‘drinking’ <i>strój</i> ‘clothing’

31. Some of these words are **obscure** and do not appear in a 758-page Polish-English dictionary (Bulas et al. 1969), including both the words listed as –woj, whereas the –wój category includes common words and others likely to be known by most speakers. Similarly, a full third of the superset –oj class consists of exclamations, while –ój includes many common words.

32. These facts suggest **considerable lexical pressure** for *convoy* to be borrowed treated as *konwój* rather than more transparent **konwoj*. In this case, apparently, the pressure overcame the default choice of borrowing the citation form as is. This generalization depends on a lexicon-based approach to the specification of the vowel in the borrowed word, and fits perfectly with the approach proposed here. Further investigation will, I predict, reveal similar examples.

33. A subgeneralization involves the **liquids** [r, r', l, l']. In the **native vocabulary**, these most often condition Raising. (Note that <rz> = [ʒ] is the surface realization of palatalized [r'].)

- | | | | |
|----|-----------------|---------------|-----------------------------|
| a. | <i>dwor-y</i> | <i>dwór</i> | ‘court’ (NOM.PL., NOM.SG.) |
| b. | <i>wybor-y</i> | <i>wybór</i> | ‘choice’ (NOM.PL., NOM.SG.) |
| c. | <i>komor-y</i> | <i>komór</i> | ‘closet’ (NOM.PL., GEN.PL.) |
| d. | <i>zapor-y</i> | <i>zapór</i> | ‘dam’ (NOM.PL., GEN.PL.) |
| e. | <i>morz-e</i> | <i>mórz</i> | ‘sea’ (NOM.SG., GEN.PL.) |
| f. | <i>sol-i</i> | <i>sól</i> | ‘salt’ (GEN.SG., NOM.SG.) |
| g. | <i>topol-a</i> | <i>topól</i> | ‘bee’ (NOM.SG., GEN.PL.) |
| h. | <i>pozwol-ę</i> | <i>pozwól</i> | ‘allow’ (1SG.PERF., IMPER.) |
| i. | <i>koł-o</i> | <i>kół</i> | ‘wheel’ (NOM.SG., GEN.PL.) |
| j. | <i>stoł-y</i> | <i>stół</i> | ‘table’ (NOM.PL., NOM.SG.) |
| k. | <i>sokoł-y</i> | <i>sokół</i> | ‘falcon’ (NOM.PL., NOM.SG.) |

34. But there are “not infrequent **exceptions**” (Gussmann 1980: 116).

- | | | |
|----|-----------------|------------------------|
| a. | <i>tor</i> | ‘rail’ |
| b. | <i>znachor</i> | ‘witch doctor’ |
| c. | <i>gwiazdor</i> | ‘star’ |
| d. | <i>kaczor</i> | ‘drake’ |
| e. | <i>sikor</i> | ‘titmouse’ (GEN.PL.) |
| f. | <i>bajor</i> | ‘muddy pool’ (GEN.PL.) |
| g. | <i>węgorz</i> | ‘eel’ |

h.	<i>kąkol</i>	‘corn cockle’
i.	<i>ramol</i>	‘gaga’
j.	<i>certol</i>	‘fuss’ (IMPER.)
k.	<i>ogol ~ ogól</i>	‘shave’ (IMPER.)
l.	<i>gruczoł</i>	‘gland’
m.	<i>warchoł</i>	‘brawler’
n.	<i>chochoł</i>	‘capsheaf’

35. **Loanwords ending in a liquid** generally do not alternate. (Gussmann 1980:116 reports “almost no” raising before borrowed [l], but does not provide an example that does have Raising. Sources differ on whether *doktor* has a raised variant *doktór*.)

a.	<i>honor</i>	‘honor’
b.	<i>aktor</i>	‘actor’
c.	<i>pomidor</i>	‘tomato’
d.	<i>metafor</i>	‘metafor’ (GEN.PL.)
e.	<i>furor</i>	‘success’ (GEN.PL.)
f.	<i>gol</i>	‘goal’
g.	<i>symbol</i>	‘symbol’
h.	<i>alkohol</i>	‘alcohol’
i.	<i>parol</i>	‘parole’
j.	<i>gondol</i>	‘gondola’ (GEN.PL.)

36. Once again, a **lexicon-based approach** deals quite well with these examples: the prior existence of final [or] licenses the same structure in a borrowing. Thus *sikora* – *sikor* ‘titmouse’ serves as precedent for *metafora* – *metafor* (with uniform realization of the stem) rather than *metafór*.

37. Since non-raised [o] is less common before other segments, such as the (underlyingly) voiced obstruents, there more **indeterminacy**. The most important criterion in these cases appears to be the **citation form**: a direct counterexample such as *snob* is borrowed as invariant /o/, while ambiguous *moda* is borrowed as underspecified /O/, thus *mód*, to conform to native words like *broda* – *bród* ‘beard’. **Lexical pressure** can override this pattern, as in *konwój*. The complete absence of existing words with Raising before a **nasal** predicts that no loanword will do this either.

Conclusion

38. As mentioned above, the statistical preponderance of underspecified /O/ in **particular contexts**, i.e. before an underlyingly voiced consonant, is due to the historical development of the vocalic category. But since the causation is historical only, we correctly predict exceptions to this tendency, which will gradually become more and more obscured over time. And as we have seen, **borrowings will be assimilated in various ways**, partly determined by resemblance to existing words or other factors unrelated to voicing. Refinement of this claim is a goal of future work.

39. Those words that **vary** with regard to Raising, such as *woź* ~ *wóź* ‘carry!’, can be treated in whatever way other sorts of **lexical variation** are handled. I am inclined toward a multiple listing of lexical choices, as for example the variant pronunciations of English *hoof* as [huf] and [huf] would require listing the two vowel options for speakers that possess both. A sufficiently sophisticated approach should permit listing of just the aspect of the representation that varies.

40. The underspecification approach appears to be compatible with **other vowel alternations** in Polish, such as *e* ~ *o*, which interacts with Raising. This rule of **Backing** changes /e/ to [o] when followed by a nonpalatalized coronal (Gussmann 1980:65). The resulting vowel is often, but not always, susceptible to Raising.

a.	<i>kościel-e</i>	<i>kościół-y</i>	<i>kościół</i>	‘church’ (LOC.SG., NOM.PL., NOM.SG.)
b.	<i>aniel-e</i>	<i>anioł-y</i>	<i>anioł</i>	‘angel’ (LOC.SG., NOM.PL., NOM.SG.)

If the /e/ that undergoes Backing to [o] lacks specification for both [back] and [high], then compatibility with Raising follows automatically. The /e/ that backs to [o] but does not raise will have [-high] but be similarly unspecified for [back]. Further details regarding this and other vowel alternations, such as $\epsilon \sim a$, and $e \sim a$, remain for future research.

41. A point of serious interest for further investigation is the extent to which this sort of feature underspecification tends eventually to be **eliminated from grammars**, and to what extent this elimination can be attributed to some version of Lexicon Optimization that prefers fully specified (**determinate**) underlying forms, or — with equivalent effect — invariant surface realizations.

References

- Bethin, Christina. 1978. *Phonological rules in the nominative singular and genitive plural of the Slavic substantive declension*. Dissertation, University of Illinois at Urbana.
- Booij, Geert, and Jerzy Rubach. 1987. Postcyclic versus postlexical rules in Lexical Phonology. *Linguistic Inquiry* 18, 1–44.
- Brooks, Maria Zagorska. 1975. *Polish reference grammar*. Mouton.
- Buckley, Eugene. 1994. Prespecification of default features: the two /i/’s of Kashaya. *Proceedings of the 24th Annual Meeting of NELS*, pp. 17–30. GLSA, U Mass Amherst.
- Bulas, Kazimierz, Lawrence L. Thomas, and Francis J. Whitfield. 1969. *The Kościuszko Foundation Dictionary: English-Polish, Polish-English* (vol. II, Polish-English).
- Carlton, Terence R. 1990. *Introduction to the phonological history of the Slavic languages*. Slavica.
- Dunaj, Bogusław. 1966. *Wzdłużenie zastępcze w języku polkim*. *Prace językoznawcze* 17. Nakł. Uniwersytetu Jagiellońskiego.
- Gussmann, Edmund. 1980. *Studies in abstract phonology*. MIT Press.
- Hajek, John. 1997. *Universals of sound change in nasalization*. (Publications of the Philological Society, 31.) Blackwell.
- Inkelas, Sharon. 1995. The consequences of Optimization for underspecification. *Proceedings of NELS 25*. GLSA, University of Massachusetts, Amherst.
- _____, C. Orhan Orgun, and Cheryl Zoll. 1994. Exceptions and static phonological patterns: Cophonologies vs. prespecification. Ms., UC Berkeley.
- Grzegorzczkova, Renata, and Jadwiga Puzynina. 1973. *Indeks a tergo do Słownika języka polskiego pod redakcją Witolda Doroszewskiego*. Państwowe Wydawnictwo Naukowe.
- Kenstowicz, Michael. 1994. *Phonology in generative grammar*. Blackwell.
- _____, and Charles Kisseberth. 1977. *Topics in phonological theory*. Academic Press.
- Kiparsky, Paul. 1993. Blocking in Non-Derived Environments. S. Hargus and E. Kaisse (eds), *Studies in lexical phonology* (Phonetics and phonology 4). Academic Press, pp. 277–313.
- Jodłowski, S., and W. Taszycki. 1967. *Słownik ortograficzny*. Ossolineum.
- Prince, Alan S., and Paul Smolensky. 1993. *Optimality Theory: Constraint interaction in generative grammar*. Ms., Rutgers University and University of Colorado, Boulder.
- Stieber, Zdzisław. 1973. *A historical phonology of the Polish language*. Carl Winter.
- Steriade, Donca. 1995. Underspecification and markedness. In J. Goldsmith (ed.), *The Handbook of Phonology*, 114–174. Blackwell.

Dept of Linguistics
619 Williams Hall
University of Pennsylvania
Philadelphia, PA 19104-6305

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gene@unagi.cis.upenn.edu