Rule Order and Rule Compatibility

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The notion of rule ordering has played a key role in the development of modern phonological theory. From the earliest days of generative phonology, the ordering of phonological rules has been adduced to account for morphophonemic derivations and to point out the interrelatedness of forms within a given language. Based on the analogy of chronological ordering of diachronic rules, the notion of extrinsically ordered synchronic rules has seemed to many investigators to place an undue strain on the credibility of phonological descriptions, and, while remaining within the domain of generative phonological theory, several recent studies have sought alternatives to the extrinsic ordering of phonological rules. The well-known studies of Ringen (1972), Koutsoudas (1973), and Koutsoudas, Sanders, and Noll (1974), among others, explored the arguments previously adduced in favor of extrinsic rule ordering and proposed alternative analyses which permitted simultaneous application of rules, allowing only for intrinsic ordering, i.e., ordering based on the inherent characteristics of the rules themselves. While subsequent studies have offered various refinements for the unordered rule hypothesis (URH), few have challenged the basic premise of the hypothesis, since simultaneous application, aside from often being empirically more defensible, provides, in most cases, simpler and more manageable phonological descriptions. Recently, however, several studies have discussed apparent counterexamples to the URH, and to its major corollary, the Obligatory-Optional Precedence Relation, which states that when the structural description of both an obligatory and an optional rule are met by the same form, the obligatory rule must necessarily apply first. The most recent of such attempts is the work of Horn (1974), who produces evidence from a dialect of Portuguese in order to reject both the URH and its corollary. The purpose of the present note will be to reexamine the data discussed by Horn, and in the process to offer an alternative characterization which does not necessitate rejection of the URH. The goal of this reexamination is not merely to provide another round in the sparring match between proponents of the URH and its opponents, which would be a trivial enough concern, but also to offer additional reflections on the basic notions of obligatory and optional rules and the constraints governing their use in phonological descriptions.

Horn's data are derived from the Mirandese dialect of continental Portuguese, although they apply almost integrally to other continental dialects and to a few Brazilian dialects, such as that of Rio de Janeiro. In essence, her discussion concerns the interaction of three rules. The first, a general rule of vowel nasalization, nasalizes vowels followed by a tautosyllabic nasal consonant, roughly:

(1) $V \rightarrow [+nas] \; / \; \_\_\_ \left\{ \begin{matrix} N \\ \# \end{matrix} \right\}$

The second rule deletes the corresponding nasal consonant if followed by a continuant or a word boundary:

(2) $N \rightarrow \phi \; / \; \_\_\_ \left\{ \begin{bmatrix} \# \\ C \\ +cont \end{bmatrix} \right\}$

Finally, there is an optional rule of resonant syllabification which changes a sequence of unstressed vowel plus resonant consonant into a syllabic resonant:

(3) $\overset{1}{\breve{V}} \begin{bmatrix} C \\ +son \end{bmatrix} \overset{2}{\rightarrow} \phi \quad \begin{bmatrix} 2 \\ +syl \end{bmatrix}$

Vowel nasalization is obligatory in all dialects of Portuguese; in fact, in most dialects nasalization (although not nasal deletion) also occurs before nasal consonants in the following syllable (cf. Lipski 1975). Rule 2 is presumably also obligatory in the dialect under discussion (but cf. the discussion below), thus removing surface sequences of nasal vowel plus nasal consonant plus continuant; e.g., /pensei/ → [pẽséi̯] 'I thought' but /entrar/ → [ẽⁿtrár] 'to enter'. One might in fact wish to collapse 1 and 2 into a single rule of vowel nasalization, except that, in Horn's analysis, rule 3 must be applied between 1 and 2 in order to correctly account for alternative forms with a syllabic resonant, such as [pn̩séi̯], [n̩trár], etc.:

	/pensei/	/entrar/
(1)	[pẽnsei]	[ẽntrar]
(3)	[pn̩sei]	[n̩trar]

Examination of the rules as presently formulated reveals in fact that if rule 2 is ordered before 3, forms like [pn̩séi] cannot be generated, since the environment for 3 is destroyed; on the other hand, the order 3-2 provides vacuous application of 2, since all its environments are bled by 3. Finally, simultaneous application is ruled out because of the mutually contradictory nature of 2 and 3 when applied to the same forms. Superficially, then, the analysis as sketched above appears to provide a counterexample to both the URH and the obligatory-optional precedence order. Further examination, however, reveals several points at which the description can be improved, thus altering the eventual conclusions.

Rule 1 seems, for the most part, to be beyond reproach. While it is conceivably possible to analyze Portuguese as exhibiting phonemic nasal vowels, the number of morphophonemic alternations occurring between

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nasal vowels and nasal consonants tips the balance in favor of an underlying representation containing only oral vowels. This is especially true since most dialects of Portuguese appear to be headed toward partial or total implementation of the most general rule of vowel nasalization, namely the universal tendency of vowels to nasalize when followed by a nasal consonant (cf. Lipski 1975).

Rule 3 is also well motivated, particularly in the continental dialects of Portuguese, where severe reduction of unstressed vowels often causes loss of syllabicity in syllables containing nonsonorant consonants, and syllabification of resonants. This phenomenon occurs not only in Mirandese, but in other European dialects, and occasionally also in Brazil, extending at times even to stressed vowels, especially in the word *uma* [ũma] ~ [m̩a] 'one'.

As might be suspected, the problem lies in the formulation of rule 2, deleting nasal consonants before noncontinuants and word boundaries. The latter part of the rule, deleting word-final nasals, is unobjectionable, since word-final nasal consonants do not normally occur in Portuguese, although frequently the nasal offglide accompanying most word-final nasal vowels assumes some consonantal characteristics (cf. Nobiling 1913). However, word-internally, matters are much more complex, regardless of the dialect being considered. In the first place, both in the Mirandese dialect and in other Portuguese dialects, nasal consonants may or may not appear before following noncontinuants; thus, for example, *entrar* may be [ẽtrár] or [ẽⁿtrár], and so forth. Psycholinguistic considerations also enter into play at this point, since the literacy of the individuals involved often determines the perception of nasal consonants. As an example, Morais-Barbosa (1961) reports conversations held in Lisbon, where speakers aware of the spelling of words like *campo* 'country' "heard" five sounds, i.e., claimed to perceive a nasal consonant, while illiterate speakers, presented with an identical pronunciation, perceived only four sounds. In any case, the nasal consonant which precedes noncontinuant consonants is at best fleeting and transitory, and is not articulated with the clarity of a full consonant. This fact led earlier investigators, such as Hall (1943) and Feldman (1967) to posit 'prenasalized' phonemes /ᵐb/, /ⁿd/, etc.

In phonetic terms, it appears more feasible to analyze the nasal 'transition sounds' which appear between nasalized vowels and following consonants in terms of prenasalization of the oral consonants in contact with a nasal vowel, i.e., a form of progressive assimilation. Head (1965), in a series of experimental observations, noted that this prenasalization also occurs between nasal vowels and following *continuant* consonants; such nasal offglides frequently pass unobserved due to the lack of phonemic nasal fricatives with which to identify them. Perhaps a more accurate analysis would characterize this prenasalization as a form of diphthongization, as defined in Andersen (1972), by assigning a mora structure to the nasal vowels and the following consonants. In any event, the key observation in this regard concerns the sporadic nature of this transitory nasal sound, which does not appear to be the direct phonological reflex of an underlying nasal consonant. Such an assertion is difficult to assess directly, since the phonotactics of Portuguese, like the other Romance languages, has always demanded that any nasal consonantal sound be homorganic with a following consonant. However, one method of empirically testing the claim that the nasal sound appearing between nasal vowels and following consonants is due to prenasalization of the oral consonant offers itself at the word boundary. Ordinarily, Portuguese tolerates no word-final nasal consonants, since rule 2 or some variant thereof deletes final nasals. When the word following a final nasal vowel begins with a consonant, however, one may observe the behavior occasioned by the juxtaposition of the nasal vowel and the following oral consonant. Nasal transition sounds of the sort described above do in fact appear, and, as might be anticipated, they are homorganic with the following consonants. Typical examples include the following:

lã branca [lɐ̃ᵐbrɐ̃ᵑkɐ]
'white wool'
homem sensível [õmẽn̩sẽn̩sívəɫ]
'sensitive man'
bom dia [bõⁿdíɐ]
'good day'

This prenasalization occurs before fricatives as well as before stops, thus indicating a more generalized process of diphthongization, as noted previously.

The events described above suggest that the analysis of Portuguese vowel nasalization may be reworked to indicate the precise nature of the prenasalization process. Instead of a rule such as 1, which nasalizes vowels, followed by 2, which deletes nasal consonants, the suggested reanalysis would offer a unified rule of vowel nasalization and consonant deletion, similar to:

$$(4)\quad \underset{1}{V}\ \underset{2}{N}\ \begin{Bmatrix}\#\\ C\end{Bmatrix}_{3} \rightarrow \tilde{V}\ \phi\ 3$$

Whether in fact rule 4 should be broken into two separate rules is at the moment immaterial, although under the proposed solution there is no evidence which suggests splitting it; thus, application of Occam's Razor dictates a single rule.

Prenasalization of consonants following nasal vowels would be handled by a rule of the general form:

$$(5)\ \phi \rightarrow \begin{bmatrix}N\\ \alpha\text{features}\end{bmatrix} / \tilde{V}\ \_\ \begin{bmatrix}C\\ \alpha\text{features}\end{bmatrix}$$

In addition, some provision must eventually be made to indicate the weakly articulated and transitory nature of the inserted nasal sound, to distinguish it from a full nasal consonant.

At first glance, replacing 1 and 2 by 4 and 5 appears to be an arbitrary reshuffling of rules to arrive at the same output, since in most cases the phonetic result will be identical regardless of which pair of rules is applied. It should be noted, however, that while proposed rule 4 is considered obligatory, the corresponding rule 5 may, in many instances, be *optional,* thus accounting for the less than totally regular appearance of the nasal transition sounds. Most importantly, consider the results of examining the pair

4-5 under the criterion of the URH. As presently formulated, 5 cannot apply until 4 has operated, since Portuguese presumably exhibits no underlying nasal vowels. Thus, 4 and 5 are intrinsically ordered and may consequently be applied simultaneously to produce results like:

	/pensei/	/entrar/
(4)	[pẽsei]	[ẽtrar]
(5)	[pẽ^{ŋ}sei]	[ẽ^{n}trar]

So far, the URH allows for production of all the standard variants. We must now face the question of how to incorporate rule 3, resonant syllabification, in order to produce the alternate forms like [pn̩sár], [n̩trár], etc. It is at this stage that there arises a need to reexamine the concepts of obligatory and optional rule application and ordering precedence. As presently stated, the 'optional' rule 3 must apply before the 'obligatory' 4, since 4 destroys all the environments to which 3 could potentially apply. However, it makes no sense to speak of 'ordering' 3 *before* 4, since 3 equally effectively bleeds off all the environments to which 4 and 5 might apply. It is in fact obvious that rules 3 and 4 are *mutually contradictory*, that is, both potentially apply to the same environments, and each destroys the environments for the other. In such a case, the requirements of scientific precision render it unacceptable to speak in terms of vacuous application of rule ordering, regardless of the so-called obligatoriness of one or the other of the rules in other circumstances. Rather, it should be accepted that, in this special case of rule interaction, the native speaker of Portuguese actually has a choice between *two* alternative derivations:

	A		*B*
	/pensei/		/pensei/
(4)	[pẽsei]	(3)	[pn̩sei]
(5)	[pẽ^{ŋ}sei]		

In other words, choice of rule 3 precludes application of 4, and vice versa. What *is* obligatory in this situation is the application of either 3 or 4-5, since without application of either rule set, unacceptable outputs would result.

In cases of mutually contradictory rules, it is therefore suggested that strict notions of optional vs. obligatory, referring to rules acting in isolation, be replaced by constraints referring to the mutual interaction of phonological rules in a single derivation, since only in this fashion will the empirical choices available to the native speaker be most accurately reflected. It may moreover be proposed that the Obligatory-Optional Precedence Relation be amended (if not replaced) to include the following provision, which may be termed the Contradictory Rule Hypothesis (CRH):

> *CRH*: Whenever two rules *x* and *y* potentially apply to a single form F, and when *x* and *y* are mutually contradictory (that is, application of *x* destroys all environments for *y* and vice versa), then at most one of the pair (*x*, *y*) may apply to F. Moreover, if failure to apply either *x* or *y* would result in unacceptable output, then one and only one of the pair (*x*, *y*) may apply to F.

It is apparent that the CRH may be extended to any number of mutually contradictory rules. This hypothesis, as tentatively stated above, makes no mention of obligatory or optional rules in isolation, since in conditions of mutual interaction such notions are meaningless. A form to which resonant syllabification has been applied, yielding, for example, [n̩trár], cannot be further subject to vowel nasalization, regardless of the status of vowel nasalization in other positions. Therefore, the CRH redefines the notions of optional and obligatory as pertaining to the interaction of rules, i.e., the overall form of the phonological derivation, rather than to individual rule applications.

What has been suggested is by no means a definitive statement regarding rule ordering. In particular, the suggestions offered are based on examination of a single case (but cf. Lipski 1974 for a similar example, also from Portuguese). The notion of derivational constraints is not new to linguistic theory, and within phonology many examples have been discussed where failure to consider constraints on the overall derivation yields incomplete or inaccurate results. By further considering situations involving choices between mutually exclusive rules, it may be possible to further generalize such hypotheses as the URH and thereby salvage phonological investigation from the seemingly endless stream of examples and counterexamples to which it has been subject.

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