CHAPTER 7
Interaction between rules

7.1 Introduction to rule formalisation and ordering

Previous chapters have shown the need for more than one level of phonological representation. If we assume that there are underlying representations from which surface (phonetic) representations are derived, we shall often need more than one rule to map underlying representations on to surface representations. The situation can be compared to rush hour city traffic at a road junction, with rules queueing up to be applied. Police officers or traffic lights are needed to regulate the flow of traffic. Likewise, in phonology a mechanism is needed to determine which one of several rules affecting a piece of data has precedence over other rules. Obviously, where rules do not interfere with each other, where they are like traffic on parallel one way streets, the question of regulation does not arise. I illustrate this with English examples in [7.1]:

\[
\begin{align*}
[7.1] & \quad [ph^h\text{t}] \quad \text{pit} \quad [p^{wh}ul] \quad \text{pool} \\
& \quad [th^h\text{k}] \quad \text{tick} \quad [t^{wh}uk] \quad \text{took} \\
& \quad [k^{hi}l] \quad \text{keel} \quad [k^{wh}ul] \quad \text{cool} \\
& \quad [\text{\text{"a\"e}th\end{end}}] \quad \text{attend} \quad [\text{\text{"a}k^{wh}ustik}] \quad \text{acoustic}
\end{align*}
\]

The rules we needed to account for [7.1] are listed informally in [7.2]

\[
\begin{align*}
[7.2] & \quad (a) \quad \text{voiceless stops are aspirated at the beginning of a stressed syllable;} \\
& \quad (b) \quad \text{consonants are labialised (rounded) before rounded vowels;} \\
& \quad (c) \quad \text{velar consonants are fronted (palatalised) before high front vowels.}
\end{align*}
\]
Rules [7.2b] and [7.2c] do not affect each other. There is no interaction problem since they do not have the same structural description, i.e. the phonetic properties of their inputs are different. Rule [7.2b] requires the presence of a rounded vowel, and all such vowels are back in English while rule [7.2c] stipulates that there must be a high front vowel. The two rules are like traffic on different highways. There is no possibility of their interfering with each other.

Determine whether rule [7.2a] interferes with either of the other two rules.

The answer must be 'no' since the voiceless stop at the beginning of a stressed syllable is aspirated regardless of the vowel that follows. Here again no traffic control system is needed. It would make no difference to the final output whatsoever which order the rules were applied in. Regulation of rule interaction is required only if one rule affects in some way the potential input to another rule.

Before we examine more closely the problem of rule interaction, I shall introduce you to the basic formal conventions used by generative phonologists because normally rules are written using distinctive features and formal notation. The motivation for rule formalisation is that it increases the explicitness of linguistic descriptions and makes it easier to expose woolly or incoherent analyses. I shall introduce the basic formal conventions of GENERATIVE PHONOLOGY, by restating formally in [7.3] the rules outlined above in [7.2]:

\[7.3\] input becomes output in the environment

(a) \([-\text{cont}]\] \([-\text{voice}\] e.g. /k/ becomes \[k^h]\] before a stressed vowel (as in acoustic)

(b) \[+\text{cons}\] e.g. /t/ becomes \[t^w]\] before a rounded vowel (as in too)
A formal rule consists of the following:
(a) the *input*, which states the sound or sounds affected by the rule;
(b) the *arrow*, which means ‘re-write as’ or ‘is realised as’ or ‘becomes’ (but no historical development is implied);
(c) what occurs to the right of the arrow is the *output* of the rule;
(d) following the output, there is a diagonal line ‘/’ to the right of that line is the *environment*, the line which forms part of the environment shows precisely where the changed segment is located;
(e) brackets round an element (like (C) in [7.3a]) indicate that a given element is optional – the rule applies regardless of the presence or absence of any optional element. In this instance it indicates that a voiceless plosive is still aspirated even where a consonant intervenes, as in *prayer*.

We shall turn to French for our next example of rule interaction and rule formalisation.

Usually in French, an underlying word final consonant is deleted unless it is followed by a vowel. This produces alternations like *[trioko]* (*le*) *tricot* ‘knitted wear’ and *[trikote]* *tricoter* ‘to knit’. A good place to look for examples of this is the alternation between the masculine and feminine form of nouns and adjectives:

[7.4] **FINAL CONSONANT DELETION**

<table>
<thead>
<tr>
<th>Masculine</th>
<th>Feminine</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>/bas/</em></td>
<td>*/bas/ [ba] bas <em>/bas/</em> [bas] basse ‘low’</td>
</tr>
<tr>
<td><em>/fat/</em></td>
<td><em>/fat/</em> [fa] chat <em>/fat/</em> [fat] chatte ‘cat’</td>
</tr>
<tr>
<td><em>/fod/</em></td>
<td><em>/fod/</em> [fo] chaud <em>/fod/</em> [fod] chaude ‘hot’</td>
</tr>
</tbody>
</table>

In the underlying representation the feminine form ends in *[a]*. Phonetically, however, that final vowel is normally deleted in contemporary French – it is the so-
called ‘silent e’. In fact, this vowel has not always been ‘silent’. It was weakly pronounced as [a] in Old French. Even today, when French poetry is recited, ‘silent e’ is scrupulously pronounced as [a] in certain contexts. The rules regulating the pronunciation or omission of [a] are complex. Their main function is to determine whether [a] contributes to the syllable count. See Grammont (1961). The rule of final consonant deletion which applies to underlying representation can be formalised as [7.5]:

\[ [7.5] \text{[cons]} \rightarrow \emptyset \rightarrow \{ C \} \]

Remarks on the notation:
(i) \( \emptyset \) means zero i.e. the segment is rewritten as zero – in other words it is deleted.
(ii) \# = word boundary
(iii) the curly brackets \{ \} indicate alternatives; here deletion of a consonant occurs either before a consonant or before a boundary at the end of a word.

Next consider VOWEL NASALISATION, another phonological process which occurs in French:

\[ [7.6] [f\tilde{E}] \text{ fin} \quad \text{‘end’} \\
[\text{d\`a}] \quad \text{dans} \quad \text{‘in’} \\
[r\tilde{o}\text{b\`e}] \quad \text{robin} \quad \text{‘lawyer (pejorative)’} \\
[f\tilde{\varepsilon}] \quad \text{faim} \quad \text{‘hunger’} \\
[s\tilde{o}] \quad \text{sans} \quad \text{‘without} \\
[\tilde{o}] \quad \text{on} \quad \text{idf. pron. ‘one’} \\
[\tilde{\alpha}] \quad \text{en} \quad \text{‘in’} \\
[t\tilde{o}] \quad \text{tant} \quad \text{‘so much’} \\
[mul\tilde{e}] \quad \text{moulin} \quad \text{‘mill’} \]

The rule to account for [7.6] is given in [7.7].

\[ [7.7] V \rightarrow [+nasal] / \rightarrow \{ C \} \]

Strictly speaking distinctive features should always be used in the formal statement of rules. But in practice, for convenience, instead of using distinctive features, we often adopt the convention of using V to represent any vowel, C to represent any consonant, G to represent any glide and N to represent any nasal.

Rule [7.7] states that a vowel is nasalised if it is followed by a nasal consonant which in turn is followed by
either another consonant or a word boundary in the underlying representation.

If you turn now to [7.8], you will see that rule [7.7] does not apply to the vowels in [7.8b] because in the underlying representation, none of them is followed by either a nasal consonant which is in turn followed by another consonant or appears in word final position. But nasalisation does apply to the vowels in [7.8a] because their underlying representations satisfy the requirements of the nasalisation rule. (We shall use the abbreviations UR and PR to stand for Underlying Representation and Phonetic Representation respectively):

**[7.8a] UR**

- /bɔn/ [bɔn (masc.) ‘good’
- /ameriken/ [amerikɛ] américain (masc.) ‘American’
- /dɔns/ [dɔ] dans ‘in’
- /marin/ [marɛ] marin ‘marine’ (masc.)
- /tant/ [tɑ] tant ‘so much’
- /an/ [ɑ] an (masc.) ‘year’
- /mulin/ [mule] moulin (masc.) ‘mill’
- /fɔnd/] [fɔ] fond (masc.) ‘bottom’
- /fɔndamɔtal/ [fɔdamɔtal] fondamental ‘fundamental’
- /fin/ [fɛ] fin (fem.) ‘end’

**[7.8b] UR**

- /bɔnɔmi/ [bɔnɔmi] bonhomie (fem.) ‘good nature’
- /amerikɛna/ [ameriken] américaine (fem.) ‘American’
- /dada/ [dada] dada (masc.) ‘hobby-horse’
- /marinɔ/ [marin] marin ‘marine’ (fem.)
- /ta/ [tɑ] ta ‘your’ (sing.)
- /a/ [ɑ] à prep. ‘to’
- /ane/ [ane] année (fem.) ‘year’
- /mulinaz/ [mulina:3] moulinage ‘milling (noun)’
- /fɔ/wa/ [fɔwa] fois (fem.) ‘time, occasion’
- /finalite/ [finalite] finalité (fem.) ‘finality’
Before moving on, list separately words in [7.8a] which have nasalised vowels:
(a) due to being followed by a nasal in word final position:
(b) due to being immediately followed by a nasal which is in turn followed by another consonant.

The words bon and fin are obvious examples of the effects of rule (a) and fondamental of rule (b).

7.2 Linear rule ordering

The French data in [7.8] pose a rule ordering problem. A word like an [ã] is subject both to the rule that deletes final consonants which are not immediately followed by a vowel and also to the nasalisation rule. To determine the order in which the two rules should be applied, we can try out the two derivations in [7.9] and [7.10] and see which one yields the correct output.

[7.9] Underlying representation /an/
First apply
   Rule [7.5]: Final consonant deletion
   [+cons] → Ø / ₀ / [C] / ₀
   (This deletes the /n/ of an as it is word-final.)
Then apply
   Rule [7.7]: Vowel nasalisation
   [−cons] → [+nasal] / ₀ / [+nasal] / ₀ / [C] / ₀
   The nasalisation rule fails to apply because the nasal which triggers off the nasalisation process is absent, having been deleted by [7.5]. Consequently the final output is *[a]. This is obviously incorrect.

Let us now try applying the two rules in reverse order, assuming again that the underlying representation is /an/.

[7.10] First apply
   Rule [7.7]: Vowel nasalisation
   [−cons] → [+nasal] / ₀ / [+nasal] / ₀ / [C] / ₀
This yields [än] (and a lowering rule affecting nasalised vowels subsequently turns it into /än/).

Then apply
Rule [7.5]: Consonant deletion
\[ [+\text{cons}] \rightarrow \emptyset / \begin{array}{|c|c|}
\text{C} & \# \\
\end{array} \]

By this rule /än/ loses its final /n/ and becomes [ä], which is the correct phonetic form.

This example shows that there are situations where the order in which rules apply makes a difference. That being the case, principles regulating the order in which rules apply are needed.

In SPE Chomsky and Halle proposed that rules should be LINEARLY ORDERED. To illustrate this, suppose in the phonological component of the grammar of a given language there are thirty rules. By this principle, the rules would be arranged in a list and it would be stipulated that each rule applies after all the rules that precede it and before all the rules that follow it on the list. It would not be possible, for instance, to apply rule two after rule ten, where both rules are applicable. Once a particular order has been established, it is strictly observed in every derivation in a language. Furthermore, a rule can only apply once in a derivation. This means that a rule cannot re-apply in the same derivation either to its own output or to the output of another rule ordered after it which satisfies its structural description.

If the application of one rule has absolutely no effect on the potential input to another rule, the question of the sequence of application of those rules simply need not be raised. This was established at the beginning of the first section of this chapter. However, the question of linear ordering arises in a very interesting way where one rule can affect another, as in the French data above. We shall explore this again by examining some data from Luganda.

[7.11] Luganda glide formation

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>UR</td>
<td>UR</td>
</tr>
<tr>
<td>PR</td>
<td>PR</td>
</tr>
</tbody>
</table>

| /mu+ana/ [mwa:na] | /mu+ti/ [muti] ‘tree’ |
| ‘child’           |                       |
Interaction between rules

/mu+ojo/ [mwo:jo] ‘soul’ /mu+kazi/ [mukazi] ‘woman’
/li+anda/ [lja:nda] ‘coal’ /li+no/ [lino] ‘this’
/mi+aka/ [mja:ka] ‘years’ /mi+ti/ [miti] ‘trees’
(+ is a sign for a morpheme boundary.)

Contrast the realisation of the underlying high vowels /i/ and /u/ in columns A and B. Write in your own words the rule which captures the relevant generalisation.

In [7.12] I have written the rule out formally (ignoring for the moment the fact that the vowel that follows the glide is lengthened).

[7.12] V
[+high] → [−syllabic]/ V

[7.12] states that a high vowel becomes a nonsyllabic glide when it is followed by another vowel.

Luganda has another rule which is of interest in this context. It is an optional rule which deletes a root-initial /j/ which is preceded by certain CV prefixes. The effect of that rule is shown in [7.13].

[7.13] UR PR
/tu+jagala/ [twa:gala] or [tujagala] ‘we like, want’
/ku+jaka/ [kwa:ka] or [kujaka] ‘to blaze’
/mu+jola/ [mwo:la] or [mujola] ‘you (pl.) carve’
/tu+jela/ [twe:la] or [tujela] ‘we sweep’
/mu+jiko/ [mujiko] or [mwi:ko] ‘trowel’

Where a prefix is represented by a lone V, root-initial /j/ is not deleted:

[7.14] UR PR
/a+jagala/ [ajagala] ‘he/she likes, wants’
/e+jaka/ [ejaka] ‘it blazes’
/a+jola/ [ajola] ‘he/she carves’
/a+jela/ [ajela] ‘he/she sweeps’
The /j/ deletion rule, can be written as [7.15]:

\[ [7.15] \quad /j/ \rightarrow \emptyset /CV[^{+\text{Pref.}}] + - V \]

These Luganda examples show that in order to derive the correct output in [7.13] for words like [twe:la] 'we sweep', it is necessary to apply the /j/ deletion rule in [7.15] before the glide formation rule in [7.12].

Work out the reason for this before you read on.

If we assume that rules apply linearly, until [7.15] has been applied to a form like /tu+jela/, the vowels /u/ and /e/ are separated by /j/ and the input to glide formation is not available and so glide formation cannot be applied. For glide formation to apply, a high vowel must be adjacent to another vowel. The deletion of /j/ creates the input to glide formation. The implications for rule ordering are obvious: /j/ deletion must precede glide formation if both rules are to apply. Technically, this kind of rule relationship where one rule opens the door to the application of another rule is called FEEDING ORDER.

The reverse is also possible. One rule may prevent or pre-empt the application of another. In that case the rules are said to be arranged in a BLEEDING ORDER. We shall explore this type of rule interaction using data from Swahili.

Swahili has a rule of homorganic nasal assimilation. Here it is illustrated applying to forms in noun class 9. This class contains many nouns referring to non-humans:

\[ [7.16] \quad \begin{array}{ll}
\text{UR} & \text{PR} \\
/N+boga/ & [mboga] \quad \text{’vegetable’} \\
/N+bu/ & [mbu]^2 \quad \text{’mosquito’} \\
/N+dizi/ & [ndizi] \quad \text{’banana’} \\
/N+dama/ & [ndama] \quad \text{’calf’} \\
/N+jugu/ & [njugu] \quad \text{’peanut’} \\
/N+guruwe/ & [nguruwe] \quad \text{’pig’} \\
/N+goma/ & [ngoma] \quad \text{’drum’} \\
\end{array} \]

The nasal prefix /N/ undergoes homorganic nasal assimilation. If a noun root begins with a voiced consonant, the nasal class prefix adjusts to its place of articulation so that it is labial, or alveolar or velar depending on whether
the first consonant of the noun root is labial, alveolar or velar (see section 5.3.4).

To write this rule formally we need to use Greek letter variables like $\alpha$ (alpha), $\beta$ (beta) and $\gamma$ (gamma) which range over both plus and minus values of a given feature. Thus, $N \ C [\alpha:ant] [\alpha:ant]$ means that the nasal and the consonant after it are either both [+ant] or both [-ant]; $[\beta back] [\beta back]$ means that the nasal and the consonant after it are either both [+back] or both [-back] etc. Building on that, we can account for [7.16] using this formal homorganic nasal assimilation rule:

\[
[7.17] \quad N [+nas] \rightarrow \begin{bmatrix} \alpha \text{ ant} \\ \beta \text{ cor} \\ \gamma \text{ back} \end{bmatrix} / \rightarrow \begin{bmatrix} \alpha \text{ ant} \\ \beta \text{ cor} \\ \gamma \text{ back} \end{bmatrix}
\]

Where, however, the noun root begins with a voiceless stop, the assimilation rule in [7.17] is blocked. In that case, the stop following the nasal is aspirated and the nasal itself is dropped, as you can see:

\[
[7.18] \quad /N+pange/ [p^{\text{hange}}] \quad \text{'gadfly'} \\
/ N+taa/ [t^{\text{haa}}] \quad \text{'lamp'} \\
/ N+kubwa/ [k^{\text{hubwa}}] \quad \text{'big (adj.)'}
\]

The rules at work here are shown in [7.19] and [7.20].

[7.19] Voiceless stop aspiration ([+spread] means ‘aspirated’)

\[
[-\text{cont.}] \rightarrow [+\text{spread}] / N+ _
\]

(Voiceless stops are aspirated after the class 9 nasal prefix.)

[7.20] Nasal deletion

\[
N \rightarrow \emptyset / _+ \begin{bmatrix} -\text{cont.} \\ -\text{voice} \\ +\text{spread} \end{bmatrix}
\]

(The nasal prefix is deleted before aspirated voiceless stops.)

The nasal deletion rule, it turns out, applies not only where a nasal is followed by a voiceless stop, but also where any other obstruent (that is, a fricative or affricate or stop) follows a nasal:
[7.21] /N+fimbo/ [fimbo] 'stick' (not *[mfimbo])
/N+siku/ [siku] 'day' (not *[nsiku])
/N+\text{tJumvi}/ [t\text{h}umvi] 'salt' (not *[nt\text{humvi}])

If we turn our attention to rule interaction, we observe that the nasal deletion rule BLEEDS the homorganic nasal assimilation rule. Having been deleted by [7.20], the nasal is no longer available to the assimilation rule in [7.17].

Now work out how nasal deletion [7.20] interacts with aspiration [7.19].

Since it is the presence of a class 9 nasal prefix which triggers off aspiration, the aspiration rule in [7.19] must precede nasal deletion [7.20], if we assume that these rules apply in a linear order. Having conditioned the aspiration, the nasal can be subsequently deleted. If the order were reversed, and [7.20] applied first, deleting the nasal, the input to [7.19] would be destroyed and the correct surface form would not be derived. The upshot is that given two obligatory rules, one of which can POTENTIALLY BLEED the other, they must be ordered in a manner that ensures that bleeding is avoided.

Now return to the French consonant deletion and vowel nasalisation examples above and see how these rules affect each other. You will recall that in order to get the right output, it is important that vowel nasalisation precedes consonant deletion; if the order is reversed, vowel nasalisation is blocked because the deletion of the consonant robs nasalisation of its input.

When two rules interact in such a way that one of them would be blocked if their order were reversed, those rules are said to be in a COUNTER-BLEEDING relationship. The French rules [7.5] and [7.7] are in a counter-bleeding relationship: unless vowel nasalisation precedes consonant deletion the derivation aborts because nasal deletion would destroy the input to vowel nasalisation. There are a number of other rule relationships which we need not go into in an introductory book of this kind.
7.3 Abandoning extrinsic ordering

The linear ordering hypothesis is presented above without considering any possible alternatives. It is assumed that phonological rules must be ordered so as to ensure that their interaction is correctly handled. For instance, where one rule would destroy the input to another (i.e. where rules are in a BLEEDING RELATIONSHIP) or where the prior application of one rule opens up the possibility of applying another (i.e. where rules are in a FEEDING RELATIONSHIP) it is claimed that the linguist needs to order the rules in the appropriate linear sequence. In fact, this linear ordering position is controversial.

Before we see why the above ordering hypothesis is controversial we need to clarify two important concepts. We shall do that by distinguishing between two kinds of ordering relationships: INTRINSIC and EXTRINSIC linear ordering. Rules are said to be extrinsically ordered if their interaction is governed by tailor-made ordering statements designed for that specific set of rules in a particular language. But rules are intrinsically ordered if the order in which they apply follows automatically from the way in which they are formulated. For instance, as we saw above, if two obligatory rules are in a feeding relationship, for both of them to apply the feeding rule must necessarily apply before the rule that is fed. In such a case an ad hoc decision needs to be made as to which rule applies first: when rules are intrinsically ordered, the order in which they apply follows automatically from universal principles. We shall consider some of these principles presently.

The approach presented in the last section allows both extrinsic and intrinsic linear ordering. Some linguists (like Koutsoudas et al. 1974, Ringen 1972, Hooper 1976, Pullum 1978) have argued strongly against extrinsic linear ordering, proposing instead that intrinsic ordering is the only kind of rule interaction that should be allowed. Essentially, the case against extrinsic linear ordering is that it gives the linguist more latitude than is warranted. However, if extrinsic ordering is disallowed, the range of legitimate rule interactions is reduced. This has the merit of making it difficult to set up underlying representations which differ greatly
from phonetic representations. This seems to be desirable. The greater the distance between surface and underlying representations, the greater the likelihood of having a very involved set of rules interacting in a complex or idiosyncratic way with each other in the mapping of underlying onto surface representations. A ban on linear rule ordering effectively means that only those underlying representations which require rules interacting in a straightforward way can be successfully mapped on phonetic representations. Derivations requiring complex rule interaction would abort.

Let us now see how the phonological rule system might operate without extrinsic linear ordering. One proposal that has been made involves SIMULTANEOUS RULE APPLICATION. It is assumed that the question whether or not a given rule applies can be answered by inspecting the underlying representation: rule application is solely dependent on whether the underlying representation satisfies the structural description of a given rule.

We shall return to the Swahili example in [7.18] which is reproduced here as [7.22] to illustrate this point:

\[
\begin{align*}
\text{[7.22]} & \quad \text{UR} \quad \text{PR} \\
& \quad \begin{array}{ll}
/ N+pange/ & [p^h\text{ange}] \quad \text{‘gadfly’} \\
/ N+taa/ & [t^h\text{a}] \quad \text{‘lamp’} \\
/ N+kubwa/ & [k^h\text{ubwa}] \quad \text{‘big (adj.)’}
\end{array}
\end{align*}
\]

The underlying representations of these data satisfy the structural descriptions of both the nasal deletion rule in [7.20] and the obstruent aspiration rule in [7.19]. So, both these rules apply directly and simultaneously to the underlying representations:

\[
\begin{align*}
\text{[7.23]} & \quad \text{UR} / N+taa/ \\
& \quad / N+ t^h\text{aa/} \quad \text{by [7.19]) and} / t^h\text{aa/} \quad \text{by [7.20])} \\
\text{PR} [t^h\text{aa]}
\end{align*}
\]

Extrinsic linear ordering is unnecessary, in cases of this kind.

Another situation in which simultaneous rule application could also be used is where rules are MUTUALLY NON-AFFECTING. In such a situation any ordering would be arbitrary. You can verify this by looking back at the English examples and rules in [7.1] to [7.3]. The rules
aspirating voiceless stops, labialising consonants before rounded vowels and fronting velars before front vowels do not affect each other’s input. Any ordering of these rules would make no difference to the final output. They can directly apply at the same time to the underlying representation whenever their structural description is satisfied.

Our next example of rule interaction will also be taken from English. The relevant rules are [7.24] and [7.25]

[7.24] **Shortening:**

\[ [+\text{segment}] \rightarrow [-\text{long}] / _{-\text{voice}} \]

(Vowels and consonant segments are shortened when followed by voiceless segments.)

The existence of this rule means that the vowel in *sat* is somewhat shorter than that in *sad*; it also means that the [l] in *colt* is shorter than that in *cold*.

[7.25] **Obstruent devoicing**

\[ [-\text{sonorant}] \rightarrow [-\text{voice}] / _{-\#} \]

(Nonsonorants (obstruents) i.e. stops, affricates and fricatives are (partially) devoiced in word final position.)

The effect of [7.25] is to make the last segment of each of the following words less fully voiced than the first one: *bib, did* and *gag*.

Proponents of extrinsic linear ordering would suggest that the fact that the vowel segment preceding the devoiced /g/ segment in a word like *gag* does not become shorter even when, after the application of [7.25], the word ends in a voiceless or partially voiceless velar, is evidence that [7.24] applies before [7.25] so that by the time [7.25] applies, the opportunity of shortening has already been missed. In other words, rule [7.25] on the face of it, could POTENTIALLY FEED [7.24] if the ordering of these two rules was reversed. But the reality is that it does not. Thus, ordering [7.24] before [7.25] ensures that a potentially feeding rule interaction is avoided.

In fact, where rules are in a potentially feeding (also called **counter-feeding** relationship), an approach which forbids extrinsic linear ordering would also yield the right
result if it stipulated that rules apply directly to underlying representations which satisfy their structural descriptions. Thus, it is possible to show that [7.24] applies since its structural description is met by the underlying representation while [7.25] fails to feed [7.24] because the voiceless obstruents produced by this rule miss the application of [7.24] since both rules are assumed to apply directly to underlying representations. No further ordering statements are needed.

Another proposal that has been made by critics of extrinsic ordering is RANDOM SEQUENTIAL RULE APPLICATION. This principle states that rules apply one at a time, rather than simultaneously. But they are not strictly regimented in a fixed order. They apply, whenever a string that satisfies their structural description arises in a derivation. In cases of potential ambiguity, rules are arranged in that order which ensures that all obligatory rules are applied.

This principle is needed because the claim made above that rules only apply directly to underlying representations is not always correct. Earlier in this chapter we established that there are rules which cannot apply directly to underlying representations and which only become applicable after their input has been created by another rule during the course of a derivation. That is the case when rules are in a feeding relationship (see [7.11] – [7.15] above). The feeding rule must precede the fed rule. But this ordering need not be done on an ad hoc basis. The random sequential application principle, by ensuring that rules apply at any stage in a derivation when their structural description is met provides a simple mechanism for arriving at the correct order: the structural description of the feeding rule must, by definition, be met before the conditions for the application of the fed rule are created. So, feeding rules must always precede the rules that are fed.

A further universal principle which renders extrinsic ordering unnecessary is the ELSEWHERE CONDITION (Kiparsky 1973). The elsewhere condition states that where the input to two rules partially overlaps, the more specific rule applies before the more general rule. Discussion of this principle will wait until section 12.2.3.
7.4 Conclusion: why ordering matters

It would be wrong to think that in this chapter too much fuss has been made over an abstruse theoretical point. This is not the case. Rule interaction is not a fringe, esoteric issue. The importance of rule ordering lies in the fact that it offers us a way of constraining the power of the model. A phonological theory, which incorporates powerful rules which can insert, move and delete elements enables the linguist to perform a very wide range of operations, some of which may not be possible in human language.

It is therefore necessary to find ways of reducing the power of the model so that only those operations that are possible in human language are catered for. Restrictions on rule interaction have the effect of reducing the range of possible outputs of phonological rules. Furthermore, restrictions on rule interaction also indirectly curtail the distance between underlying and surface representations. Very complex extrinsic rule ordering is required where a large number of rules are needed to translate abstract underlying representations into phonetic representations.

The theme of constraining the remoteness of underlying representations from phonetic representations is developed further, from a different angle, in the next chapter.

Exercises

1. In fast, casual speech the words in the left-hand column may be realised as indicated in the right-hand column.
   
<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>handball</td>
<td>[hæmbɔl]</td>
</tr>
<tr>
<td>handbag</td>
<td>[hæmbæg]</td>
</tr>
<tr>
<td>hand-made</td>
<td>[hæmmeid]</td>
</tr>
</tbody>
</table>

   (a) Formulate the rules needed to state the processes involved.

   (b) Should these rules be extrinsically ordered?

2. Study the data below and answer the questions which follow. Assume that the morphemes of the two dialects have identical underlying representations. The differences in the phonetic shape of morphemes are due to
differences in their phonological rules. Lumasaaba (Uganda) (based on Brown (1972))

<table>
<thead>
<tr>
<th>Dialect A</th>
<th>Dialect B</th>
</tr>
</thead>
<tbody>
<tr>
<td>im-piso</td>
<td>i:-piso</td>
</tr>
<tr>
<td>im-pale</td>
<td>i:-pale</td>
</tr>
<tr>
<td>im-fula</td>
<td>i:fula</td>
</tr>
<tr>
<td>in-temu</td>
<td>i:-temu</td>
</tr>
<tr>
<td>in-cesc</td>
<td>i:-cesc</td>
</tr>
<tr>
<td>in-kafu</td>
<td>i:-kafu</td>
</tr>
<tr>
<td>in-sami</td>
<td>i:-sami</td>
</tr>
<tr>
<td>im-beba</td>
<td>im-beba</td>
</tr>
<tr>
<td>in-dali</td>
<td>in-dali</td>
</tr>
<tr>
<td>in-zu</td>
<td>in-zu</td>
</tr>
<tr>
<td>in-gwe</td>
<td>in-gwe</td>
</tr>
<tr>
<td>im-bululuka</td>
<td>I fly</td>
</tr>
<tr>
<td>in-dima</td>
<td>in-dima</td>
</tr>
<tr>
<td>in-cina</td>
<td>i:-cina</td>
</tr>
<tr>
<td>in-jo:la</td>
<td>in-jo:la</td>
</tr>
<tr>
<td>in-kuba</td>
<td>i:-kuba</td>
</tr>
</tbody>
</table>

(a) Determine the underlying representation of each prefix.
(b) State formally the rules that account for the alternation in the shape of the prefixes in the two dialects.
(c) Describe the differences in rule interaction which you have observed in the two dialects.

Notes

1. Note, incidentally, that vowel nasalisation tends to induce lowering. Oral [i] corresponds to nasalised [e], oral [o] to nasalised [ɔ], and so on. We do not have the space to explore this phenomenon in depth here.

2. This nasal prefix is both homorganic and syllabic before monosyllabic roots like /N+bu/[mbu] ‘mosquito’.