Feeding, bleeding, and rule interactions

LING 20: Introduction to Linguistic Analysis

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Review

- In some cases, the underlying form of a word violates a phonotactic constraint.

- In these cases, a rule is applied that changes the offending sound.

- The resulting representation no longer violates the phonotactic constraint.

Rule interactions

- In some cases, more than one rule applies to a word.

- We are going to take a look at possible **interactions** between the rules that can arise in such cases.

Scenario 1: Unrelated rules

- **Rule 1 (Aspiration):**

  Change $\Big/ \begin{matrix} -\text{aspirated} \\ -\text{voice} \\ +\text{plosive} \end{matrix} \Big/$ to [+aspirated] if it occurs at the

  beginning of an onset.

- **Rule 2 (Devoicing):**

  Change /z/ to [s] if it follows a [−voice] sound in the same coda.

Scenario 1: Unrelated rules

/tɪpz/   'tips'

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/tɹɪpz/ → [tʰɹɪps]   'tips'

Scenario 1: Unrelated rules

/tɪpz/ → [tʰɪps]   'tips'

Input:	/tɪpz/
1. aspiration:	
2. devoicing:	
Output:	

Input:	/tɪpz/
1. devoicing:	
2. aspiration:	
Output:	

/tɪpz/ → [tʰɪps]   'tips'

Input:	/tɪpz/
1. aspiration:	[tʰɪpz]
2. devoicing:	
Output:	

Input:	/tɪpz/
1. devoicing:	
2. aspiration:	
Output:	

/tɪpz/ → [tʰɪps]   'tips'

Input:	/tɪpz/
1. aspiration:	[tʰɪpz]
2. devoicing:	[tʰɪps]
Output:	

Input:	/tɪpz/
1. devoicing:	
2. aspiration:	
Output:	

/tɪpz/ → [tʰɪps] 'tips'

Input:	/tɪpz/
1. aspiration:	[tʰɪpz]
2. devoicing:	[tʰɪps]
Output:	[tʰɪps]

Input:	/tɪpz/
1. devoicing:	
2. aspiration:	
Output:	

Scenario 1: Unrelated rules

/tɪpz/ → [tʰɪps]   'tips'

Input:	/tɪpz/
1. aspiration:	[tʰɪpz]
2. devoicing:	[tʰɪps]
Output:	**[tʰɪps]**

Input:	/tɪpz/
1. devoicing:	[tɪps]
2. aspiration:	
Output:	

Scenario 1: Unrelated rules

/tɪpz/ → [tʰɪps]   'tips'

Input:	/tɪpz/
1. aspiration:	[tʰɪpz]
2. devoicing:	[tʰɪps]
Output:	**[tʰɪps]**

Input:	/tɪpz/
1. devoicing:	[tɪps]
2. aspiration:	[tʰɪps]
Output:	

Scenario 1: Unrelated rules

/tɪpz/ → [tʰɪps] 'tips'

Input:	/tɪpz/
1. aspiration:	[tʰɪpz]
2. devoicing:	[tʰɪps]
Output:	**[tʰɪps]**

Input:	/tɪpz/
1. devoicing:	[tɪps]
2. aspiration:	[tʰɪps]
Output:	**[tʰɪps]**

/tɪpz/ → [tʰɪps] 'tips'

Input:	/tɪpz/
1. aspiration:	[tʰɪpz]
2. devoicing:	[tʰɪps]
Output:	**[tʰɪps]**

Input:	/tɪpz/
1. devoicing:	[tɪps]
2. aspiration:	[tʰɪps]
Output:	**[tʰɪps]**

- The rules produce the correct result regardless of the order that they apply in. They do not interact with each other.

In other cases, the rules must apply in a **specific order**.

English [ɹ̥]

[spɹa͡wt]   'sprout'   [fɹa͡jt]   'fright'
[bɹa͡jt]   'bright'   [pʰɹ̥e͡j]   'prey'
[tʰɹ̥ɪp]   'trip'   [baɹo͡w]   'borrow'
[fɹʌm]   'from'   [ɛɹəɹ]   'error'
[stɹɪp]   'strip'   [kʰɹ̥e͡jɑn]   'crayon'
[ɹɑŋ]   'wrong'   [gɹa͡jm]   'grime'
[pʰɹ̥a͡wd]   'proud'   [skɹætʃ]   'scratch'
[kʰɹ̥a͡j]   'cry'   [dɹɪɹi]   'dreary'

English [ɹ̥]

- **Generalization:**
  [ɹ̥] occurs after aspirated sounds;
  [ɹ] occurs anywhere else

- **Underlying form:**
  /ɹ/

- **Phonotactic constraint:**
  *[aspirated][ɹ]

- **Rule:**
  Change /ɹ/ to [ɹ̥] if it follows an aspirated sound.

/pɹa͡ʊd/ → [pʰɹ̥a͡ʊd]

Input:	/pɹa͡ʊd/		*Input:*	/pɹa͡ʊd/
1. aspiration:			1. [ɹ]-devoicing:	
2. [ɹ]-devoicing:			2. aspiration:	
Output:			*Output:*	

Two conceivable orders

/pɹa͡wd/ → [pʰɹ̥a͡wd]

Input:	/pɹa͡wd/
1. aspiration:	[pʰɹa͡wd]
2. [ɹ]-devoicing:	

Output:

Input:	/pɹa͡wd/
1. [ɹ]-devoicing:	
2. aspiration:	

Output:

Two conceivable orders

/pɹaw̃d/ → [pʰɹ̥aw̃d]

Input:	/pɹaw̃d/
1. aspiration:	[pʰɹaw̃d]
2. [ɹ]-devoicing:	[pʰɹ̥aw̃d]

Output:

Input:	/pɹaw̃d/
1. [ɹ]-devoicing:	
2. aspiration:	

Output:

Two conceivable orders

/pɹaʊ̯d/ → [pʰɹ̥aʊ̯d]

Input:	/pɹaʊ̯d/		Input:	/pɹaʊ̯d/
1. aspiration:	[pʰɹaʊ̯d]		1. [ɹ]-devoicing:	
2. [ɹ]-devoicing:	[pʰɹ̥aʊ̯d]		2. aspiration:	
Output:	**[pʰɹ̥aʊ̯d]**		*Output:*	

Two conceivable orders

/pɹaw͡d/ → [pʰɹ̥aw͡d]

Input:	/pɹaw͡d/		Input:	/pɹaw͡d/
1. aspiration:	[pʰɹaw͡d]		1. [ɹ]-devoicing:	—
2. [ɹ]-devoicing:	[pʰɹ̥aw͡d]		2. aspiration:	
Output:	**[pʰɹ̥aw͡d]**		*Output:*	

Two conceivable orders

/pɹa͡wd/ → [pʰɹ̥a͡wd]

Input:	/pɹa͡wd/
1. aspiration:	[pʰɹa͡wd]
2. [ɹ]-devoicing:	[pʰɹ̥a͡wd]
Output:	**[pʰɹ̥a͡wd]**

Input:	/pɹa͡wd/
1. [ɹ]-devoicing:	—
2. aspiration:	[pʰɹa͡wd]
Output:	

Two conceivable orders

/pɹa͡wd/ → [pʰɹ̥a͡wd]

Input:	/pɹa͡wd/		Input:	/pɹa͡wd/
1. aspiration:	[pʰɹa͡wd]		1. [ɹ]-devoicing:	—
2. [ɹ]-devoicing:	[pʰɹ̥a͡wd]		2. aspiration:	[pʰɹa͡wd]
Output:	**[pʰɹ̥a͡wd]**		*Output:*	**[pʰɹa͡wd]**

Two conceivable orders

/pɹa͡wd/ → [pʰɹ̥a͡wd]

Input:	/pɹa͡wd/
1. aspiration:	[pʰɹa͡wd]
2. [ɹ]-devoicing:	[pʰɹ̥a͡wd]
Output:	**[pʰɹ̥a͡wd]**

Input:	/pɹa͡wd/
1. [ɹ]-devoicing:	—
2. aspiration:	[pʰɹa͡wd]
Output:	***[pʰɹa͡wd]**

Two conceivable orders

/pɹãʊ̯d/ → [pʰɹ̥ãʊ̯d]

Input:	/pɹãʊ̯d/		Input:	/pɹãʊ̯d/
1. aspiration:	[pʰɹãʊ̯d]		1. [ɹ]-devoicing:	—
2. [ɹ]-devoicing:	[pʰɹ̥ãʊ̯d]		2. aspiration:	[pʰɹãʊ̯d]
Output:	**[pʰɹ̥ãʊ̯d]**		*Output:*	***[pʰɹãʊ̯d]**

Only the order "**Aspiration → [ɹ]-devoicing**" produces the right result.

- This is because [ɹ]-devoicing only applies in the context of an aspirated sound.

➙ [ɹ]-devoicing can't apply unless aspiration applies first.

Feeding

- Aspiration **creates** the environment for [ɹ]-devoicing.

- This interaction between rules is called **FEEDING**.

- Aspiration **feeds** [ɹ]-devoicing.

Terminology: Feeding

Rule A **FEEDS** Rule B when A creates a context for B, and B would not apply otherwise.

Bleeding

- Another type of interaction between rules is called **BLEEDING**.

- We will look at two rules in Canadian English that illustrate bleeding.

Just like American English, Canadian English has a flapping rule.

- **Flapping rule:**
  Change [d] and [t] to [ɾ] if preceded and followed by a vowel and the [d] or [t] occurs in an unstressed syllable.

- **In features:**
  Change [alveolar, plosive] to [voiced, flap] if preceded and followed by a vowel and the [alveolar, plosive] occurs in an unstressed syllable.

Rule 2: Raising

- In Canadian English, the diphthongs [a͡ɪ] and [ʌ͡ɪ] are in **complementary distribution**.

- The diphthongs [a͡w] and [ʌ͡w] are also in **complementary distribution**.

Rule 2: Raising

[fa͡jv]	[f ʌ͡jf]	[la͡ʊd]	[st ʌ͡ʊt]
[la͡jm]	[m ʌ͡jti]	[kʰa͡ʊz]	[l ʌ͡ʊs]
[ba͡j]	[sp ʌ͡jt]	[f ɹa͡ʊn]	[m ʌ͡ʊθ]
[la͡jz]	[l ʌ͡js]	[ha͡ʊ]	[kʰ ʌ͡ʊtʃ]
[ɹa͡j]	[tʰ ʌ͡jp]	[pʰa͡ʊdɨɹ]	[əb ʌ͡ʊt]

Rule 2: Raising

[fa͡jv]	[fʌ͡jf]	[la͡wd]	[stʌ͡wt]
[la͡jm]	[mʌ͡jti]	[kʰa͡wz]	[lʌ͡ws]
[ba͡j]	[spʌ͡jt]	[fɹa͡wn]	[mʌ͡wθ]
[la͡jz]	[lʌ͡js]	[ha͡w]	[kʰʌ͡wtʃ]
[ɹa͡j]	[tʰʌ͡jp]	[pʰa͡wdɨɹ]	[əbʌ͡wt]

Generalization:

[ʌ͡j] and [ʌ͡w] appear before voiceless consonants; [a͡j] and [a͡w] appear anywhere else.

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Rule 2: Raising

- **Underlying form:**
  /a͡ɪ/, /a͡ʊ/

- **Phonotactic constraint:**
  *[+diphthong, +low, +back, +tense] [−voice]

- **Rule:**

  $$\text{Change} \Big/ \begin{array}{l} \text{+diphthong} \\ \text{+low} \\ \text{+back} \\ \text{+tense} \end{array} \Big/ \text{to [−tense] before [−voice]}$$

Rule ordering

'writer':   [ɹaɪ̯ɾɨɹ]
                 *[ɹʌɪ̯ɾɨɹ]

Rule ordering

'writer': [ɹaɪ̯ɾɨɹ]
*[ɹʌɪ̯ɾɨɹ]

Input:	/ɹaɪ̯tɨɹ/
1. Raising:	
2. Flapping:	
Output:	

Input:	/ɹaɪ̯tɨɹ/
1. Flapping:	
2. Raising:	
Output:	

Rule ordering

'writer': [ɹaɪ̯ɾɨɹ]
         *[ɹʌɪ̯ɾɨɹ]

Input:	/ɹaɪ̯tɨɹ/
1. Raising:	[ɹʌɪ̯tɨɹ]
2. Flapping:	
Output:	

Input:	/ɹaɪ̯tɨɹ/
1. Flapping:	
2. Raising:	
Output:	

Rule ordering

'writer': [ɹaɪ̯ɾɨɹ]
*[ɹʌɪ̯ɾɨɹ]

Input:	/ɹaɪ̯tɨɹ/
1. Raising:	[ɹʌɪ̯tɨɹ]
2. Flapping:	[ɹʌɪ̯ɾɨɹ]
Output:	

Input:	/ɹaɪ̯tɨɹ/
1. Flapping:	
2. Raising:	
Output:	

Rule ordering

'writer': [ɹaɪ̯ɾɨɹ]
*[ɹʌɪ̯ɾɨɹ]

Input:	/ɹaɪ̯tɨɹ/
1. Raising:	[ɹʌɪ̯tɨɹ]
2. Flapping:	[ɹʌɪ̯ɾɨɹ]
Output:	**[ɹʌɪ̯ɾɨɹ]**

Input:	/ɹaɪ̯tɨɹ/
1. Flapping:	
2. Raising:	
Output:	

Rule ordering

'writer':   [ɹaɪ̯ɾɨɹ]
                    *[ɹʌɪ̯ɾɨɹ]

Input:	/ɹaɪ̯tɨɹ/		*Input:*	/ɹaɪ̯tɨɹ/
1. Raising:	[ɹʌɪ̯tɨɹ]		1. Flapping:	[ɹaɪ̯ɾɨɹ]
2. Flapping:	[ɹʌɪ̯ɾɨɹ]		2. Raising:	
Output:	**[ɹʌɪ̯ɾɨɹ]**		*Output:*	

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Rule ordering

'writer': [ɹaɪ̯ɾɹ̩]
*[ɹʌɪ̯ɾɹ̩]

Input:	/ɹaɪ̯tɹ̩/		*Input:*	/ɹaɪ̯tɹ̩/
1. Raising:	[ɹʌɪ̯tɹ̩]		1. Flapping:	[ɹaɪ̯ɾɹ̩]
2. Flapping:	[ɹʌɪ̯ɾɹ̩]		2. Raising:	—
Output:	**[ɹʌɪ̯ɾɹ̩]**		*Output:*	

Rule ordering

'writer':   [ɹa͡ɪɾɨɹ]
         *[ɹʌ͡ɪɾɨɹ]

Input:	/ɹa͡ɪtɨɹ/
1. Raising:	[ɹʌ͡ɪtɨɹ]
2. Flapping:	[ɹʌ͡ɪɾɨɹ]
Output:	**[ɹʌ͡ɪɾɨɹ]**

Input:	/ɹa͡ɪtɨɹ/
1. Flapping:	[ɹa͡ɪɾɨɹ]
2. Raising:	—
Output:	**[ɹa͡ɪɾɨɹ]**

Rule ordering

'writer': [ɹaɪ̯ɾɨɹ]
*[ɹʌɪ̯ɾɨɹ]

Input:	/ɹaɪ̯tɨɹ/
1. Raising:	[ɹʌɪ̯tɨɹ]
2. Flapping:	[ɹʌɪ̯ɾɨɹ]
Output:	**[ɹʌɪ̯ɾɨɹ]*

Input:	/ɹaɪ̯tɨɹ/
1. Flapping:	[ɹaɪ̯ɾɨɹ]
2. Raising:	—
Output:	**[ɹaɪ̯ɾɨɹ]**

- Only the ordering "**Flapping** → **Raising**" produces the right result.

The relationship between the two rules

- No raising takes place because the flap is voiced and hence there is no need to raise the vowel.

- Importantly, before flapping changes /t/ to [ɾ], raising *could* have apply.

- Flapping **destroys** the context in which raising takes place.

Bleeding

- Flapping destroys the context in which raising takes place.

- Flapping **BLEEDS** raising.

Terminology: Bleeding
Rule A **BLEEDS** Rule B when A creates a context in which B can no longer apply.

Summary:

1. **No interaction:**
   The rules have nothing to do with each other; they are completely independent.

2. **Feeding:**
   Rule A creates the context for rule B. Rule A applies first, followed by rule B.

3. **Bleeding:**
   Rule A destroys the context for rule B. Rule A applies first and prevents rule B from taking place.