Lexical Rules
Overview

• How lexical rules fit in
• Three types of lexical rules, constraints
• Example: Plural noun lexical rule
• Advice on writing lexical rules
• Constant lexemes
• ARG-ST & ARP
• The feature FORM
• Questions about homework?
Lexical Types & Lexical Rules

- Lexemes capture the similarities among *run*, *runs*, *running*, and *ran*

- The lexical type hierarchy captures the similarities among *run*, *sleep*, and *laugh*, among those and other verbs like *devour* and *hand*, and among those and other words like *book*.

- Lexical rules capture the similarities among *runs*, *sleeps*, *devours*, *hands*, ...
Lexical rules capture **productive** generalizations.

There may be some ‘precompiling’ going on as well.
Three Kinds of Lexical Rules

• Inflectional: *lexeme* to *word*
  Examples?

• Derivational: *lexeme* to *lexeme*
  Examples?

• Post-Inflectional: *word* to *word* 
  (Chapters 11, 13, 14)
Three Subtypes of \textit{l-rule}

\textit{l-rule}:
\[
\begin{cases}
\text{INPUT} & \text{l-sequence} \langle X, \ [\text{SEM} / 2] \rangle \\
\text{OUTPUT} & \text{l-sequence} \langle Y, \ [\text{SEM} / 2] \rangle
\end{cases}
\]

\textit{i-rule}:
\[
\begin{cases}
\text{INPUT} & \langle X, \ [\text{lexeme SYN } 3] \rangle \\
\text{ARG-ST} & \text{A} \\
\text{OUTPUT} & \langle Y, \ [\text{word SYN } 3] \rangle \\
\text{ARG-ST} & \text{A}
\end{cases}
\]

\textit{d-rule}:
\[
\begin{cases}
\text{INPUT} & \langle X, \ [\text{lexeme SYN } 3] \rangle \\
\text{ARG-ST} & \text{A} \\
\text{OUTPUT} & \langle Y, \ [\text{lexeme SYN } 3] \rangle \\
\text{ARG-ST} & \text{A}
\end{cases}
\]
Plural Noun LR

\[
\begin{align*}
\text{i-rule} & \\
\text{INPUT} & \langle [1], \text{cntn-lxm} \rangle \\
\text{OUTPUT} & \left\langle F_{NPL}(1), \begin{bmatrix} \text{word} \\ \text{SYN} \begin{bmatrix} \text{HEAD} \begin{bmatrix} \text{AGR} \begin{bmatrix} \text{NUM} \begin{bmatrix} \text{pl} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \right\rangle
\end{align*}
\]
Plural Noun LR with Inherited Constraints

\[ i\text{-rule} \]

INPUT \( \langle \text{contn-lxm} \rangle \)

\( \left[ \begin{array}{c}
\text{SYN} \ 3 \\
\text{VAL} \\
\text{SEM} \ 2 \ [[\text{MODE} / \text{ref}]] \\
\text{ARG-ST} \ B \oplus C
\end{array} \right] \)

OUTPUT \( \langle F_{NPL}(\Pi), \text{word} \rangle \)

\( \left[ \begin{array}{c}
\text{SYN} \ 3 \\
\text{VAL} \\
\text{SEM} \ 2 \\
\text{ARG-ST} \ B \oplus C
\end{array} \right] \)
Practicalities - Applying Lexical Rules

- INPUT is a family of lexical sequences.
- OUTPUT is another family of lexical sequences.
  - ...usually a smaller family
  - ...usually a disjoint one
- The only differences between the families are those stipulated in the rule (or the rule’s type).
- Similarities are handled by the constraints on l-rule and its subtypes.
- If we’ve written the LRs correctly, nothing is left underconstrained.
Example: Lexical Entry for cat

\[
\langle \text{cat}, \begin{bmatrix}
\text{cntn-lxm} \\
\text{SEM} \\
\text{RESTR}
\end{bmatrix}
\begin{bmatrix}
\text{INDEX} & k \\
\text{RELN} & \langle \begin{bmatrix}
\text{INST} & \text{cat} \\
k
\end{bmatrix} \rangle
\end{bmatrix} \rangle
\]
Example: *cat*, with inheritance
Plural Noun LR

\[ i\text{-rule} \]

INPUT \( \left\langle 1 , \text{cntn-lxm} \right\rangle \)

OUTPUT \( \left\langle F_{NPL}(1) , \left[ \begin{array}{c} \text{word} \\
\text{SYN} \left[ \begin{array}{c} \text{HEAD} \\
\text{AGR} \left[ \text{NUM pl} \right] \end{array} \right] \end{array} \right] \right\rangle \)
Licensing *cats*

\[ i\text{-rule} \]

\[ \text{cntn-lxm} \]

**INPUT** \[ \langle 1 \text{cat} , \rangle \]

**SYN** \[ 3 \]

**VAL**

**SPR** \[ \langle \text{COUNT} + \rangle \]

**DP**

**MODE** \[ \text{ref} \]

**INDEX** \[ k \]

**SEM** \[ 2 \]

**RESTR** \[ \langle \text{RELN cat} \rangle \]

\[ \text{ARG-ST}  \]

**OUTPUT** \[ \langle \text{F}_{\text{NPL}}(1) \rangle \]

**SYN** \[ 3 \]

**VAL**

**SPR** \[ [\text{COUNT} + ] \]

\[ \text{COMPS} \]

\[ \text{SEM}  \]

\[ \text{ARG-ST}  \]

\[ \text{word} \]

\[ \text{HEAD} [\text{AGR [NUM pl]}] \]
Three Subtypes of $l$-rule

$l$-rule:

INPUT $l$-sequence $\langle X, [\text{SEM} / 2] \rangle$
OUTPUT $l$-sequence $\langle Y, [\text{SEM} / 2] \rangle$

$i$-rule:

\[
\begin{align*}
\text{INPUT} & \quad \langle X, [\text{lexeme SYN 3 ARG-ST A}] \rangle \\
\text{OUTPUT} & \quad \langle Y, [\text{word SYN 3 ARG-ST A}] \rangle
\end{align*}
\]

$d$-rule:

\[
\begin{align*}
\text{INPUT} & \quad \langle X, [\text{lexeme SYN / 3}] \rangle \\
\text{OUTPUT} & \quad \langle Y, [\text{lexeme SYN / 3}] \rangle
\end{align*}
\]
cats: The Lexical Sequence

\[ \langle \text{cats,} \rangle \]

\[ \left[ \begin{array}{c}
\text{word} \\
\text{SYN} \\
\text{VAL} \\
\text{SEM} \\
\text{ARG-ST}
\end{array} \right] \]

\[ \left[ \begin{array}{c}
\text{HEAD} \\
\text{SPR} \\
\text{COMPS} \\
\text{MODE} \\
\text{RESTR}
\end{array} \right] \]

\[ \left[ \begin{array}{c}
noun \\
\text{AGR} 3pl \\
\text{SPR} \\
\text{COMPS} \\
\text{RELN cat} \\
\text{INST} k
\end{array} \right] \]

\[ \left[ \begin{array}{c}
\text{DP} \\
\text{COUNT} + \\
\text{AGR} 7
\end{array} \right] \]
Practicalities -- Writing Lexical Rules

- Determine the type of the LR.
- Determine the class of possible inputs.
- Determine what should change.
  - If INPUT and OUTPUT values are identified (by default or otherwise) and only OUTPUT value is mentioned, then... information is added.
    (Lexical sequences incompatible with that value are not possible inputs)
  - If INPUT and OUTPUT values are identified by default, but different values are given on the INPUT and OUTPUT of the rule, then... information is changed.
  - If INPUT and OUTPUT values are identified by an inviolable constraint, but different values are given on the INPUT and OUTPUT of the rule, then... there is no well-formed output
Constant lexemes

- What kinds of words are constant lexemes in our grammar?
- Why do we need a rule for these words?
- What would be an alternative analysis?
Constant Lexeme LR

\[
\begin{align*}
\text{INPUT} & \quad \langle [1], \text{const-lxm} \rangle \\
\text{OUTPUT} & \quad [\text{FIRST } [1]]
\end{align*}
\]

- What keeps this from applying to, say, verb lexemes?
- Why is this an \textit{i-rule}?
ARG-ST & ARP

- Given the ARP, what do we need to specify about the valence properties of words?
- Why isn’t the ARP a constraint on the type *lexeme*?
The Feature FORM

• Different inflected forms of verbs show up in different syntactic environments. Examples?

• These different forms are syntactically distinguished by the feature FORM, as assigned by lexical rules.

• FORM is also useful in our analyses of coordination and PP selection.
What rules these out?

• *Kim eat pizza.
• *Kim seems to eats pizza.
• *Dana helped Leslie pack and moved.
• *Kim relies for Sandy.
• *Dana walked and Kim.
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