Ling 566
Oct 31, 2011
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
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*, ...
Parsimony & Plausibility

• 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 $l$-rule

$l$-rule

$i$-rule  $d$-rule  $pi$-rule

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

$i$-rule: \[
\begin{align*}
\text{INPUT} & \quad \langle X, \left[ \begin{array}{c} \text{lexeme} \\ \text{SYN} 3 \\ \text{ARG-ST} A \end{array} \right] \rangle \\
\text{OUTPUT} & \quad \langle Y, \left[ \begin{array}{c} \text{word} \\ \text{SYN} 3 \\ \text{ARG-ST} A \end{array} \right] \rangle 
\end{align*}
\]

$d$-rule: \[
\begin{align*}
\text{INPUT} & \quad \langle X, \left[ \begin{array}{c} \text{lexeme} \\ \text{SYN} / 3 \end{array} \right] \rangle \\
\text{OUTPUT} & \quad \langle Y, \left[ \begin{array}{c} \text{lexeme} \\ \text{SYN} / 3 \end{array} \right] \rangle 
\end{align*}
\]
Plural Noun LR

\[ \text{i-rule} \]

INPUT \[ \langle 1 , \text{cntn-lxm} \rangle \]

OUTPUT \[ \langle F_{NPL}(1) , \begin{bmatrix} \text{word} \\ \text{SYN} [\text{HEAD} [\text{AGR} [\text{NUM pl}]]] \end{bmatrix} \rangle \]
Plural Noun LR with Inherited Constraints
Plural Noun LR with Inherited Constraints

\[ i\text{-rule} \]

INPUT \( \langle 1, \rangle \)

SEM \[ 2 \]

\[ cnm\text{-}lxm \]

\[ \text{word} \]

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

SEM \[ 2 \]

\[ \text{HEAD} \ [\text{AGR} \ [\text{NUM} \ pl]] \]
Plural Noun LR with Inherited Constraints
Plural Noun LR with Inherited Constraints
Plural Noun LR with Inherited Constraints

\[
\begin{align*}
\text{INPUT} & \quad \left< \begin{array}{c}
\text{SYN} 3 \quad \text{VAL} \\
\text{SEM} 2 \quad \text{ARG-ST} B \oplus C
\end{array} \right> \\
\text{OUTPUT} & \quad \left< \begin{array}{c}
\text{SYN} 3 \\
\text{SEM} 2 \\
\text{ARG-ST} B \oplus C
\end{array} \right>
\end{align*}
\]
Plural Noun LR with Inherited Constraints

INPUT: \( i \)-rule

\( \langle 1 \rangle \),

**cntn-lxm**

**HEAD**

\[ \text{noun} \]

\[ \text{AGR} \]

\[ 4 \]

\[ \text{PER} \]

\[ 3rd \]

**VAL**

\[ \text{SPR} \]

\[ \langle \text{DP} \] (\text{COUNT} + \rangle \]

\[ \text{ARG-ST} \]

\[ B \oplus C \]

**SEM**: \( 2 \)[MODE / ref]

OUTPUT: \( F_{\text{NPL}}(\Pi) \),

**word**

**HEAD**

\[ \text{noun} \]

\[ \text{AGR} \]

\[ 4 \]

\[ \text{PER} \]

\[ 3rd \]

\[ \text{VAL} \]

\[ \text{SPR} \]

\[ \langle \text{COMPS} \] (\text{B} \oplus \text{C} \rangle \]

**ARG-ST**

\[ B \oplus C \]

**SEM**: \( 2 \)
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 \textit{l-rule} and its subtypes.
• If we’ve written the LRs correctly, nothing is left underconstrained.
Example: Lexical Entry for *cat*

\[
\langle \text{cat}, \left[ \begin{array} \text{cntn-lxm} \\
\text{SEM} \\
\text{RESTR} \\
\langle \left[ \begin{array} \text{RELN} \\
\text{INST} \\
\text{cat} \end{array} \right] \rangle \\
\end{array} \right] \rangle
\]
Example: *cat*, with inheritance
Example: *cat*, with inheritance
Example: *cat*, with inheritance

\[
\begin{array}{c}
\langle cat, \\
\langle \text{cntn-lxm} \\
\langle \text{SYN} \\
\langle \text{VAL} \\
\langle \text{HEAD} \\
\langle \text{noun} \\
\langle \text{AGR} \\
\langle \text{PER} \\
\langle 3rd \\
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\rangle \\
\langle \text{SEM} \\
\langle \text{INDEX} \\
\langle \text{ref} \\
\langle k \\
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\langle \text{ARG-ST} \\
\langle X \rangle \\
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\end{array}
\]
Example: *cat*, with inheritance
Plural Noun LR

\[
i\text{-rule} \\
\begin{array}{l}
\text{INPUT} \\
\langle [1], cntn-lxm \rangle \\
\end{array} \\
\begin{array}{l}
\text{OUTPUT} \\
\langle F_{NPL}(1), [\text{word}, \text{SYN} [\text{HEAD} [\text{AGR} [\text{NUM pl}]])] \rangle \\
\end{array}
\]
Licensing \textit{cats}
cats: The Lexical Sequence

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

\[
\begin{align*}
\text{word} & : [\text{DEP} \langle \text{DP} \rangle] \\
\text{SYN} & : [\text{DEP} \langle \text{COMPS} \rangle] \\
\text{VAL} & : [\text{DEP} \langle \text{SPR} \langle \text{COUNT} + \rangle \rangle] \\
\text{SEM} & : [\text{DEP} \langle \text{MODE ref} \rangle] \\
\text{INDEX} & : [\text{DEP} \langle \text{REF} \rangle] \\
\text{RESTRICTION} & : [\text{DEP} \langle \text{RELN cat} \rangle] \\
\text{ARG-ST} & : [\text{DEP} \langle \text{INST} k \rangle] \\
\text{AGR} & : [\text{DEP} \langle \text{AGR 3pl} \rangle] \\
\text{noun} & : [\text{DEP} \langle \text{AGR 3pl} \rangle] \\
\end{align*}
\]
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?
What keeps this from applying to, say, verb lexemes?

• Why is this an $i$-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?
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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• The feature FORM
• Reading Questions
Reading Questions

• Is a rule with something like Fpast a complete rule, or do we need to specify the function Fpast to make the rule complete?

• What prevents derivational rules from specifying feature for a given type as output that violate constraints on those types?

• If all lexical types have FORM, doesn't that license *Kim walks and the?
Reading Questions

• How come the Present Participle Lexical Rule and Past Participle Lexical Rule are nearly identical rather than being generalized better into one rule?

• If FORM values of coordinated conjuncts must be the same according to the Coordination Rule on p. 249, how do we account for the sentence: *The fish ate and was eaten.*
Reading Questions

• Why doesn’t this lexical sequence give rise to any words?
Reading Questions

• Why do we have a rule when nothing happens if we are modeling a language with no singular lexeme-word 'transformation'?

• In the l-rule description (# 59 on page 251) why are the values for SEM defeasible?

• What’s the difference between X and [1]?

• Are the lexical rules ordered with respect to each other?