Ling 566
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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:

\[ \begin{array}{c}
\text{INPUT} & l\text{-sequence} & \langle X, [\text{SEM} / 2] \rangle \\
\text{OUTPUT} & l\text{-sequence} & \langle Y, [\text{SEM} / 2] \rangle
\end{array} \]

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

```
i-rule

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

OUTPUT  \langle F_{NPL}(1), \text{word} \rfloor \text{SYN} \lfloor \text{HEAD} \lfloor \text{AGR} \lfloor \text{NUM pl} \rfloor \rfloor \rangle
```
Plural Noun LR with Inherited Constraints
Plural Noun LR with Inherited Constraints

\[ i\text{-rule} \]

INPUT \( \langle 1 \rangle \)

\[ \text{cntn-lx} \]

SEM \( \langle 2 \rangle \)

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

\[ \text{word} \]

\[ \text{HEAD} \ [\text{AGR} \ [\text{NUM} \ pl]] \]

SEM \( \langle 2 \rangle \)
Plural Noun LR with Inherited Constraints
Plural Noun LR with Inherited Constraints

**i-rule**

**INPUT**

\[\left(1, \begin{array}{l}
\text{cntn-lxm} \\
\text{SYN} [3] \\
\text{SEM} [2] \\
\text{ARG-ST} [B \oplus C]
\end{array}\right)\]

**OUTPUT**

\[\left(\text{FINP}(1), \begin{array}{l}
\text{word} \\
\text{SYN} [3] \\
\text{SEM} [2] \\
\text{ARG-ST} [B \oplus C]
\end{array}\right)\]
Plural Noun LR with Inherited Constraints

\[
\begin{align*}
\text{INPUT} & \quad \left[ i\text{-rule} \right] \\
& \quad \left[ \begin{array}{l}
\text{cntn-lxm} \\
\text{HEAD} \\
\text{VAL} \\
\text{SEM} \\
\text{ARG-ST}
\end{array} \right] \\
& \quad \left[ \begin{array}{l}
\text{noun} \\
\text{AGR} [\text{PER} 3\text{rd}] \\
\text{DP} \\
\text{SPR} \left[ \begin{array}{l}
\text{COUNT} + \\
\text{AGR} 4
\end{array} \right]
\end{array} \right]
\end{align*}
\]

\[
\begin{align*}
\text{OUTPUT} & \quad \left[ F_{NPL} (\Pi) \right] \\
& \quad \left[ \begin{array}{l}
\text{word} \\
\text{SYN} \\
\text{SEM} \\
\text{ARG-ST}
\end{array} \right] \\
& \quad \left[ \begin{array}{l}
\text{HEAD} [\text{AGR} [\text{NUM pl}] \\
2
\end{array} \right]
\end{align*}
\]
Plural Noun LR with Inherited Constraints

\[ i\text{-rule} \]

\[ \begin{array}{l}
\text{INPUT} \quad \left\langle 1 \right\rangle , \\
\quad \left. \begin{array}{l}
\text{SYN} \quad 3 \\
\text{VAL} \\
\text{SEM} \quad 2 \text{[MODE / ref]} \\
\text{ARG-ST} \quad B \oplus C
\end{array} \right| \\
\text{cntn-lxm} \\
\text{HEAD} \\
\left. \begin{array}{l}
\text{noun} \\
\text{AGR} \quad 4 \text{[PER 3rd]}
\end{array} \right| \\
\text{SPR} \left\langle \left[ \text{COUNT} + \right] \right\rangle \\
\text{DP} \\
\left. \begin{array}{l}
\text{AGR} \quad 4 
\end{array} \right|
\end{array} \]

\[ \begin{array}{l}
\text{OUTPUT} \quad \left\langle F_{NPL}(\Pi) \right\rangle , \\
\quad \left. \begin{array}{l}
\text{SYN} \quad 3 \\
\text{VAL} \\
\text{SEM} \quad 2 \\
\text{ARG-ST} \quad B \oplus C
\end{array} \right| \\
\text{word} \\
\text{HEAD} \\
\left. \begin{array}{l}
\text{AGR} \quad [\text{NUM pl}] \\
\text{SPR} \quad [\text{COMPS} [B] [C]]
\end{array} \right| \\
\left. \begin{array}{l}
\text{COMPS} [B] [C]
\end{array} \right|
\end{array} \]
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 \( l\text{-rule} \) and its subtypes.
- If we’ve written the LRs correctly, nothing is left underconstrained.
Example: Lexical Entry for *cat*

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

\[
\begin{array}{c}
\text{SYN} \\
\text{VAL} \\
\text{INDEX} \\
\text{RESTR}
\end{array}
\]

\[
\begin{array}{c}
\langle \text{cntn-lxm} \rangle \\
\langle \text{cat} \rangle \\
\langle \text{cat} \rangle
\end{array}
\]

\[
\langle \text{SEM} \rangle
\]

\[
\langle \text{SPR} \rangle
\]

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

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

\[
\langle \text{INST k} \rangle
\]

\[
\langle \text{RESTR} \rangle
\]

\[
\langle \text{SEM} \rangle
\]

\[
\langle \text{INDEX} k \rangle
\]

\[
\langle \text{REST} \rangle
\]
Example: cat, with inheritance
Example: *cat*, with inheritance
Plural Noun LR

\[ i\text{-rule} \]

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

OUTPUT  \( \langle F_{NPL}(1), \begin{cases} \text{word} \\ \text{SYN} \begin{cases} \text{HEAD} \\ \text{AGR} \begin{cases} \text{NUM} \ \text{pl} \end{cases} \end{cases} \end{cases} \rangle \)
Licensing *cats*

**INPUT**

```
\[\text{cat}\, ,
\begin{array}{c}
\text{cntn-lxm} \\
\text{ SYN } 3 \\
\text{ VAL } 3
\end{array}
\begin{array}{c}
\text{HEAD} \\
\text{AGR 7[ PER 3rd ]}
\end{array}
\begin{array}{c}
\text{SPR} \\
\text{COMP} 3
\end{array}
\begin{array}{c}
\text{ARG-ST} 2 \\
\text{SEM 2}
\end{array}
\begin{array}{c}
\text{MODE ref} \\
\text{INDEX k}
\end{array}
\begin{array}{c}
\text{RESTR} 2 \\
\text{INST k}
\end{array}
\begin{array}{c}
\text{word} \\
\text{SEM 2}
\end{array}
\begin{array}{c}
\text{ARG-ST B} \\
\text{SEM 2}
\end{array}
\begin{array}{c}
\text{ARG-ST B} \\
\text{SEM 2}
\end{array}
\]```

**OUTPUT**

```
\[\text{FNPL(1)},
\begin{array}{c}
\text{SYN 3} \\
\text{VAL 3}
\end{array}
\begin{array}{c}
\text{HEAD} \\
\text{AGR [NUM pl]} \\
\text{SPR B} \\
\text{COMPS C}
\end{array}
\begin{array}{c}
\text{ARG-ST B} \\
\text{SEM 2}
\end{array}
\begin{array}{c}
\text{ARG-ST B} \\
\text{SEM 2}
\end{array}
\]```
cats: The Lexical Sequence
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

\[
\begin{bmatrix}
\text{i-rule} \\
\text{INPUT} & \langle \mathbf{1}, \text{const-lxm} \rangle \\
\text{OUTPUT} & \left[ \text{FIRST } \mathbf{1} \right]
\end{bmatrix}
\]

- What keeps this from applying to, say, verb lexemes?
- Why is this an \textit{i-rule}?
• 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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- The feature FORM
- Reading Questions
Reading Questions

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

• How does the l-rule subhierarchy fit into the larger hierarchy?

• Any harm in looking at INPUT/OUTPUT as procedural? (changing rather than relating)

• In i-rules what's actually enforcing the identity of SYN values between INPUT and OUTPUT?
Reading Questions

• Are morphological functions "functions" in the mathematical sense?

• Why don't we give the details of them?

• What do they look like formally? Can they be conceptualized as constraints?

• How are they handled in the ERG?

• What does "morphological change" mean when we say that zero derivation doesn't involve any?
Reading Questions

• Can we say that syntactic structure dictates which l-rules are used?

• When do we apply lexical rules?

• What is the 'family of lexical sequences' for dog? For eat?

• How do we group lexical sequences into families?
Reading Questions

- Could we use FORM for CASE?
- Are nouns/adjectives ever going to have values other than nform/aform?
- What does it mean for a verb to be finite? In *I may have read the book*, which verb is finite? Which verb is the head?
- How do we handle plurals of mass nouns? (I'll take three waters.)
Reading Questions

• Where do lexical exceptions like the one below come from, and how do we model them?

  Jan gave Dale a book
  Jan gave a book to Dale
  *Kris donated the library a book
  Kris donated a book to the library

• How does the agent nominalization LR change the MODE without mentioning it?
Reading Questions

• How do we decide what to model with a lexical rule v. what to model with a grammar rule? What about N-N compounds?

• How do lexical rules relate to transformations?

• Will we use feature structures the way we're using them for lexical rules elsewhere, too?
Reading Questions

• Is it only in the use of [FORM fin] to add FORM feature to initial symbol S? The HFP also hold for other cases where [FORM prp|psp|pass], therefore, isn't it true for those cases?

• Why do we want FORM to be a HEAD feature?

• Does our coordination rule handle *Kim likes singing and dancing.*?
Reading Questions

• If the initial symbol is now [FORM fin], how do we handle imperatives?

• What about *Sandy walks*? It consists of an NP and a VP. How does it form something that matches the initial symbol?

• Often different forms of a verb can have the same orthography (past participle and passive are often the same for example). Given a sentence we want to parse, how can we tell which form is correct?