Ling 566
Oct 23, 2014

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*

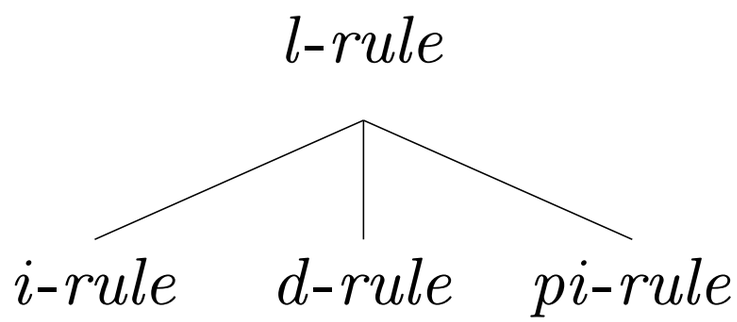
  Examples?

- Derivational: *lexeme* to *lexeme*

  Examples?

- Post-Inflectional: *word* to *word*
  (Chapters 11, 13, 14)

Three Subtypes of *l-rule*



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

$$i\text{-}rule : \begin{bmatrix} \text{INPUT} & \left\langle \text{X} , \begin{bmatrix} lexeme & \\ \text{SYN} & \boxed{3} \\ \text{ARG-ST} & \boxed{\text{A}} \end{bmatrix} \right\rangle \\ \text{OUTPUT} & \left\langle \text{Y} , \begin{bmatrix} word & \\ \text{SYN} & \boxed{3} \\ \text{ARG-ST} & \boxed{\text{A}} \end{bmatrix} \right\rangle \end{bmatrix}$$

$$d\text{-}rule : \begin{bmatrix} \text{INPUT} & \left\langle \text{X} , \begin{bmatrix} lexeme & \\ \text{SYN} & / \boxed{3} \end{bmatrix} \right\rangle \\ \text{OUTPUT} & \left\langle \text{Y} , \begin{bmatrix} lexeme & \\ \text{SYN} & / \boxed{3} \end{bmatrix} \right\rangle \end{bmatrix}$$

Plural Noun LR

$$\begin{bmatrix} \textit{i-rule} & \\ \text{INPUT} & \left\langle \boxed{1}\ ,\ \textit{cntn-lxm} \right\rangle \\ \text{OUTPUT} & \left\langle \text{F}_{NPL}(\boxed{1})\ ,\ \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{AGR} & \begin{bmatrix} \text{NUM} & \text{pl} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix}$$

Plural Noun LR with Inherited Constraints

$$\begin{bmatrix} \textit{i-rule} \\ \text{INPUT} \quad \left\langle \boxed{1}, \begin{bmatrix} \textit{cntn-lxm} \\ \\ \end{bmatrix} \right\rangle \\ \text{OUTPUT} \quad \left\langle \mathrm{F}_{NPL}(\boxed{1}), \begin{bmatrix} \textit{word} \\ \begin{bmatrix} \text{HEAD} & [\text{AGR} & [\text{NUM} & \text{pl}]] \\ & & & \end{bmatrix} \\ \\ \end{bmatrix} \right\rangle \end{bmatrix}$$

Plural Noun LR with Inherited Constraints

$$\begin{bmatrix} \textit{i-rule} & \\ \text{INPUT} & \left\langle \boxed{1}\,,\ \begin{bmatrix} \textit{cntn-lxm} & \\ \text{SEM} & \boxed{2} \end{bmatrix} \right\rangle \\ \text{OUTPUT} & \left\langle \mathrm{F}_{NPL}(\boxed{1})\,,\ \begin{bmatrix} \textit{word} & \\ & \begin{bmatrix} \text{HEAD} & [\text{AGR} \quad [\text{NUM} \quad \text{pl}]] \end{bmatrix} \\ \text{SEM} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix}$$

Plural Noun LR with Inherited Constraints

$$\begin{bmatrix} \textit{i-rule} & \\ \text{INPUT} & \left\langle \boxed{1}\,, \begin{bmatrix} \textit{cntn-lxm} & \\ & \\ \text{SEM} & \boxed{2} \\ \text{ARG-ST} & \boxed{B} \oplus \boxed{C} \end{bmatrix} \right\rangle \\ \text{OUTPUT} & \left\langle \mathrm{F}_{NPL}(\boxed{1})\,, \begin{bmatrix} \textit{word} & \\ & \begin{bmatrix} \text{HEAD} & [\text{AGR} \quad [\text{NUM} \quad \text{pl}]] \end{bmatrix} \\ \text{SEM} & \boxed{2} \\ \text{ARG-ST} & \boxed{B} \oplus \boxed{C} \end{bmatrix} \right\rangle \end{bmatrix}$$

Plural Noun LR with Inherited Constraints

$$\begin{bmatrix} \textit{i-rule} & \\ \text{INPUT} & \left\langle \boxed{1}, \begin{bmatrix} \textit{cntn-lxm} & \\ \text{SYN} & \boxed{3} \\ \text{SEM} & \boxed{2} \\ \text{ARG-ST} & \boxed{B} \oplus \boxed{C} \end{bmatrix} \right\rangle \\ \text{OUTPUT} & \left\langle \mathrm{F}_{NPL}(\boxed{1}), \begin{bmatrix} \textit{word} & \\ \text{SYN} & \boxed{3}\begin{bmatrix} \text{HEAD} & [\text{AGR} \quad [\text{NUM} \quad \text{pl}]] \end{bmatrix} \\ \text{SEM} & \boxed{2} \\ \text{ARG-ST} & \boxed{B} \oplus \boxed{C} \end{bmatrix} \right\rangle \end{bmatrix}$$

Plural Noun LR with Inherited Constraints

$$\begin{bmatrix} \textit{i-rule} & \\ \text{INPUT} & \left\langle \boxed{1}, \begin{bmatrix} \textit{cntn-lxm} & \\ \text{SYN} & \boxed{3}\begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{AGR} & \boxed{4}[\text{PER} \quad \text{3rd}] \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \left\langle \begin{bmatrix} \text{DP} & \\ \text{COUNT} & + \\ \text{AGR} & \boxed{4} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \boxed{2}[\text{MODE} \ / \ \text{ref}] \\ \text{ARG-ST} & \boxed{B} \oplus \boxed{C} \end{bmatrix} \right\rangle \\ \text{OUTPUT} & \left\langle \text{F}_{NPL}(\boxed{1}), \begin{bmatrix} \textit{word} & \\ \text{SYN} & \boxed{3}\begin{bmatrix} \text{HEAD} & [\text{AGR} \quad [\text{NUM} \quad \text{pl}]] \\ & \end{bmatrix} \\ \text{SEM} & \boxed{2} \\ \text{ARG-ST} & \boxed{B} \oplus \boxed{C} \end{bmatrix} \right\rangle \end{bmatrix}$$

Plural Noun LR with Inherited Constraints

$$\begin{bmatrix} \textit{i-rule} & \\ \text{INPUT} & \left\langle \boxed{1}, \begin{bmatrix} \textit{cntn-lxm} & \\ \text{SYN} & \boxed{3}\begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{AGR} & \boxed{4}[\text{PER} \quad \text{3rd}] \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \left\langle \begin{bmatrix} \text{DP} & \\ \text{COUNT} & + \\ \text{AGR} & \boxed{4} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \boxed{2}[\text{MODE} \ / \ \text{ref}] \\ \text{ARG-ST} & \boxed{B} \oplus \boxed{C} \end{bmatrix} \right\rangle \\ \text{OUTPUT} & \left\langle \text{F}_{NPL}(\boxed{1}), \begin{bmatrix} \textit{word} & \\ \text{SYN} & \boxed{3}\begin{bmatrix} \text{HEAD} & [\text{AGR} \quad [\text{NUM} \quad \text{pl}]] \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \boxed{B} \\ \text{COMPS} & \boxed{C} \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \boxed{2} \\ \text{ARG-ST} & \boxed{B} \oplus \boxed{C} \end{bmatrix} \right\rangle \end{bmatrix}$$

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*

$$\left\langle \text{cat}\ ,\ \begin{bmatrix} \textit{cntn-lxm} & \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & k \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{cat} \\ \text{INST} & k \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

Example: *cat*, with inheritance

$$\left\langle \text{cat}\ ,\ \begin{bmatrix} \textit{cntn-lxm} & \\ \text{SYN} & \begin{bmatrix} & \\ \text{VAL} & \begin{bmatrix} & \\ & \end{bmatrix} \\ & \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} & \\ \text{INDEX} & k \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{cat} \\ \text{INST} & k \end{bmatrix} \right\rangle \end{bmatrix} \\ & \end{bmatrix} \right\rangle$$

Example: *cat*, with inheritance

$$\left\langle \text{cat}\ ,\ \begin{bmatrix} \textit{cntn-lxm} & \\ \text{SYN} & \begin{bmatrix} & \\ \text{VAL} & \begin{bmatrix} & \\ \text{SPR} & \left\langle \begin{bmatrix} & \\ \text{COUNT} & + \\ & \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} & \\ \text{INDEX} & k \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{cat} \\ \text{INST} & k \end{bmatrix} \right\rangle \end{bmatrix} \\ & \end{bmatrix} \right\rangle$$

Example: *cat*, with inheritance

$$\left\langle \text{cat}\ ,\ \begin{bmatrix} \textit{cntn-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{AGR} & [\ \text{PER}\quad \text{3rd}\ ] \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \left\langle \begin{bmatrix} \text{DP} \\ \text{COUNT}\quad + \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{ref} \\ \text{INDEX} & k \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{cat} \\ \text{INST} & k \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{ARG-ST} & \langle \text{X} \rangle \end{bmatrix} \right\rangle$$

Example: *cat*, with inheritance

$$\left\langle \text{cat}\ ,\ \begin{bmatrix} \textit{cntn-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{AGR} & \boxed{7}\ [\ \text{PER}\ \ \text{3rd}\ ] \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \left\langle \begin{bmatrix} \text{DP} & \\ \text{COUNT} & + \\ \text{AGR} & \boxed{7} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{ref} \\ \text{INDEX} & k \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{cat} \\ \text{INST} & k \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{ARG-ST} & \langle \text{X} \rangle \end{bmatrix} \right\rangle$$

Plural Noun LR

$$\begin{bmatrix} \textit{i-rule} & \\ \text{INPUT} & \left\langle \boxed{1}\ ,\ \textit{cntn-lxm} \right\rangle \\ \text{OUTPUT} & \left\langle \text{F}_{NPL}(\boxed{1})\ ,\ \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{AGR} & \begin{bmatrix} \text{NUM} & \text{pl} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix}$$

Licensing *cats*

$$\begin{bmatrix} \textit{i-rule} & \\ \text{INPUT} & \left\langle \boxed{1}\text{cat}\ ,\ \begin{bmatrix} \textit{cntn-lxm} & \\ \text{SYN} & \boxed{3}\begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{AGR} & \boxed{7}\begin{bmatrix} \text{PER} & \text{3rd} \end{bmatrix} \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \left\langle \begin{bmatrix} \text{DP} & \\ \text{COUNT} & + \\ \text{AGR} & \boxed{7} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \boxed{2}\begin{bmatrix} \text{MODE} & \text{ref} \\ \text{INDEX} & k \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{cat} \\ \text{INST} & k \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{ARG-ST} & \boxed{B}\langle\ \text{X}\ \rangle \oplus \boxed{C}\langle\ \rangle \end{bmatrix} \right\rangle \\ \text{OUTPUT} & \left\langle \text{F}_{NPL}(\boxed{1})\ ,\ \begin{bmatrix} \textit{word} & \\ \text{SYN} & \boxed{3}\begin{bmatrix} \text{HEAD} & [\text{AGR} \quad [\text{NUM} \quad \text{pl}]] \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \boxed{B} \\ \text{COMPS} & \boxed{C} \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \boxed{2} \\ \text{ARG-ST} & \boxed{B} \oplus \boxed{C} \end{bmatrix} \right\rangle \end{bmatrix}$$

cats: The Lexical Sequence

$$\left\langle \text{cats}\ ,\ \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{AGR} & \textit{3pl} \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \boxed{\text{B}}\left\langle \begin{bmatrix} \text{DP} & \\ \text{COUNT} & + \\ \text{AGR} & \boxed{7} \end{bmatrix} \right\rangle \\ \text{COMPS} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{ref} \\ \text{INDEX} & k \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{cat} \\ \text{INST} & k \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{ARG-ST} & \boxed{\text{B}} \end{bmatrix} \right\rangle$$

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

$$\begin{bmatrix} \textit{i-rule} & \\ \text{INPUT} & \langle\ \boxed{1}\ ,\ \textit{const-lxm}\ \rangle \\ \text{OUTPUT} & \begin{bmatrix} \text{FIRST} & \boxed{1} \end{bmatrix} \end{bmatrix}$$

- 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*?

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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- Reading Questions

Reading Questions

- If you can just use an "F" to "handle" morphology, why not use that magic everywhere?
- What about isolating languages? Do they only need the Constant Lexeme LR?
- Is the distinction between inflectional and derivational morphology really that clear-cut?
- This is a lot of rules, how well are we expected to know them?

Reading Questions

- (74) shows a not good lexical sequence licensed from lexical entry (32). I understand it is because lexical entry is underspecified that it may license many lexical sequence. Then the book says that such bad structured lexical sequence could be ruled out by lexical rules to the lexeme, in this case to cntn-lxm. I notice the singular noun lexical rule of (62) only mentions about adding ARG [Num sg] but nothing else. How can we bar the bad example in (74) with this rule?

Reading Questions

- In other words: Why doesn't this lexical sequence give rise to any words?

$$\left\langle \text{dog}\ ,\ \begin{bmatrix} \textit{cntn-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{AGR} & \boxed{1}\begin{bmatrix}\text{PER 3rd}\end{bmatrix} \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \langle\ \text{NP}[\text{AGR}\ \boxed{1}]\ \rangle \\ \text{COMPS} & \langle\ \text{NP, NP, VP, NP}\ \rangle \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{ref} \\ \text{INDEX} & i \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \textbf{dog} \\ \text{INST} & i \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{ARG-ST} & \langle\ \begin{matrix}\text{DP} \\ [\text{COUNT}\ \ +]\end{matrix}\ \rangle \end{bmatrix} \right\rangle$$

Reading Questions

- 1. According to the Agent Nominalization Lexical Rule specified in (76), the OUTPUT has the same RESTR list as the INPUT. If that is so, then why doesn't the lexical sequence for driver in (78) have a SIT index in the drive predication? Don't all verbs have a SIT in their predications that identifies with their INDEX?

(76) Agent Nominalization Lexical Rule

$$\begin{bmatrix} \textit{d-rule} & \\ \text{INPUT} & \left\langle \boxed{2}, \begin{bmatrix} \textit{stv-lxm} & \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \end{bmatrix} \\ \text{ARG-ST} & \langle\, \text{X}_i\ ,\ \text{NP}_j\ \rangle \end{bmatrix} \right\rangle \\ \text{OUTPUT} & \left\langle \text{F}_{-er}(\boxed{2}),\ \begin{bmatrix} \textit{cntn-lxm} & \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & i \end{bmatrix} \\ \text{ARG-ST} & \left\langle \text{Y}\left(,\begin{bmatrix} \text{FORM} & \text{of} \end{bmatrix}^{\text{PP}_j} \right) \right\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

(78)

$$\left\langle \text{driver}\ ,\ \begin{bmatrix} \textit{cntn-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{AGR} & \boxed{1}[\text{PER}\ \ \text{3rd}] \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \left\langle [\text{AGR}\ \ \boxed{1}] \right\rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \text{X}_i\ (,\ \text{PP}[\textit{of}]_j) \right\rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{ref} \\ \text{INDEX} & i \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \textbf{drive} \\ \text{DRIVER} & i \\ \text{DRIVEN} & j \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \begin{matrix} \text{DP} \\ [\text{COUNT}\ \ +] \end{matrix} \right\rangle \end{bmatrix} \right\rangle$$

Reading Questions

- Why identify SYN of input and output in i-rule if the whole point is to produce outputs of different SYN values (e.g. AGR)?
- Why defensibly identify SYN of input and output of d-rule if lots of derivation rules change pos?
- Why can/do we add the constraint that only finite Ss can be stand-alone sentences?

Reading Questions

- When do we apply these lexical rules? I'm guessing the answer is that it happens at "the speed of math" and that "top down and bottom up result in equal structures," so maybe a better way to ask is: How does the grammar tell us which lexical rules to apply? Are the lexical rules tied to certain features in certain contexts in the trees? Or do we just apply whichever rules make the correct word in the tree?