Structure and rules

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Relation of rules to structures

1. A PS-rule does more than list the order of words in a phrase. It is part of a grammar of PS rules, which together define possible tree structures in the hierarchical analysis of the language:

Relation of trees & rules

| No tree | ⇔ | No rule |

2. Consequences

1. A PS-rule expanding phrase A does no work if phrase A does not occur on the right hand side of a rule (unless A is S, the “root node”)

2. The hierarchical structure of the grammar defines a complex set of conditions for word occurrences: The occurrence of a word is conditional on the occurrence of the structure introducing it.
PS-Grammars and trees

c d f g

A → B E
B → C D
E → F G
C → c
D → d
E → e
F → f

A → C D F G
B → C D
E → F G
C → c
D → d
E → e
F → f
PS-Grammars and trees

A
  /\   /
 B  E
|   |   |
C  D  F  G
|   |   |
c  d  f  g

A → B E
B → C D
E → F G
C → c
D → d
E → e
F → f

A → C D F G
B → C D
E → F G
C → c
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PS-Grammars and trees

A → B E
B → C D
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E → e
F → f

A → C D F G
B → C D
E → F G
C → c
D → d
E → e
F → f
Missing structure

S

V

S

V

NP

Adv

lopa

beli

lale

kuntu

walk

man

old

slowly

lopa

beli

lale

kuntu

béli

lopa

lale

kuntu

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Missing structure

- \[ S \]
  - \[ \text{V} \]
  - \[ \text{N} \]
  - \[ \text{Adj} \]
  - \[ \text{Adv} \]
    - \[ \text{lopa} \]
    - \[ \text{fo-bel} \]
    - \[ \text{lale-pu} \]
    - \[ \text{Kuntu} \]

- \[ S \]
  - \[ \text{V} \]
  - \[ \text{NP} \]
  - \[ \text{Adv} \]
    - \[ \text{lopa} \]
    - \[ \text{N} \]
    - \[ \text{Adj} \]
    - \[ \text{Kuntu} \]
      - \[ \text{fo-bel} \]
      - \[ \text{lale-pu} \]
Missing structure

S

/ \  /  /  /
V  N  Adj  Adv
|   |   |   |
lopa  fo-beli  lale-pu  *kuntu-pu

S

/ \  /
V  NP  Adv
|   |
lopa  N  Adj
|   |
fo-beli  lale-pu

lopa  fu-beli  lale-pu  kuntu
walk  men  old  slowly
The two grammars

Grammar for bad tree

\[
S \rightarrow V \ N \ (\text{Adj}) \ \text{Adv} \\
NP \rightarrow N \ (\text{Adj})
\]

Grammar for good tree

\[
S \rightarrow V \ NP \ \text{Adv} \\
NP \rightarrow N \ (\text{Adj})
\]
The two grammars

Grammar for bad tree

\[ S \rightarrow V \ N \ (\text{Adj}) \ \text{Adv} \]

NP Rule useless!

Grammar for good tree

\[ S \rightarrow V \ NP \ \text{Adv} \]

\[ NP \rightarrow N \ (\text{Adj}) \]
Co-occurrence: Modifiers depend on heads

Mersthami

7. lopa [NP fotaha lalepu] kuntu lale
walked women old slowly very

The old women walked very slowly.

Possible Grammar 1

\[
S \rightarrow V (NP) (Adv) (Adj) \\
NP \rightarrow N (Adj)
\]

Possible Grammar 2

\[
S \rightarrow V (NP) (AdvP) \\
NP \rightarrow N (Adj) \\
AdvP \rightarrow Adv (Adj)
\]

Grammar 2

* lopa fotaha lalepu lale

Both grammars

* lopa lalepu

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Bad structure

```
S
| V  |
| lopa |
| NP |
| N  | Adj | Adv |
| beli | lale | kuntu |
```

```
S
| V  |
| lopa |
| NP |
| N  | Adj |
| beli | lale |
| Adv |
| kuntu |
```
Bad structure

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Bad structure

\[
S \rightarrow V \rightarrow NP \\
\downarrow \quad \downarrow \quad \quad \downarrow \\
lopa \quad N \quad Adj \\
\quad \quad \quad \quad \quad \quad \downarrow \\
fo-beli \quad lele-pu \quad *kuntu-pu \\
\]

\[
S \rightarrow V \rightarrow NP \rightarrow Adv \\
\downarrow \quad \downarrow \quad \quad \downarrow \\
lopa \quad N \quad Adj \quad kuntu \\
\quad \quad \quad \quad \quad \quad \downarrow \\
fo-beli \quad lele-pu \\
\]
PS-rule heuristics

1. Part of what your PS rules are capturing is head-modifier relations.
2. Intensifiers (very, such a, extremely, too, ... ) modify what they intensify: very modifies unhappy in an extremely unhappy man.
3. Head-modifier relations are semantically-based. Use your knowledge of English head-modifier relations to guide you (not decide all issues!).

Adverbs/intensifiers never modify nouns

- The old man
- The slowly man
- *The very man

Even if the parts of speech change, the semantic relationships may not.