Ambiguity

Syntax Trees

Preface of Structure and Interpretation of Computer Programs
by Harold Abelson and Gerald Sussman with Julie Sussman

Programs must be written for people to read

programs (noun)
a series of coded software instructions

programs (verb)
provide a computer with coded instructions

must (verb)
be obliged to

must (noun)
dampness or mold

Definitions from the New Oxford American Dictionary

Ambiguity

Syntactic Ambiguity in English

Sentence

Noun

Verb

Phrase

Phrase

Subordinate

Clause

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Representing Syntactic Structure

A tree represents a phrase:
- tag -- What kind of phrase (e.g., S, NP, VP)
- branches -- Sequence of Tree or Leaf components

A leaf represents a single word:
- tag -- What kind of word (e.g., N, V)
- word -- The word

(Leaf('N', 'cows'))
(Leaf('V', 'intimidate'))

Tree('S', [Tree('NP', ['cows']), Tree('VP', ['intimidate', Tree('NP', ['cows'])])])

Context-Free Grammar Rules

A grammar rule describes how a tag can be expanded as a sequence of tags or words

Grammar
- NP -> VP
- S -> NP VP
- NP -> cows
- VP -> V NP
- V -> intimidate

Exhaustive Parsing

Expand all tags recursively, but constrain words to match input

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Scoring a Tree Using Relative Frequencies

Not all syntactic structures are equally common

```
NP --|------ S
NP --| VP  --| NP
  | NN | VBZ | JJ | NNS
```

teacher strikes idle kids

Rule frequency per 100,000 tags

- S → NP VP: 25372
- NP → NN NNS: 1335
- VP → VB NP: 6679
- NP → NNS: 4282

Translation

```
S
NP VP
25372
NP NN NNS
1335
VP VB NP
6679
NP NNS
4282
```

Syntactic Reordering

```
English → Yoda-English

Help you, I can! Yes! Mm!
When 900 years old you reach,
look as good, you will not. Hm.
```

(Demo)