Introduction to treebanks

Session 1: 7/08/2011

Outline

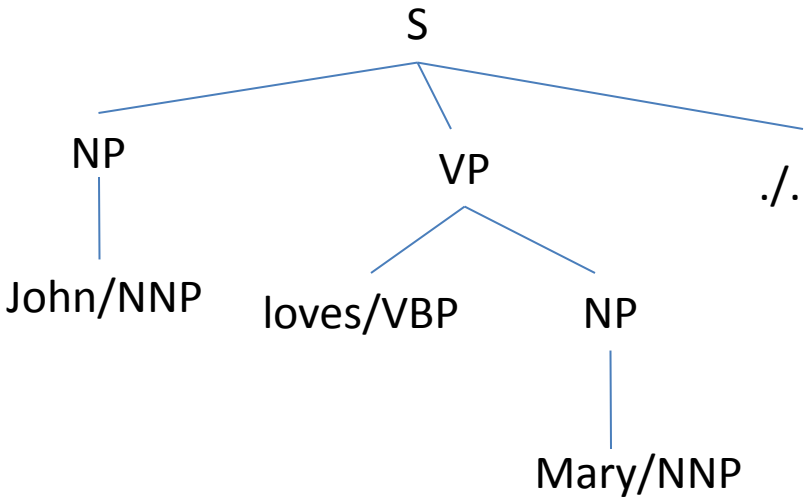
- Types of treebanks
  - (Syntactic) Treebank
  - PropBank
  - Discourse Treebank
- The English Penn Treebank
- Why do we need treebanks?
- Hw1

(Syntactic) Treebank

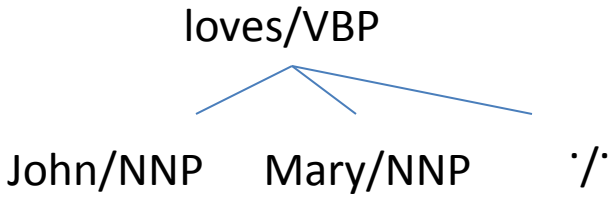
- Sentences annotated with syntactic structure (dependency structure or phrase structure)
- 1960s: Brown Corpus
- Early 1990s: The English Penn Treebank
- Late 1990s: Prague Dependency Treebank
- 1990s – now: Arabic, Chinese, Dutch, Finnish, French, German, Greek, Hebrew, Hindi, Hungarian, Icelandic, Italian, Japanese, Korean, Latin, Norwegian, Polish, Spanish, Turkish, etc.

An example

- John loves Mary .



- (S (NP (NNP John))
  (VP (VBP loves)
  (NP (NNP Mary)))
  (. .))



PropBank

- Sentences annotated with predicate argument structure

- Ex: John loves Mary
  - “loves” is the predicate
  - “John” is Arg0 (“Agent”)
  - “Mary” is Arg1 (“Theme”)

- 2000s: The English PropBank, followed by the PropBanks for Chinese, Arabic, Hindi/Urdu, etc.

Discourse Treebank

- 2006-2008: The English Discourse Treebank

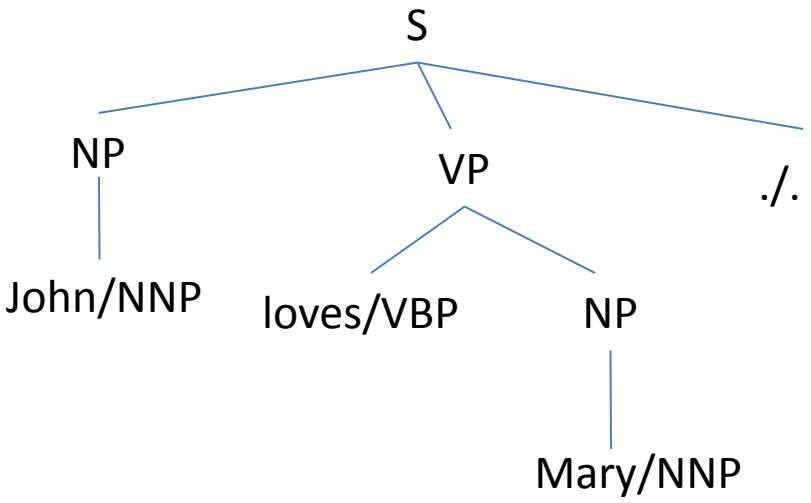
- The city's Campaign Finance Board has refused to pay Mr. Dinkins $95,142 in matching funds because his campaign records are incomplete.

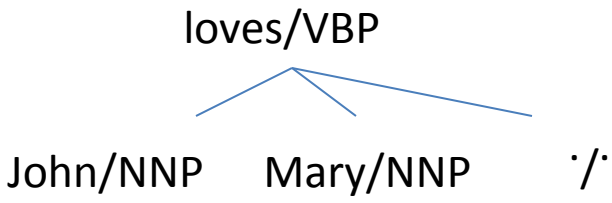
- Motorola is fighting back against junk mail. So much of the stuff poured into its Austin, Texas, offices that its mail rooms there simply stopped delivering it. Implicit = so Now, thousands of mailers, catalogs and sales pitches go straight into the trash.

Multi-representational, multi-layered treebank

- 2010-: Multi-representational, multi-layer Treebank for Hindi/Urdu

- The treebank includes both PS, DS, and PB.





"loves" is predicate.
"John" is Arg0.
"Mary" is Arg1.

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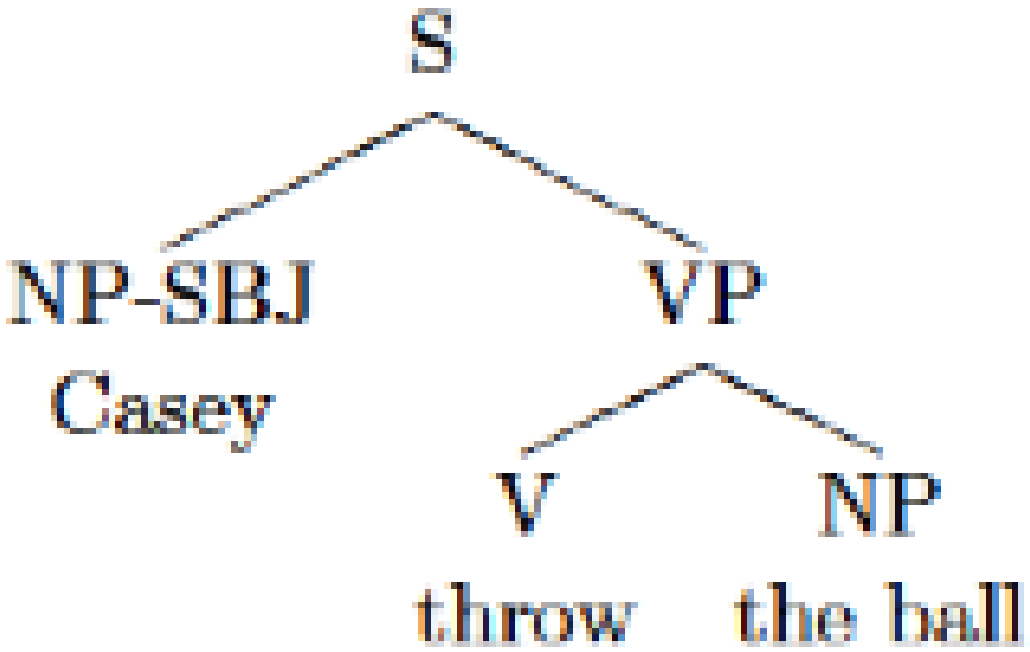
The English Penn Treebank (PTB)

- Developed at UPenn in early 1990s
- Most commonly used treebank in the CL field
- Data:
  - WSJ: 1-million words from 1987 to 1989
  - Others: Brown Corpus, ATIS, etc.
- Release:
  - 1992: version 1
  - 1995: version 2
  - 1999: version 3

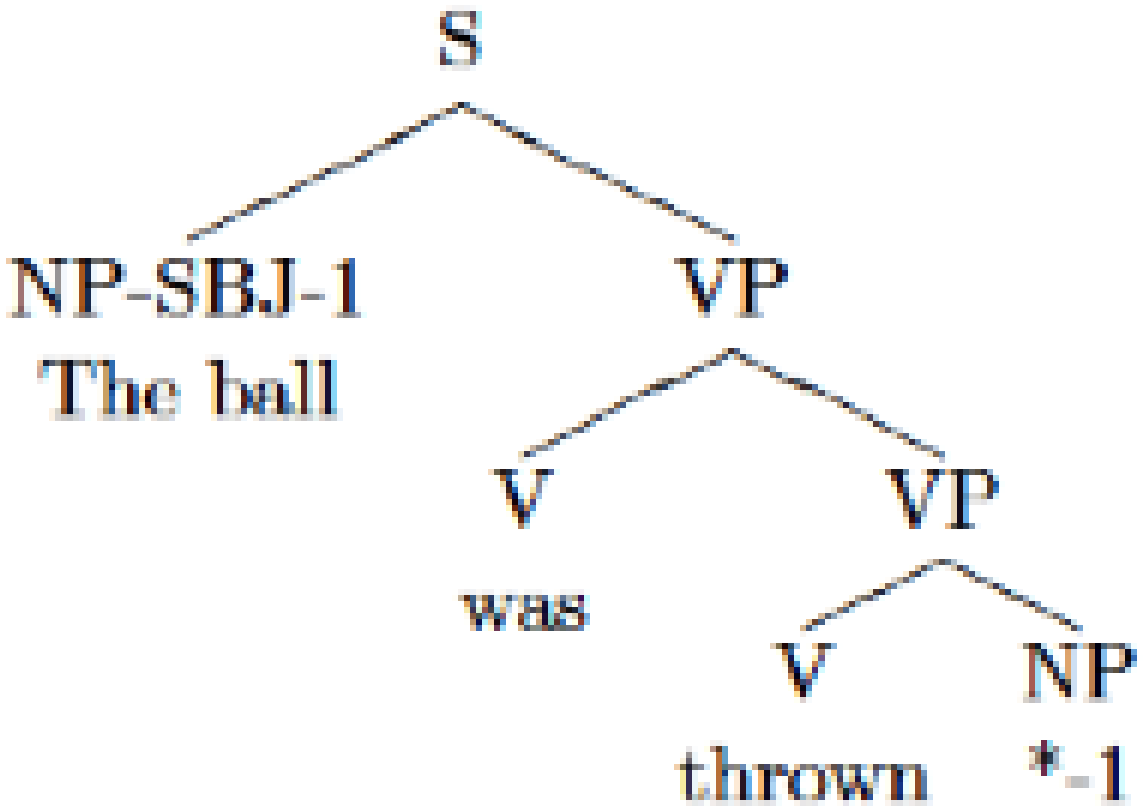
An example



The PTB Tagset

- Syntactic labels: e.g., NP, VP
- Function tags: e.g., -SBJ, -LOC
- Empty categories (ECs): e.g., *T* (for A-bar movement)
- Sub-categories for ECs: e.g., 0 (zero complementizers), NP* (PRO, A-movement)

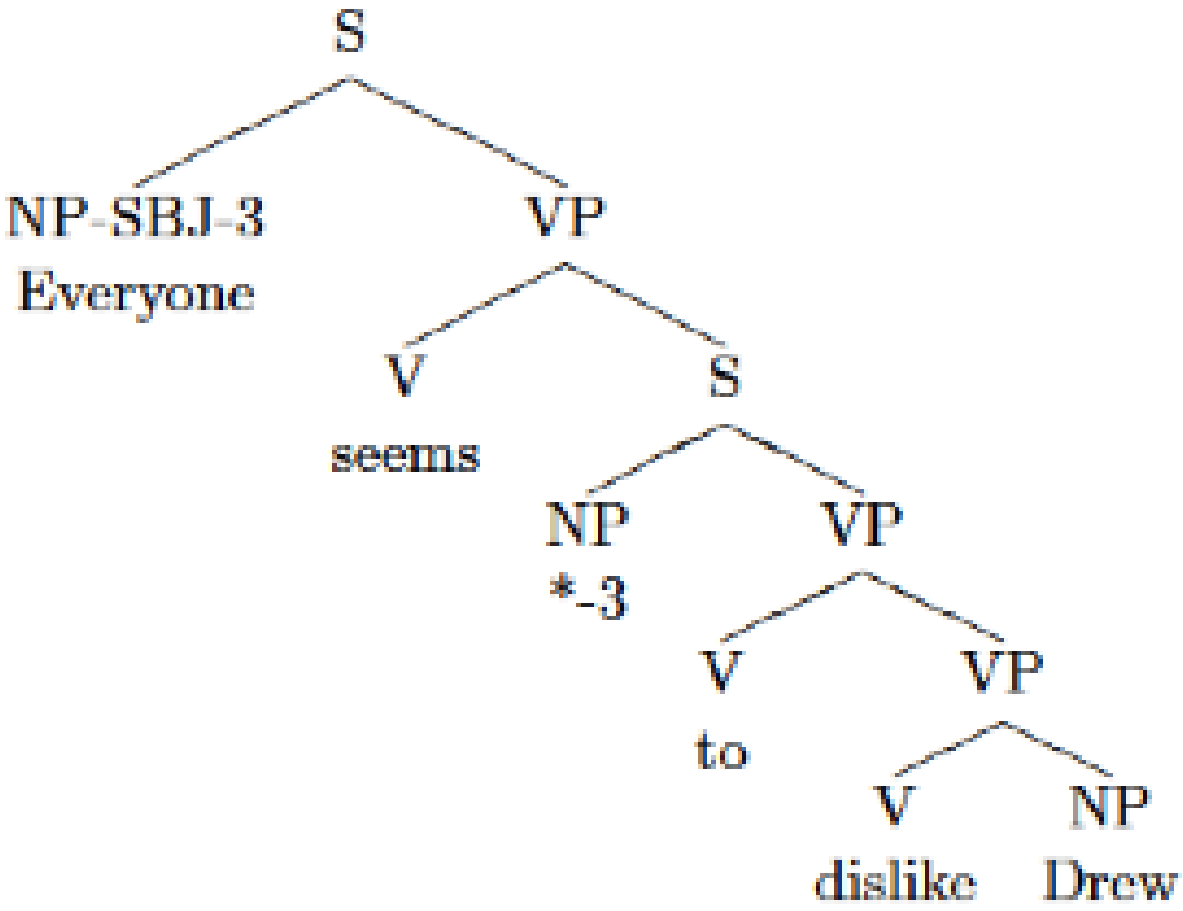
Passive



Clausal Complementation

```
(S (NP-SBJ he)
   (VP wrote
       (SBAR that
             (S (NP-SBJ he)
                (VP had
                    (VP given (PRT up)
                        (NP hope
                            (SBAR 0
                                  (S (NP-SBJ they)
                                     (VP would
                                         (ADVP-TMP ever)
                                         (VP agree
                                             (PP-CLR on
                                                     (NP anything)))))))))))))
```

Raising



Wh-Relative Clauses

```
(NP (NP answers)
    (SBAR (WHNP-6 that/which)
          (S (NP-SBJ-3 we)
             (VP 'd
                 (VP like
                     (S (NP-SBJ *-3)
                        (VP to
                            (VP have
                                (NP *T*-6)))))))))
```

Contact Relatives

```
(NP (NP answers)
    (SBAR (WHNP-3 0)
          (S (NP-SBJ-4 we)
             (VP 'd
                 (VP like
                     (S (NP-SBJ *-4)
                        (VP to
                            (VP have
                                (NP *T*-3)))))))))
```

Indirect Questions

```
( (S (NP-SBJ I)
     (VP forgot
         (SBAR (WHNP who)
               (S (NP-SBJ they)
                  (VP said
                      (SBAR (WHNP-2 0)
                            (S (NP-SBJ-1 they)
                               (VP wanted
                                   (S (NP-SBJ *-1)
                                      (VP to
                                          (VP hire
                                              (NP *T*-2)))))))))))
     .))
```

Punctuation

```
( (S (SBAR-ADV If
                (S (NP-SBJ-1 the judge)
                   (VP is
                       (VP impeached
                           (NP *-1)))))
     ,
     (SBAR-ADV as
                (S (NP-SBJ-2 *)
                   (VP is
                       (VP thought
                           (S (NP-SBJ *-2)
                              (ADJP-PRD likely))))))
     ,
     (NP-SBJ-3 he)
     (VP will
         (VP be
             (VP removed
                 (NP *-3)
                 (PP-DIR from
                         (NP office))
                 (ADVP-TMP immediately))))
     .))
```

FinancialSpeak

```
(S (NP-SBJ Copper)
    (VP finished
        (ADVP-CLR down
                  (NP 4.5 cents))
        ,
        (PP-CLR at
                (NP (NP $ 1.2345 *U*)
                    (NP-ADV a pound))))
    .)
```

Lists 1

```
( (S (NP-SBJ-1 It)
     (VP was
         (VP used
             (NP *-1)
             (S-CLR (NP-SBJ *)
                    (VP (VP (LST -LRB-
                                 1
                                 -RRB-)
                            to
                            (VP investigate
                                (NP wave behavior)))
                        ,
                        (VP (LST -LRB-
                                 2
                                 -RRB-)
                            to
                            (VP estimate
                                (NP the wave energy)))
                        ,
                        and
                        (VP (LST -LRB-
                                 3
                                 -RRB-)
                            forecast
                            (NP coastal changes))))))
     .))
```

Lists 2

```
( (S (NP-SBJ The aged care plan)
     (VP carries
         (NP these benefits)
         (PP for
             (NP (NP persons)
                 (PP over
                     (NP 65)))))
     :))
( (NP (LST 1)
      (NP Full payment)
      (PP of
          (NP (NP hospital bills)
              (PP for
                  (NP (NP stays)
                      (NP (QP up to 90) days)))))
      .))
( (NP (LST 2)
      (NP Full payment)
      (PP of
          (NP nursing home bills))
      (PP-TMP for
              (NP (NP (QP up to 180) days)
                  (PP-TMP following
                          (NP (NP discharge)
                              (PP from
                                  (NP a hospital))))))
      .))
( (NP (LST 3)
      (NP Hospital outpatient clinic diagnostic service)
      (PP for
          (NP (NP all costs)
              (PP in
                  (NP (NP excess)
                      (PP of
                          (NP (NP $ 20)
                              (NP-ADV a patient)))))))
      .))
```

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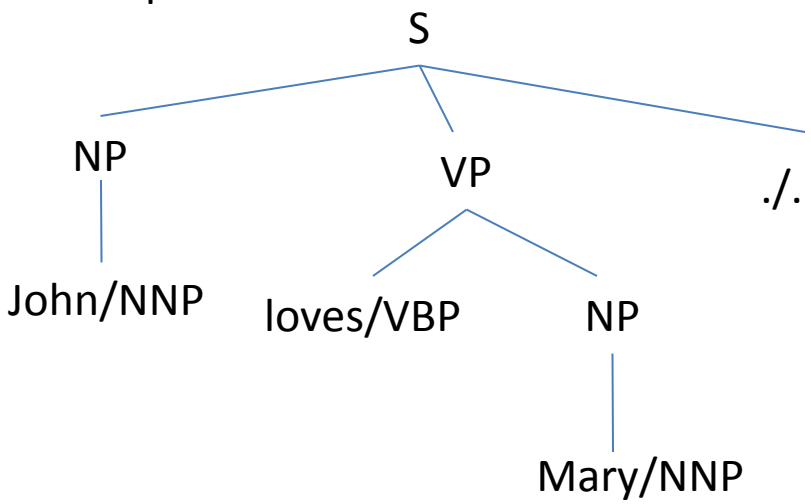
Why do we need treebanks?

- Computational Linguistics: (Session 6-7)
  - To build and evaluate NLP tools (e.g., word segmenters, part-of-speech taggers, parsers, semantic role labelers)
  - This leads to significant progress of the CL field
- Theoretic linguistics: (Session 2 and 5-6)
  - Annotation guidelines are like a grammar book, with more detail and coverage
  - As a discovery tool
  - One can test linguistic theories and collect statistics by searching treebanks.

CL example: Parsing

Input: John loves Mary .

Output:



S => NP VP .

NP => NNP

VP => VBP NP

NNP => John

NNP => Mary

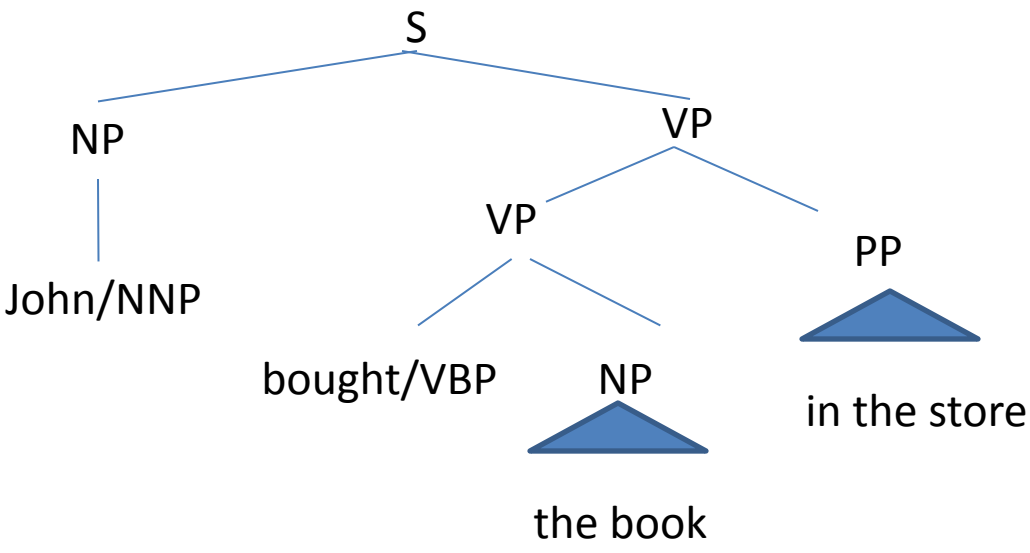
VBP => loves

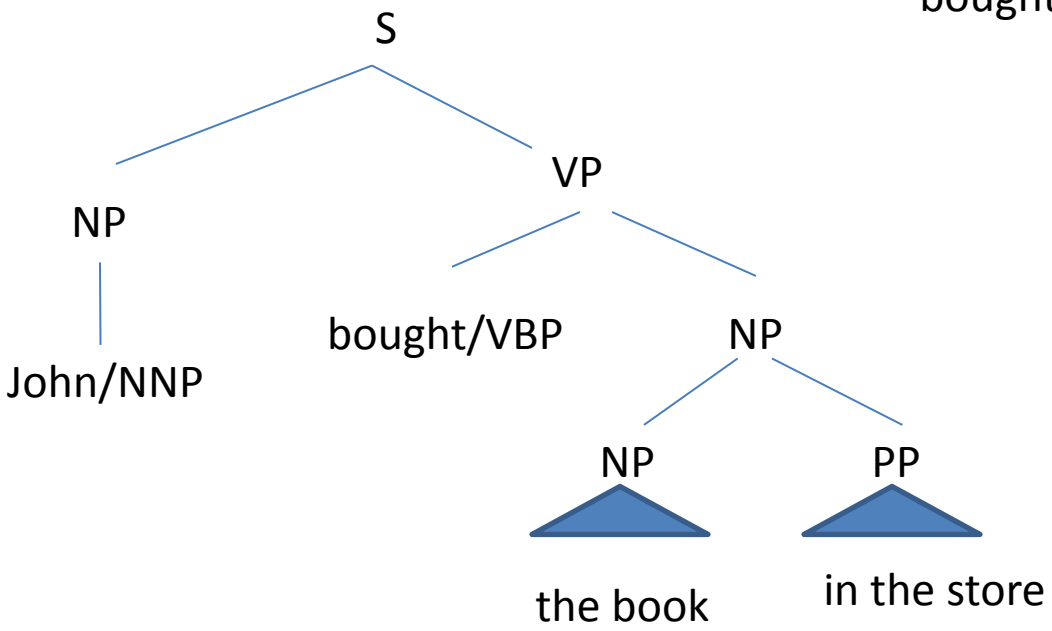
. => .

Ambiguity

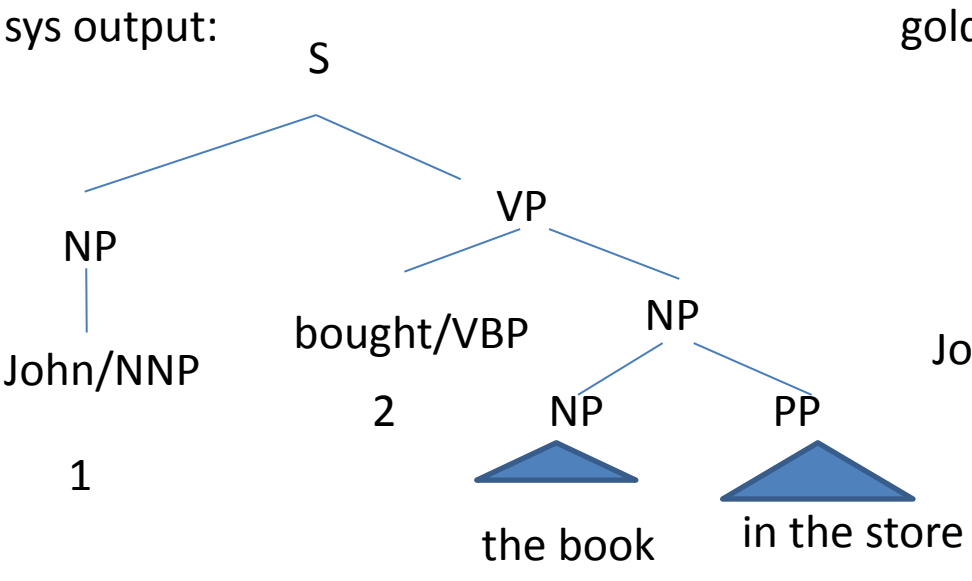
PP attachment: John bought the book in the store

S => NP VP
NP => PN
VP => V NP
VP => VP PP
NP => NP PP
PP => P NP

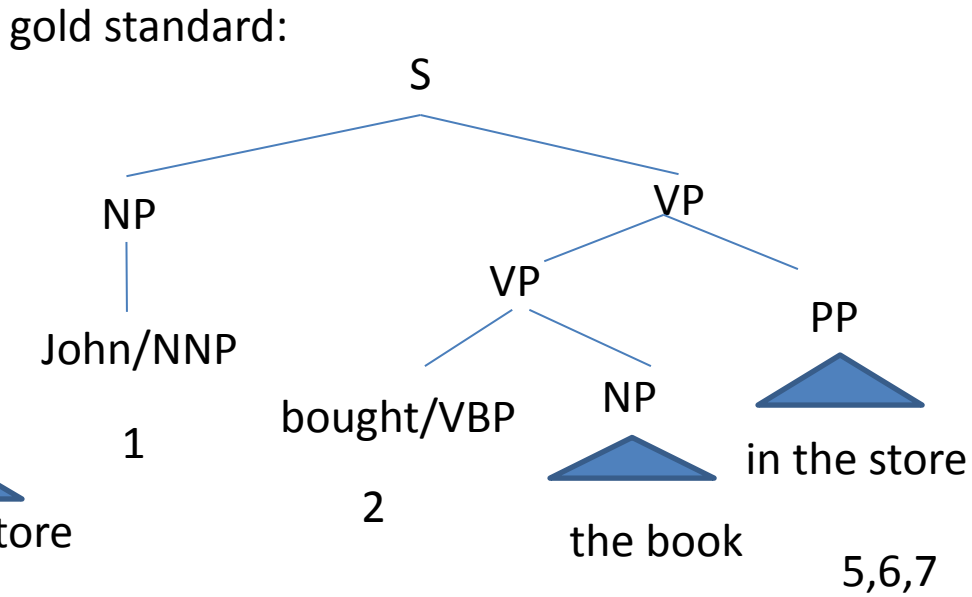




Labeled f-score



(1, 7, S)
(1, 1, NP)
(2, 7, VP)
(3, 7, NP)
(3, 4, NP)
(5, 7, PP)
(6, 7, NP)



(1, 7, S)
(1, 1, NP)
(2, 7, VP)
(2, 4, VP)
(3, 4, NP)
(5, 7, PP)
(6, 7, NP)

Prec=6/7, recall=6/7, f-score=6/7

Parsing evaluation

- Use the English Penn Treebank
  - Section 2-18 for training
  - Section 23 for final testing
  - Section 0-1, 22, and 24 for development

- Evaluation:
  - precision, recall, f-score
  - Best f-score: around 91%

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Hw1: required part

- Required reading: Chapters 1 and 2 of the PTB guidelines

- Assignment:
  - pick a specific phenomenon handled by the PTB,
  - discuss the PTB treatment of this phenomenon, and
  - explain whether you concur with the treatment or not. If you do not, outline how you would have represented it differently.