

# Dependency Syntax in the CoNLL Shared Task 2008

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## 1 Introduction

This document gives a brief overview of the conversion of the Penn Treebank (Marcus et al., 1993, 1994) to the dependency structures used in the CoNLL-2008 Shared Task. Our dependency framework has the following properties:

- *single-head*: every word has exactly one parent, except the root, which has no parent.
- *single-root*: only one word in the sentence is root.
- *traceless*: the dependency structures use no empty categories. Special arc labels are used to encode gapping.
- *nonprojective*: some long-distance syntactic phenomena are represented in the dependency structure by means of non-local links.

The conversion procedure relies on earlier work on constituent-to-dependency conversion (Magerman, 1994; Collins, 1999; Yamada and Matsumoto, 2003; Johansson and Nugues, 2007). In addition, we imported dependencies inside NPs and hyphenated words from a version of the Penn Treebank mapped into GLARF, the Grammatical and Logical Argument Representation Framework (Meyers et al., 2001).

To assign dependency labels, we used the following general principles:

- If there is a Treebank label other than CLR, HLN, NOM, TPC, or TTL: use this label.
- If the link is inside an NP or a hyphenated word: use the label from GLARF.
- Else infer a label using a set of rules.

The complete set of labels is listed in Section 4.

## 2 Head Percolation Rules

Following earlier work on conversion from constituents to dependencies, the central principle of the conversion procedure is to assign a head word to each constituent. The head words are found by *head percolation*: recursively searching through constituents using heuristic rules to determine in which child the head can be found. When a head word has been assigned to each constituent, conversion to dependency structure is straightforward.

The following table lists the head percolation rules for each phrase type. The second column indicates search direction, and the third is a priority list of phrase types to look for. For instance, to find the head of an S phrase, we look from right to left for a VP. If no VP was found, look for anything with a PRD function tag, and so on.

ADJP	←	NNS QP NN \$ ADVP JJ VBN VBG ADJP JJR NP JJS DT FW RBR RBS SBAR RB
ADVP	→	RB RBR RBS FW ADVP TO CD JJR JJ IN NP JJS NN
CONJP	→	CC RB IN
FRAG	→	(NN*   NP) W* SBAR (PP   IN) (ADJP   JJ) ADVP RB
INTJ	←	*
LST	→	LS :
NAC	←	NN* NP NAC EX \$ CD QP PRP VBG JJ JJS JJR ADJP FW
NP, NX, WHNP	←	(NN*   NX) NP-ε JJR CD JJ JJS RB QP NP
PP, WHPP	→	IN TO VBG VBN RP FW
PRN	→	S* N* W* PP IN ADJP JJ* ADVP RB*
PRT	→	RP
QP	←	\$ IN NNS NN JJ RB DT CD NCD QP JJR JJS
RRC	→	VP NP ADVP ADJP PP
S	←	VP *-PRD S SBAR ADJP UCP NP
SBAR	←	S SQ SINV SBAR FRAG IN DT
SBARQ	←	SQ S SINV SBARQ FRAG
SINV	←	VBZ VBD VBP VB MD VP *-PRD S SINV ADJP NP
SQ	←	VBZ VBD VBP VB MD *-PRD VP SQ
UCP	→	*
VP	→	VBD VBN MD VBZ VB VBG VBP VP *-PRD ADJP NN NNS NP
WHADJP	←	CC WRB JJ ADJP
WHADVP	→	CC WRB
X	→	*

### 3 Treatment of Some Complex Linguistic Phenomena

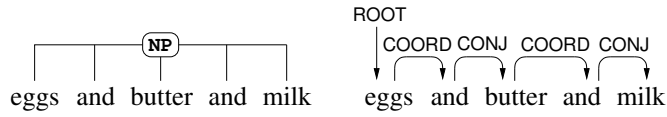
This section lists a number of non-trivial constructions for which attachment is determined by special heuristics rather than head percolation.

#### 3.1 Coordination

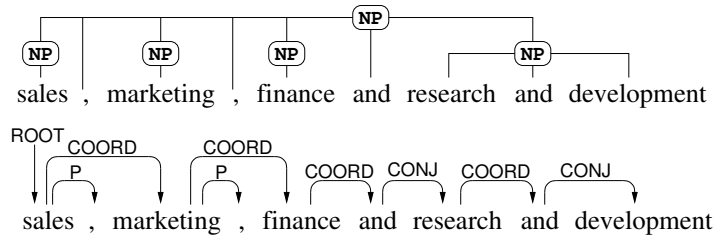
We use Mel'čuk-style analysis of coordination (Mel'čuk, 1988). Specifically, we use the following conventions:

- The first conjunct is regarded as the head of the coordinated structure.
- The second conjunct is linked to the first via a COORD link.
- If a coordinating conjunction is present, it becomes the head of the second conjunct using a CONJ link.

- Coordination is right-associative.

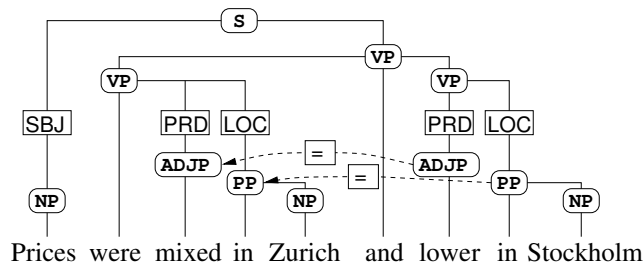


A more complex example involving a multi-level coordination with commas is shown below.

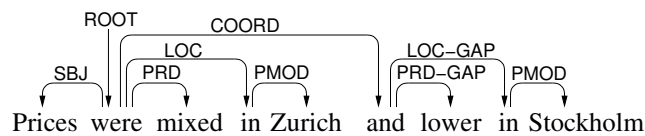


### 3.2 Gapping

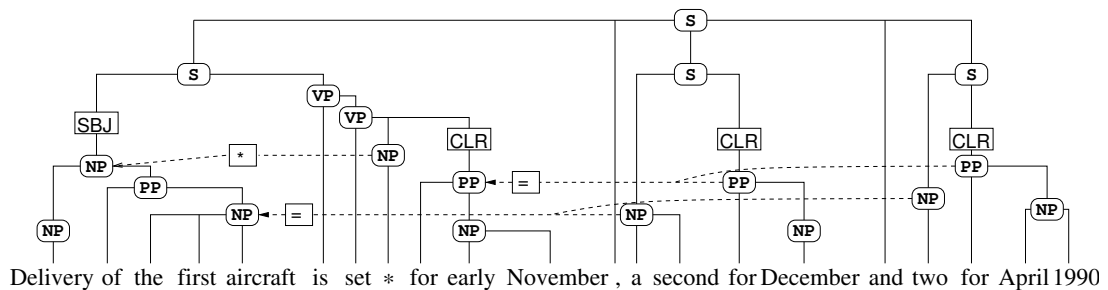
Gapping refers to the phenomenon that the head of the second conjunct in a coordination is missing, such as the verb in this example:

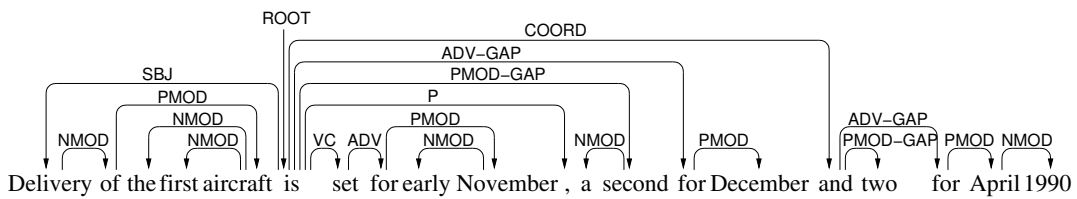


To handle this phenomenon without introducing empty categories, we follow the analysis in the Danish Dependency Treebank (Trautner Kromann et al., 2004), meaning that the parts of the second conjunct are attached to the conjunction, and the links carry a GAP label. If there is no conjunction, the parts are attached to the head of the first conjunct.



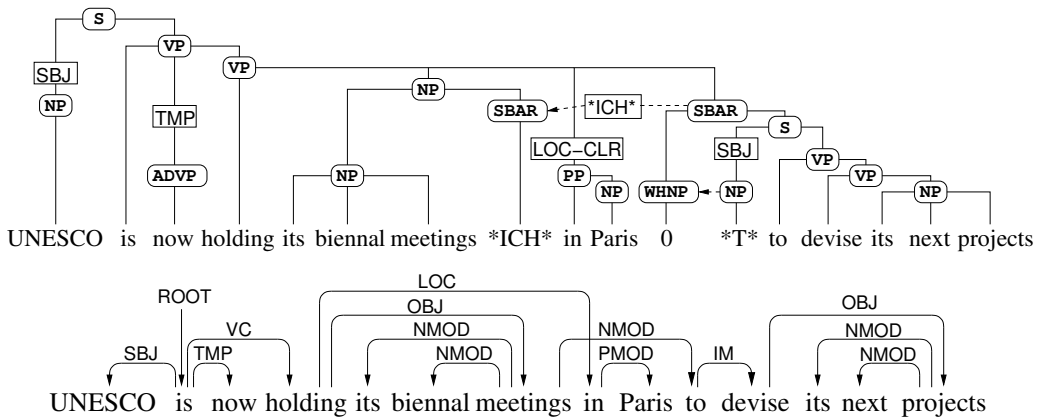
Here is a more complex example:





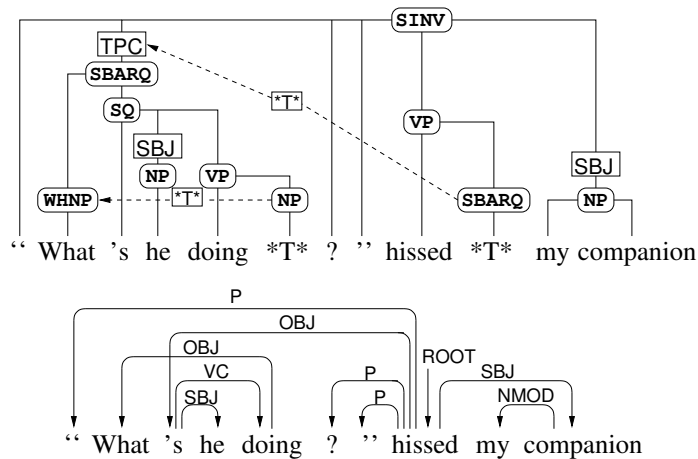
### 3.3 Discontinuous Structures (\*ICH\*)

Discontinuous structures, represented in the Treebank by the \*ICH\* link (“interpret constituent here”), are simply handled by introducing nonprojective links.

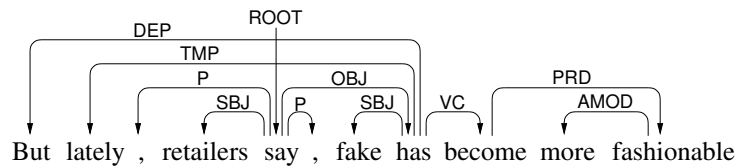
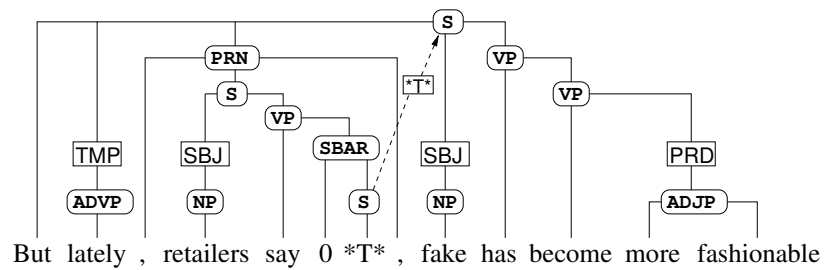


### 3.4 Nonlocal Dependencies

Some phenomena such as *wh*-movement and topicalization are represented in the Treebank by the empty category \*T\* (“trace”). When building the dependency representation, these links take priority over constituent attachment.

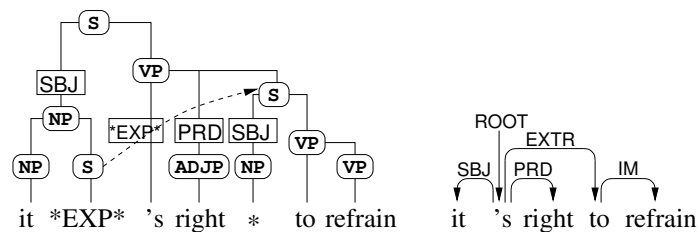


For some discontinuous structures, the Treebank uses a parenthetical and a trace linking the parenthetical to the top node. In these cases, the conversion procedure moves the parenthetical over its parent to break the cycle.



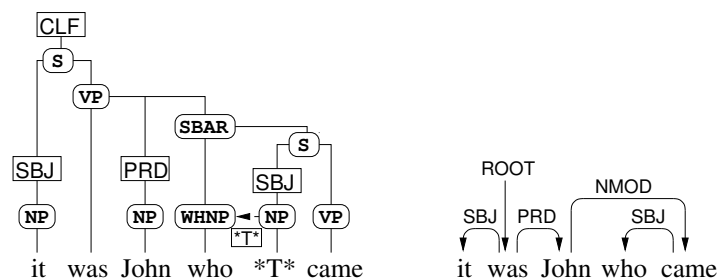
### 3.5 Expletive *it*

The extraposed element in an expletive construction gets an *EXTR* label.



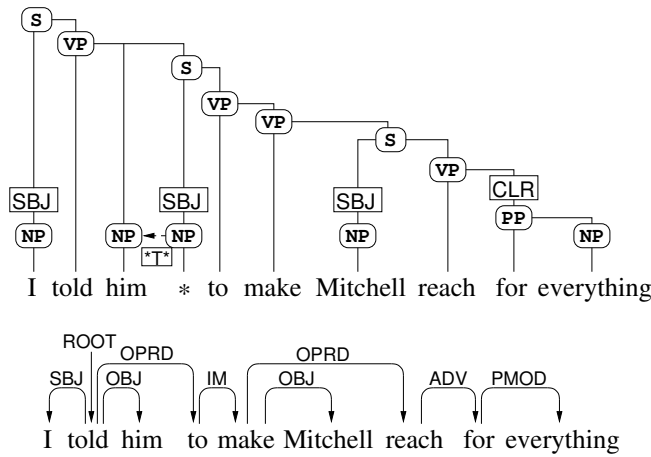
### 3.6 Cleft Sentences

The extraposed element in an *it*-cleft is treated as if attached to its antecedent.

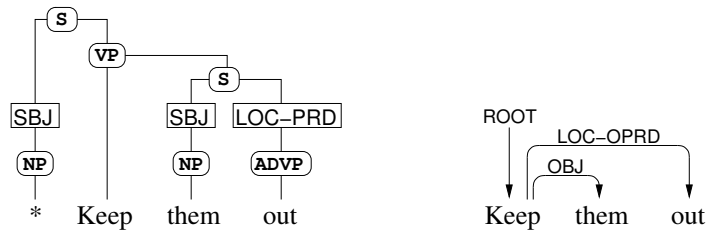


### 3.7 Object Complements

Some constructions, such as “small clauses” (see Bies et al. (1995), section 15), are represented in the Treebank using an *S* node directly inside a verb phrase. Since the case and position of the “subject” of such an *S* is determined by the voice of the verb in the enclosing *VP*, we move it to the object position in the *VP*. The remainder of the *S* clause is labeled with an *OPRD* label (“object predicative complement”).

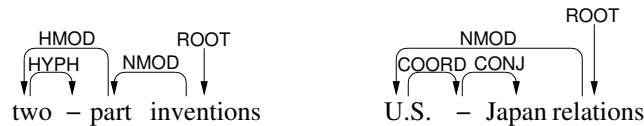


If the head part of the S has a function label, and this label is not PRD, this label is prefixed to the OPRD label, as in the example below.



### 3.8 Hyphenated Structures

To represent hyphenated structures, we have introduced two new POS tags: *HYPH* for hyphens and *PRF* for prefixes such as *non-* and *anti-*. We distinguish two types of relations inside hyphenated words: modification and coordination. The following figure shows how they are represented.



## 4 List of Dependency Relations

Note that labels may be combined, such as *LOC-OPRD* or *PRD-GAP*.

## 4.1 Labels Retained from the Penn Treebank

Label	Meaning
ADV	Unclassified adverbial
BNF	Benefactor (the <i>for</i> phrase for verbs that undergo dative shift)
DIR	Direction
DTV	Dative (the <i>to</i> phrase for verbs that undergo dative shift)
EXT	Extent
LGS	Logical subject
LOC	Location
MNR	Manner
PRD	Predicative complement
PRP	Purpose or reason
PUT	Various locative complements of the verb <i>put</i>
SBJ	Subject
TMP	Temporal
VOC	Vocative

## 4.2 Labels Derived from GLARF

Label	Meaning
APPO	Apposition
HMOD	Modifier in hyphenation, such as <i>two</i> in <i>two-part</i>
HYPH	Between first part of hyphenation and hyphen
NAME	Name-internal link
POSTHON	Posthonorifics such as <i>Jr, Inc.</i>
SUFFIX	Possessive 's
TITLE	Titles such as <i>Mr, Dr</i>

## 4.3 Inferred Labels

Label	Meaning
AMOD	Modifier of adjective or adverb
CONJ	Between conjunction and second conjunct in a coordination
COORD	Coordination
DEP	Unclassified relation
EXTR	Extrapolated element in expletive constructions
GAP	Gapping: between conjunction and the parts of a structure with an ellipsed head
IM	Between infinitive marker and verb
NMOD	Modifier of nominal
OBJ	Direct or indirect object or clause complement
OPRD	Object complement
P	Punctuation
PMOD	Between preposition and its child in a PP
PRN	Parenthetical
PRT	Particle
ROOT	Root
SUB	Between subordinating conjunction and verb
VC	Verb chain

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