Unbounded Dependency Constructions
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1 Basics

Unbounded Dependency Constructions (UDCs), aka Long Distance Dependencies (LDDs).

(1) On Kim, Sandy depends $\Delta$.
(2) *Kim, Sandy depends $\Delta$.
(3) On Kim, Chris believes [ Sandy depends $\Delta$]
(4) *Kim, Chris believes [ Sandy depends $\Delta$]

- unbounded
- syntactic dependency

1.1 Constraints

(5) *Who do you believe [ the claim that Sam likes $\Delta$]
(6) *Who do you know [ a man who likes $\Delta$]
(7) *Who do you like [ Sam and $\Delta$]?
(8) Who do you think [[ Sam likes $\Delta$] and [Kim hates $\Delta$]]?
(9) *Whose do you admire [ $\Delta$ book ]?
(10) *Who do you believe that $\Delta$ likes Sam?
(11) When do they *deny/believe [ that Sam left $\Delta$]

1.2 Strong vs Weak UDCs

Strong: antecedent in non-argument position (filler-gap constructions).

(12) Kim$_i$, Sandy loves $\Delta_i$  (Topicalization)
(13) I wonder [ who$_i$ Sandy loves $\Delta_i$ ]  (Wh-Question)
(14) The person [ who$_i$ Sandy loves $\Delta_i$ ]  (Wh-relative)
(15) It's Kim [ who$_i$ Sandy loves $\Delta_i$ ]  (It-relative)
(16) This is [ what$_i$ Kim loves $\Delta_i$ ]  (Pseudo-cleft)

Weak: antecedent in argument position.

(17) Sandy$_i$ is hard to love $\Delta_i$  (Tough Movement)
(18) I bought it$_i$ for Sandy to eat $\Delta_i$  (Purpose Infinitive)
(19) This is the person$_i$ [ Sandy loves $\Delta_i$ ]  (Relative)
(20) It's Kim$_i$, Sandy loves $\Delta_i$  (It cleft)

2 Approaches

2.1 Classical

Movement rule, plus stipulated constraints.
2.2 Move-α

General movement rule, plus general constraints (trace theory, Government, Binding, etc.), empty operators for weak UDCs.

2.3 GPSG

SLASH features; S/NP is an S with an NP hole in it.

3 HPSG: Overview

Similar to GPSG in spirit, but different in most technical details.
4 HPSG: Details

4.1 Outline: Basic Apparatus

- Nonlocal Feature Value
- Non-Local Feature Principle
- Trace (a lexical entry)
- Filler-Head ID Schema
- Lexical Entries (weak UDCs): tough
- Constraints
- Trace Principle, and Subject Extraction Lexical Rule (SELR)
- Coordination Principle

4.2 Nonlocal Values

HPSG employs three non-local attributes: SLASH, REL and QUE. Here we focus on SLASH (REL is used in relative clauses, QUE in questions).

\[
\begin{array}{c}
\text{PHON} \\
\text{SYNSEM} \\
\text{LOCAL} \\
\text{NONLOCAL} \\
\text{INHERITED|SLASH} \\
\text{TO-BIND|SLASH}
\end{array}
\]

4.3 Nonlocal Feature Principle

For each nonlocal feature, the INHERITED value on the mother is the union of the INHERITED values on the daughters —
4.4 The bottom of the dependency: Trace

Lexical entry for trace:

\[
\begin{align*}
&\text{PHONOLOGY} \quad \{\} \\
&\text{SYNSEM} \quad \text{LOCAL} \quad \begin{bmatrix} \text{INHER|SLASH} \{1\} \end{bmatrix} \\
&\text{LOCAL} \\
&\text{INHERITED} \quad \begin{bmatrix} \text{SLASH} \{1\} \end{bmatrix} \\
&\text{REL} \quad \{\} \\
&\text{QUE} \quad \{\} \\
&\text{NONLOCAL} \quad \text{SLASH} \{1\} \\
&\text{TO-BIND} \quad \text{SLASH} \{1\} \\
&\text{REL} \quad \text{set-of-ref-indices} \\
&\text{QUE} \quad \text{set-of-npro} \\
&\text{TO-BIND} \quad \text{set-of-local-structures} \\
&\text{set-of-local-structures} \\
&\text{set-of-ref-indices} \\
&\text{set-of-npro}
\end{align*}
\]

\[\text{they think admire} \quad \text{LOC} \quad \text{NONLOCAL|SLASH} \{1\}\]

\[\text{Kim} \quad \text{S} \quad \text{INHER|SLASH} \{\} \]

\[\text{VP} \quad \text{S} \quad \text{INHER|SLASH} \{1\}\]

\[\text{NP} \quad \text{I} \quad \text{INHER|SLASH} \{1\}\]

\[\text{V} \quad \text{think} \quad \text{INHER|SLASH} \{1\}\]

\[\text{NP} \quad \text{they} \quad \text{INHER|SLASH} \{1\}\]

\[\text{V} \quad \text{admire} \quad \text{LOC} \quad \text{NONLOCAL|SLASH} \{1\}\]

... minus the TO-BIND value on the HEAD daughter.
Since SLASH is set-valued, multiple extraction is permitted:

(21) It is easy to play these sonatas on these violins.
(22) These sonatas are easy to play on these violins.
(23) Which violins are these sonatas easy to play on Δ_i?

4.5 Strong UDCs: Filler Head Schema (ID 6)

Schema 6 (ID6: FILLER HEAD SCHEMA)

a phrase with DTRS value of sort filler-head-structure, such that the head daughter’s TO-BIND|SLASH value is a singleton set, whose member is token identical with the LOCAL value of the filler daughter.

![Diagram of Filler Head Schema]

For example:

(24) X

The FILLER:[1] HEAD:

\[
\text{INHER|SLASH } \{ \square \ldots \} \\
\text{TO-BIND|SLASH } \{ \square \}
\]

Non-locally:

For example:

(25) S[fin] → XP INHER|SLASH \{ \square \ldots \}

\[
\text{TO-BIND|SLASH } \{ \square \}
\]

4.6 Weak UDCs (e.g. tough)

(26) Sam_i is tough (for us) to please t_i

tough: SUBCAT: \(<NP_{t_i}(PP), VP/NP_t\)
(27) Sam is tough to please.

4.7 Constraints

4.7.1 Trace Principle

Every trace must be subcategorized by a substantive head.

For English: Every trace must be strictly subcategorized by a substantive head; i.e. every trace must be a non-subject complement of the appropriate head.

Hence:

1. No extraction of adjuncts:
   (28) When do they *deny/believe [that Sam left Δ]

2. No extraction of subjects:
   (29) *Who did you claim that Δ left?
   (30) Whose did you read Δ book?

But:

1. Extraction of adjuncts is sometimes possible.
   (31) How long ago do you believe that Kim left?
   (32) When did they say [that Sam left Δ]?
   (33) How did they say [(?that) Sam died Δ]?

2. Subjects appear to move:
   (34) Who did Kim claim left?
   (35) Who did Kim claim [VP left ]
   (36) *Who did Kim claim [Δ left ]?

Notice that questions involving the matrix subject are not counter examples:
4.7.2 Extraction of “Subjects”: SELR

The structure of (37) is not (38), but (39):

(37) Who did you claim ∆ left?
(38) Who_i did you claim [S ∆_1 left ]?
(39) Who_i did you claim [VP left ]?

Claim has two subcategorizations:

1. \{NP, S[unmarked]\}
2. \{S, VP\}

related by a lexical rule: the Subject Extraction Lexical Rule (SELR) SELR:

\[
\begin{align*}
X \left[ \text{SUBCAT} \left( Y, S[\text{UNMARKED}], \ldots \right) \right] & \Rightarrow \\
X \left[ \text{SUBCAT} \left( Y, VP[\text{SUBCAT} \left( [\text{LOC}] \right), \ldots \right) \right] & \text{INHER} \text{ SLASH} \# \\
\end{align*}
\]

4.7.3 Extraction of Adjuncts

Similarly, to allow extraction of adjuncts, one could have lexical rule along the following lines:¹

Adjunct Extraction Lexical Rule:

\[
\begin{align*}
\left[ \text{SUBCAT} \left( \ldots, S \ldots \right) \right] & \Rightarrow \\
\text{INHER} \text{ SLASH} \{ \} \\
\left[ \text{SUBCAT} \left( \ldots, S \ldots \right) \right] & \text{INHER} \text{ SLASH} \{ \text{YP} \left[ \text{MOD} \, E \right], \ldots \} \\
\text{CONTENT} \text{ SOA-ARG} \, E \\
\text{think:} \langle NP, S \rangle / \{ \} & \Rightarrow \text{think:} \langle NP, S \rangle / \{ YP \}
\end{align*}
\]

The YP here is something that can modify (have as its MOD value) something like the original S, and the CONTENT of the S is identified with that of the adjunct (the adjunct ‘absorbs’ the semantics of the S via the MOD feature).

The effect is to make the following have the same content:

(40) Yesterday, I think [ Kim left ].
(41) I think [ Kim left yesterday ].

¹This is not what Pollard and Sag (1994, 385ff) actually propose, but the idea is similar.
4.7.4 Coordination Principle

The trace principle forbids:

(42) *Who do you like [ Sam and Δ ]

Coordination of unlike constituents, and ATB extraction is allowed by the Coordination Principle:

Coordination Principle: In a coordinate structure, the CATEGORY and NONLOCAL value of each conjunct daughter is subsumed by (is an extension of) that of the mother.

\[ VP_{fin} \]
\[ \rightarrow SLASH \]
\[ NP \]

\[ VP_{fin, -AUX} \] and \[ VP_{fin, +AUX} \]
\[ SLASH \]

likes Δ and is trying to buy Δ

(43) Which picture do you think....
   a. Sam likes Δ and is trying to buy Δ
   b. *Sam likes it and is trying to buy Δ

NB such structures are not ‘complete’, i.e. not totally well typed or sort resolved.

\[ LOC | CAT \]
\[ \rightarrow HEAD | ADJ \]
\[ SUBCAT | \]
\[ NP | VP | INF, INHER | SLASH | \{ NP | ACC | PPRO | \} \]
\[ NONLOCAL | TO-BIND | SLASH | \{ \} \]

4.7.5 Complex NP Constraint

One case of the CNPC forbids extraction from relative clauses:

(44) *Who did Kim see a person who admires Δ

Extraction from Relative Clauses is blocked because lexical entries for relativizers permit only single slashes on relative clauses.
(Intuitively, this slash corresponds to the NP that heads the relative clause; see Pollard and Sag (1994, ch5) for details).

4.7.6 Other Constraints

Subject Condition (parasitic gaps) — also considered, but rejected: SIP (Slash Inheritance Principle), and Incomplete Constituent Constraint.

5 Further Issues

- The account in Pollard and Sag (1994) actually assumes several different mechanisms for extraction of non-subject arguments, subjects, and adjuncts. However, this seems wrong: e.g. ‘local encoding’ on the extraction path seems to work the same for all kinds of extraction (Hukari and Levine (1991)). This is addressed in Bouma et al. (2001).
- lots of issues of detail, precise formulations of constraints, proper treatment of adjuncts, problems of connectivity, etc.
  
  For example: ‘connectivity’, sometimes ‘preposing’ makes something grammatical, which is a mystery if local values of trace and filler are the same:
  
  (45) *You can rely on that Kim will help you.
  (46) That Kim will help you, you can rely on.

- parasitic gaps, . . .
  
  (47) a. Who did my talking to t₁ bother t₁?
    b. *Who did my talking to t₁ bother Sam?
    c. *Who did my talking to Sam bother t₁?
  
  (48) a. Those reports, I filed t₁ without reading t₁.
    b. Those reports, I filed t₁ without reading your letter.
    c. ?Those reports, I filed your letter without reading t₁.

- A traceless account:
  
  Pollard and Sag (1994, 376ff), Sag and Fodor (1994), Bouma et al. (2001), and Sag and Wasow (1999) provide accounts where instead of having the trace lexical item, there is a lexical rule, or general principle that allows a complement to be removed from the list of complements, and placed in SLASH:
  
  (49) \( \text{kiss}(NP, NP)/\{\} \rightarrow \text{kiss}(NP)/\{NP\} \)
  
  (The extracted item should remain on the SUBCAT list, for reasons to do with binding theory, inter alia, so this analysis requires a slightly different treatment of subcategorization. This is argued for independently in Pollard and Sag (1994, Ch 9).)

References


