How not to distinguish arguments from adjuncts in LFG

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HeadLex16
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Example and **terminology** (dependents = arguments + adjuncts):

- [John] *put* [the book] [on the chair] [on Monday].
- [John] *read* [the book] [on the chair] [on Monday].

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- no reliable tests for the argument-adjunct dichotomy (AAD),
- LFG already mostly does not distinguish them,
- easy to get rid of AAD altogether.
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**Obligatoriness:** arguments are obligatory, adjuncts are optional.

**Problem 1:** syntactically optional arguments (even in English):
- I lost 20 lbs and nobody has **noticed**. Feeling down about it.
- He will tell you everything when he has **finished**.
- Andrew has already **eaten** and isn’t hungry.

In all these cases direct (passivisable) objects – that is, clear cases of arguments – are omitted.

**Attempted solution:** it’s semantic obligatoriness, not syntactic obligatoriness, that counts (Panevová 1974, Fillmore 1969, 1986).

Fewer predicates affected, but still a problem for predicates such as **EAT**:
- He’s already **noticed** (*but I have no idea what he’s noticed*).
- He’s already **finished** (*but I have no idea what he’s finished*).
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  - ... in a bad part of town.
  - ... only with great difficulty.
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Also e.g. (Goldberg and Ackerman 2001):

- The claim was believed # (in the seventh century / in the South).
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Iterability: adjuncts – but not arguments – of the same type may iterate (Bresnan 1982b):

- Fred *deftly* [Manner] handed a toy to the baby *by reaching behind his back* [Manner] *over lunch* [Temp] *at noon* [Temp] *in a restaurant* [Loc] *last Sunday* [Temp] *in Back Bay* [Loc] *without interrupting the discussion* [Manner].
- *John escaped from prison with dynamite* [Inst] *with a machine gun* [Inst].

Problem: iteration is possible if iterated dependents of the same type specify the same entity, but then also iteration of arguments (Zaenen and Crouch 2009, Goldberg 2002):

- I count *on you, on your kindness.*
- He lives in France, in a small village.
- With a slingshot he broke the window with a rock.
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**Problem:** counterexamples easy to find, e.g. (McConnell-Ginet 1982):
- *Annie weighs 120 pounds {heavily, beautifully, quickly, elegantly}.
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Koenig et al. 2003:
- manual examination of 3909 English verbs (by two independent examiners),
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- John ate a banana yesterday, and Geraldine *did so* today.
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**Problem**: known cases where the reference of verbal proforms may omit some arguments (Miller 1992, Culicover and Jackendoff 2005):

- Robin broke the window with a hammer and Mary *did the same to* the vase.
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Escape strategies

Tutunjian and Boland 2008: 633: “the sheer number of these tests underlines the fact that **no single test is entirely satisfactory.** Furthermore, when the tests are applied as a group, phrases often yield **contradictory results**, patterning as arguments on some tests and adjuncts on others.”

**Common reactions:**

- the distinction is there, we just haven’t found good tests yet (after over 50 years of intensive research, at least since Tesnière 1959 and Chomsky 1965),

- it’s an $n$-way distinction; commonly, $n = 3$, but $n = 6$ in Somers 1984, etc. (i.e. replace 1 ill-defined distinction with $n − 1$ ill-defined distinctions).
Escape strategies

Tutunjian and Boland 2008: 633: “the sheer number of these tests underlines the fact that **no single test is entirely satisfactory.** Furthermore, when the tests are applied as a group, phrases often yield **contradictory results**, patterning as arguments on some tests and adjuncts on others.”

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AAD in syntactic representations

John waited for the book on the chair on Monday.

**No distinction** at c-structure (e.g. Kaplan and Bresnan 1982: 217):

\[
\begin{align*}
VP & \rightarrow \ V \ ( \ NP \ ) \ ( \ NP \ ) \ PP^* \\
(\uparrow \ OBJ) & = \downarrow \quad (\uparrow \ OBJ_\theta) = \downarrow \\
\{ (\uparrow (\downarrow \text{PCASE}) = \downarrow) \mid \\
\downarrow \in (\uparrow \text{ADJUNCTS}) \}
\end{align*}
\]

Conspicuous distinction at f-structure:
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\text{VP} \rightarrow \text{V ( NP ) ( NP )} \quad \text{(UP OBJ)} = \downarrow \quad \text{(UP OBJ_\theta)} = \downarrow \\
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\]

Conspicuous distinction at f-structure:

\[
\begin{align*}
\text{PRED} & \quad \text{\textquote{\text{WAIT\{1,2\}}}} \\
\text{SUBJ} & \quad 1\text{PRED \text{\textquote{\text{JOHN}}}} \\
\text{OBL} & \quad 2\text{PRED \text{\textquote{\text{BOOK}}}} \\
\text{ADJ} & \quad \left\{ \begin{array}{c}
\text{PRED} \quad \text{\textquote{\text{ON\{3\}}}} \\
\text{OBJ} \quad 3\text{PRED \text{\textquote{\text{CHAIR}}}} \\
\end{array} \right\} \quad \left\{ \begin{array}{c}
\text{PRED} \quad \text{\textquote{\text{ON\{4\}}}} \\
\text{OBJ} \quad 4\text{PRED \text{\textquote{\text{MONDAY}}}} \\
\end{array} \right\}
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\text{VP} \rightarrow V ( \text{NP} ) ( \text{NP} ) \quad \text{PP}^* \quad \ldots
\]

\[
(\uparrow \text{OBJ}) = \downarrow \\
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\[
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\text{PRED} & \quad \text{‘WAIT$\langle 1,2 \rangle$’} \\
\text{SUBJ} & \quad [\text{PRED} \quad \text{‘JOHN’}] \\
\text{OBL} & \quad [\text{PRED} \quad \text{‘BOOK’}] \\
\text{ADJ} & \quad \left\{ \begin{array}{l}
\text{PRED} \quad \text{‘ON$\langle 3 \rangle$’} \\
\text{OBJ} \quad [\text{PRED} \quad \text{‘CHAIR’}] \\
\end{array} \right. \\
\text{OBJ} & \quad [\text{PRED} \quad \text{‘ON$\langle 4 \rangle$’}] \\
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\text{VP} \rightarrow \text{V} \left( \text{NP} \right) \left( \text{NP} \right) \text{PP}^* \quad \ldots \\
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\[
\begin{align*}
PRED & \quad \text{‘WAIT:\(\langle 1,2 \rangle\)’} \\
\text{SUBJ} & \quad 1 \begin{bmatrix} PRED & \text{‘JOHN’} \end{bmatrix} \\
\text{OBL} & \quad 2 \begin{bmatrix} PRED & \text{‘BOOK’} \end{bmatrix} \\
\text{ADJ} & \quad \left\{ \begin{bmatrix} PRED & \text{‘ON:\(\langle 3 \rangle\)’} \end{bmatrix}, \begin{bmatrix} PRED & \text{‘ON:\(\langle 4 \rangle\)’} \end{bmatrix} \right\} \\
\text{OBJ} & \quad 3 \begin{bmatrix} PRED & \text{‘CHAIR’} \end{bmatrix}, \begin{bmatrix} OBJ & 4 \begin{bmatrix} PRED & \text{‘MONDAY’} \end{bmatrix} \end{bmatrix} \\
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\end{align*}
\]
No distinction at s-structure.

In some recent LFG work (e.g. Asudeh et al. 2014):

- s-level attributes ARG\(_1\), \ldots, ARG\(_4\) represent a subset of arguments (those in the scope of the Lexical Mapping Theory),

- other arguments – as well as adjuncts – have dedicated s-level attributes BENEFICIARY, INSTRUMENT, etc.
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---

Figure 5: Relevant structures and correspondences for \textit{Kim drew Godzilla for Sandy}.
No distinction in final semantic representations, as they commonly use the neo-Davidsonian approach (Davidson 1967, Parsons 1990).

For example (Maienborn and Schäfer 2011:1400):

- Peter opened the box with a knife in the garage.
  \[ \exists e. [open(e) \land agent(e, peter) \land patient(e, the box) \land location(e, the garage) \land instr(e, a knife)] \]

No distinction:

- Peter sleeps in the garage.
  \[ \exists e. [sleep(e) \land agent(e, peter) \land location(e, the garage)] \]
- Peter resides in the garage.
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Traditionally in LFG:

- **arguments** specified:
  - always in lexical entries (of items governing them),
  - also in grammatical rules,
- **adjuncts** only specified in grammatical rules.

For example:

\[
\text{S} \rightarrow \text{NP} \quad \text{VP} \\
(\Uparrow \text{SUBJ}) = \Downarrow
\]

\[
\text{VP} \rightarrow \text{V} \quad (\text{NP}) \quad (\text{NP}) \\
(\Uparrow \text{OBJ}) = \Downarrow \quad (\Uparrow \text{OBJ}_\theta) = \Downarrow
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\[
\{ (\uparrow (\downarrow \text{PCASE}) = \downarrow) \mid \downarrow \in (\uparrow \text{ADJUNCTS}) \}
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\text{WAIT} \quad V \quad (\uparrow \text{PRED}) = \text{`WAIT}\langle \text{SUBJ}, \text{OBL}\rangle'
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\text{VP} \rightarrow \quad V \quad (\uparrow \text{NP} \quad ) \quad (\uparrow \text{NP} \quad ) \quad \text{PP}^* \quad \text{...} \\
\quad (\uparrow \text{OBJ}) = \downarrow \quad (\uparrow \text{OBJ}_\theta) = \downarrow \quad \{(\uparrow (\downarrow \text{PCASE}) = \downarrow) \mid \downarrow \in (\uparrow \text{ADJUNCTS})\}
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For example:

\[
\text{\textsc{wait} } \textsc{V} \quad (\uparrow \textsc{pred}) = \langle \textsc{wait} (\textsc{subj}, \textsc{obl}) \rangle
\]

\[
\text{S} \quad \longrightarrow \quad \text{NP} \quad \text{VP} \quad (\uparrow \textsc{subj}) = \downarrow
\]

\[
\text{VP} \quad \longrightarrow \quad \textsc{V} \quad \langle \text{NP} \rangle \quad \langle \text{NP} \rangle \quad \text{PP}^* \quad \text{\ldots}
\]

\[
(\uparrow \textsc{obj}) = \downarrow \\
(\uparrow \textsc{obj}_\theta) = \downarrow \\
\{ (\uparrow (\downarrow \textsc{pcase}) = \downarrow ) \ |
\downarrow \in (\uparrow \textsc{adjuncts}) \}
\]
Sarah elbowed her way through the crowd.

Recent LFG work (e.g. Asudeh et al. 2008, 2013) – arguments are added via general templates, e.g.:

- \( \text{TRANSLATIVE-OBLIQUE(PFN)} := (\uparrow \text{PRED}) = \langle \text{PFN}((\uparrow \text{SUBJ}), (\uparrow \text{OBJ}), (\uparrow \text{OBL})) \rangle \)
- \( \text{ENGLISH-WAY(PFN)} := @\text{TRANSLATIVE-OBLIQUE(PFN)} \ldots \)
- \( \text{SWEDISH-DMC(PFN)} := @\text{TRANSLATIVE-OBLIQUE(PFN)} \ldots \)

**English:**

\[
\begin{align*}
\text{WAY} & \quad \text{N} \quad (\uparrow \text{PRED}) = \langle \text{WAY} \\ @\text{ENGLISH-WAY((OBJ $\uparrow$)PRED FN) } \\
\ldots
\end{align*}
\]

**Swedish:**

\[
\begin{align*}
V' & \quad \rightarrow \quad (V^0) \\
\quad & \quad \text{NP} \quad \text{PP} \\
\quad & \quad (\uparrow \text{OBJ}) = \downarrow \quad (\uparrow \text{OBL}) = \downarrow \\
\quad & \quad @\text{SWEDISH-DMC(}$\uparrow$\text{PRED FN) } \\
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- $\text{ENGLISH-WAY(PFN)} := @\text{TRANSITIVE-OBLIQUE(PFN)} \ldots$
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**English:**

WAY $\quad$ N $\quad$ (↑ PRED) $\quad$ = ‘WAY’

$\quad$ @ENGLISH-WAY((OBJ ↑)PRED FN)

... 

**Swedish:**

$V' \quad \rightarrow \quad (V^0)$

NP $\quad$ PP

(↑ OBJ) $\quad$ = \downarrow$\quad$ (↑ OBL) $\quad$ = \downarrow

@SWEDISH-DMC(↑ PRED FN)

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PP (↑ OBL) =

@SWEDISH-DMC(↑ PRED FN)

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**English:**

\[
\begin{align*}
\text{WAY} & \quad (\uparrow \text{PRED}) = \text{WAY} \\
@\text{ENGLISH-WAY}\left((\text{OBJ} \uparrow)\text{PRED FN}\right) \\
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Even more recent LFG work (e.g. Asudeh and Giorgolo 2012, Findlay 2014, Asudeh et al. 2014):

- Glue makes PRED largely superfluous (Dalrymple et al. 1993),
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```
PRED 'WAIT'
SUBJ [PRED 'JOHN']
OBL [PRED 'BOOK']
ADJ { [PRED 'ON']
    OBJ [PRED 'CHAIR']
} [PRED 'ON'
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\begin{verbatim}
[[PRED 'WAIT' SUBJ [PRED 'JOHN'] OBL [PRED 'BOOK'] ADJ { [PRED 'ON' OBJ [PRED 'CHAIR']] [PRED 'ON' OBJ [PRED 'Monday']] } ]
\end{verbatim}
Outline of the proposal

Outline:

- **instead** of SUBJ, OBL, COMP, etc., vs. ADJ,
- a single list-valued DEPS (dependents),
- extending HPSG’s DEPS (Bouma *et al.* 2001) to all dependents of the predicate,
- at least those relating to the event introduced by the predicate (as opposed e.g. to speaker-oriented *honestly, maybe*, etc.).

Something like DEPS needed in LFG anyway:

- encodes the **functional hierarchy** (not the same as *thematic hierarchy*),
- which is referred to in analyses of (Dalrymple 2001, Bresnan *et al.* 2015):
  - control,
  - pronominal and anaphoric binding,
  - *wh*-movement, etc.
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- **a single list-valued DEPS** (dependents),
- extending HPSG's DEPS (Bouma et al. 2001) to all dependents of the predicate,
- at least those **relating to the event** introduced by the predicate (as opposed e.g. to speaker-oriented honestly, maybe, etc.).

Something like DEPS **needed** in LFG anyway:

- encodes the **functional hierarchy** (not the same as thematic hierarchy),
- which is referred to in analyses of (Dalrymple 2001, Bresnan et al. 2015):
  - control,
  - pronominal and anaphoric binding,
  - wh-movement, etc.
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- encodes the **functional hierarchy** (not the same as *thematic hierarchy*),
- which is referred to in analyses of (Dalrymple 2001, Bresnan et al. 2015):
  - control,
  - pronominal and anaphoric binding,
  - *wh*-movement, etc.
**Example**

*John waited for the book on the chair on Monday.*

\[
\begin{align*}
PRED & \quad \text{‘WAIT’} \\
DEPS & \quad \left[ \begin{array}{c}
PRED & \text{‘JOHN’} \\
DEPS & \left[ \begin{array}{c}
PRED & \text{‘ON’} \\
DEPS & \left[ \begin{array}{c}
PRED & \text{‘CHAIR’} \\
DEPS & \left[ \begin{array}{c}
PRED & \text{‘MONDAY’} \\
\end{array} \right] \right] \right] \right] \\
DEPS & \left[ \begin{array}{c}
PRED & \text{‘ON’} \\
\end{array} \right] \right]
\end{array} \right]
\end{align*}
\]

As before, some dependents may be singled-out.
Example

John waited for the book on the chair on Monday.

As before, some dependents may be singled-out.
A more conservative variant

A more conservative variant – all dependents are named:

\[
\begin{align*}
\text{PRED} & \quad \text{‘WAIT’} \\
\text{DEPS} & \quad \langle \text{SUBJ:} \left[ \text{PRED} \quad \text{‘JOHN’} \right], \\
& \quad \langle \text{OBL:} \left[ \text{PRED} \quad \text{‘BOOK’} \right], \\
& \quad \langle \text{LOC:} \left[ \text{DEPS} \langle \left[ \text{PRED} \quad \text{‘CHAIR’} \right] \right] \\
& \quad \langle \text{TEMP:} \left[ \text{DEPS} \langle \left[ \text{PRED} \quad \text{‘MONDAY’} \right] \right] \rangle \\
\end{align*}
\]

(Cf. functors in Functional Generative Description; Sgall et al. 1986.)
A more conservative variant

A more conservative variant – all dependents are named:

\[
\begin{align*}
\text{PRED} & \quad \text{"WAIT"} \\
\text{DEPS} & \quad \begin{cases}
\text{SUBJ} & \quad \left[ \text{PRED} \quad \text{"JOHN"} \right], \\
\text{OBL} & \quad \left[ \text{PRED} \quad \text{"BOOK"} \right], \\
\text{LOC} & \quad \begin{cases}
\left[ \text{PRED} \quad \text{"ON"} \right], \\
\text{DEPS} & \quad \left[ \left[ \text{PRED} \quad \text{"CHAIR"} \right] \right], \\
\text{PRED} & \quad \text{"ON"} \\
\text{TEMP} & \quad \left[ \left[ \text{PRED} \quad \text{"MONDAY"} \right] \right].
\end{cases}
\end{cases}
\end{align*}
\]

(Cf. functors in Functional Generative Description; Sgall et al. 1986.)
A more conservative variant – all dependents are named:

```
PRED 'WAIT'
DEPS
  SUBJ: [PRED 'JOHN'],
  OBL: [PRED 'BOOK'],
  LOC: [PRED 'ON',
    DEPS [PRED 'CHAIR'],
    PRED 'ON',
    DEPS [PRED 'MONDAY']]

(Cf. functors in Functional Generative Description; Sgall et al. 1986.)
```
Technically, use specific attributes instead of FIRST (or HEAD) in the standard FIRST / REST (or HEAD / TAIL) list encoding:
A more conservative variant – technically

Technically, use specific attributes instead of FIRST (or HEAD) in the standard FIRST / REST (or HEAD / TAIL) list encoding:

```
[ PRED 'WAIT' ]
  [ SUBJ ]
    [ PRED 'JOHN' ]
      [ OBL ]
        [ PRED 'BOOK' ]
          [ LOC ]
            [ PRED 'ON' ]
              [ DEPS OBJ ]
                [ PRED 'CHAIR' ]
                  [ REST ]
                    [ TEMP ]
                      [ PRED 'ON' ]
                        [ DEPS OBJ ]
                          [ PRED 'Monday' ]
```

...
Peter sleeps in the garage.
Peter resides in the garage.

The only other difference between lexical entries of \textit{SLEEP} and \textit{RESIDE}:
- (↑ \textsc{DEPS REST* LOC})
- (a similar constraint absent in the case of the object of \textit{EAT}, etc.).
No AAD in the more conservative variant

Peter sleeps in the garage.
Peter resides in the garage.

The only other difference between lexical entries of SLEEP and RESIDE:
- \( \uparrow \text{DEPS REST* LOC} \)
- (in the entry for RESIDE)
- (a similar constraint absent in the case of the object of EAT, etc.).
No AAD in the more conservative variant

Peter sleeps in the garage.
Peter resides in the garage.

The only other difference between lexical entries of SLEEP and RESIDE:

- (↑ DEPS REST* LOC)
- (a similar constraint absent in the case of the object of EAT, etc.)
No AAD in the more conservative variant

*Peter sleeps in the garage.*
*Peter resides in the garage.*

\[
\begin{align*}
\text{PRED} & \quad \langle \text{\textsc{sleep}} \rangle \\
\text{DEPS} & \quad \langle \text{\textsc{subj}}: [\text{PRED} \quad \langle \text{\textsc{Peter}} \rangle], \text{\textsc{loc}}: [\text{PRED} \quad \langle \text{\textsc{in}} \rangle] \rangle \\
\end{align*}
\]

\[
\begin{align*}
\text{PRED} & \quad \langle \text{\textsc{reside}} \rangle \\
\text{DEPS} & \quad \langle \text{\textsc{subj}}: [\text{PRED} \quad \langle \text{\textsc{Peter}} \rangle], \text{\textsc{loc}}: [\text{PRED} \quad \langle \text{\textsc{in}} \rangle] \rangle \\
\end{align*}
\]

The **only other difference** between lexical entries of *sleep* and *reside*:
- \(\uparrow \text{DEPS REST}^* \text{LOC}\) (in the entry for *reside*),
- (a similar constraint absent in the case of the object of *eat*, etc.)
No AAD in the more conservative variant

Peter sleeps in the garage.
Peter resides in the garage.

The only other difference between lexical entries of *sleep* and *reside*:
- \( \uparrow \text{DEPS REST* LOC} \) (in the entry for *reside*)
- (a similar constraint absent in the case of the object of *eat*, etc.)
A worked example 1

Worked example:

- John resided in France for two years, in a small village called Saint-Couat-d’Aude.

Additional assumption:
- dependent types are generally iterable (i.e., sets).

Simplifying assumptions for this worked example:
- NPs have no internal structure,
- they contribute semantic constants:
  - $j$ in case of John,
  - $f$ in case of France,
  - $ty$ in case of two years and
  - $asv$ in case of a small village....
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Worked example:

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  - j in case of John,
  - f in case of France,
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  - asv in case of a small village....
A worked example 2

John resided in France for two years, in a small village...

Intended f-structure and semantic representation:

\[
\begin{align*}
\text{PRED} & \quad \text{‘RESIDE’} \\
\text{TENSE} & \quad \text{PAST} \\
\text{DEPS} & \quad \langle \text{SUBJ: \{[PRED \quad \text{‘JOHN’}]\}} \\
& \quad \langle \text{LOC: \{[PRED \quad \text{‘IN’}] [DEPS \quad \langle \text{OBJ: “FRANCE”} \rangle] \}} \\
& \quad \langle \text{DUR: \{[PRED \quad \text{‘FOR’}] [DEPS \quad \langle \text{OBJ: “TWO YEARS”} \rangle] \}} \\
\end{align*}
\]

\[
\exists e. [\text{reside}(e) \land \text{past}(e) \land \text{agent}(e, j) \land \text{duration}(e, ty) \\
\land \text{location}(e, f) \land \text{location}(e, asv)]
\]
A worked example 2

John resided in France for two years, in a small village...

Intended f-structure and semantic representation:

```plaintext
\[
\begin{aligned}
\text{PRED} & \quad \text{‘RESIDE’} \\
\text{TENSE} & \quad \text{PAST} \\
\text{DEPS} & \quad \langle \text{SUBJ:} \left\{ \begin{array}{l}
\text{PRED} \quad \text{‘JOHN’}
\end{array} \right\}, \\
\text{LOC:} & \quad \left\{ \begin{array}{l}
\text{PRED} \quad \text{‘IN’} \\
\text{DEPS} \quad \langle \text{OBJ: “FRANCE”} \rangle \\
\text{DEPS} \quad \langle \text{OBJ: “A… VILLAGE…”} \rangle
\end{array} \right\} \rangle,
\text{DUR:} & \quad \left\{ \begin{array}{l}
\text{PRED} \quad \text{‘FOR’} \\
\text{DEPS} \quad \langle \text{OBJ: “TWO YEARS”} \rangle
\end{array} \right\} \rangle
\end{aligned}
\]
```

\(\exists e. [\text{reside}(e) \land \text{past}(e) \land \text{agent}(e, j) \land \text{duration}(e, ty) \land \text{location}(e, f) \land \text{location}(e, asv)]\)
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John resided in France for two years, in a small village...

Intended f-structure and semantic representation:

\[
\begin{align*}
\text{PRED} & \quad \text{`RESIDE'} \\
\text{TENSE} & \quad \text{PAST} \\
\text{DEPS} & \quad \text{SUBJ: \{PRED `JOHN'\},} \\
\text{DEPS} & \quad \text{LOC: \{PRED `IN' \langle OBJ: "FRANCE" \rangle,} \\
\text{DEPS} & \quad \text{DEPS \langle OBJ: "A... VILLAGE..." \rangle\},} \\
\text{DEPS} & \quad \text{DUR: \{PRED `FOR' \langle OBJ: "TWO YEARS" \rangle\}} \\
\end{align*}
\]

\[\exists e. [\text{reside}(e) \land \text{past}(e) \land \text{agent}(e, j) \land \text{duration}(e, ty) \land \text{location}(e, f) \land \text{location}(e, asv)]\]
A worked example 3

Lexical entries:

- **resided** | \( \uparrow \text{PRED} = \text{‘RESIDE’} \)
  \[ @\text{AGENT} @\text{PAST} \]
  \[ \lambda e.\text{reside}(e) : (\uparrow_\sigma \text{EVENT}) \rightarrow \uparrow_\sigma \]
  \[ (\uparrow \text{DEPS REST* LOC}) \]

- **in** \( P \) | \( \uparrow \text{PRED} = \text{‘IN’} \)
  \[ \%\text{HD} = (\text{DEPS REST* LOC} \in \uparrow) \]
  \[ \lambda x\lambda P\lambda e.[P(e) \land \text{location}(e, x)] : \]
  \[ (\uparrow \text{DEPS OBJ} \in \sigma) \rightarrow [((\%\text{HD}_\sigma \text{EVENT}) \rightarrow \%\text{HD}_\sigma] \]
  \[ \rightarrow (\%\text{HD}_\sigma \text{EVENT}) \rightarrow \%\text{HD}_\sigma \]

- **in France**: \( \%\text{HD} = (\text{DEPS REST* LOC} \in \uparrow) \)
  \[ \lambda P\lambda e.[P(e) \land \text{location}(e, f)] : \]
  \[ [((\%\text{HD}_\sigma \text{EVENT}) \rightarrow \%\text{HD}_\sigma] \rightarrow (\%\text{HD}_\sigma \text{EVENT}) \rightarrow \%\text{HD}_\sigma] \]
A worked example 3

Lexical entries:

- **resided**  \(\uparrow \text{PRED} = \text{‘RESIDE’} \)
  - \(\text{@AGENT} \text{ @PAST} \)
  - \(\lambda e.\text{reside}(e) : (\uparrow_\sigma \text{EVENT}) \rightarrow \uparrow_\sigma \)
  - \((\uparrow \text{DEPS} \text{ REST}^* \text{ LOC})\)

- **in**  \(\uparrow \text{PRED} = \text{‘IN’} \)
  - \(\%\text{HD} = (\text{DEPS} \text{ REST}^* \text{ LOC} \in \uparrow) \)
  - \(\lambda x \lambda P \lambda e. [P(e) \land \text{location}(e, x)] : \)
    - \((\uparrow \text{DEPS OBJ} \in )_\sigma \rightarrow [(%\text{HD}_\sigma \text{ EVENT}) \rightarrow %\text{HD}_\sigma] \)
    - \(\rightarrow (\%\text{HD}_\sigma \text{ EVENT}) \rightarrow %\text{HD}_\sigma \)

- **in France:**  \(\%\text{HD} = (\text{DEPS} \text{ REST}^* \text{ LOC} \in \uparrow) \)
  - \(\lambda P \lambda e. [P(e) \land \text{location}(e, f)] : \)
    - \([(%\text{HD}_\sigma \text{ EVENT}) \rightarrow %\text{HD}_\sigma] \rightarrow (\%\text{HD}_\sigma \text{ EVENT}) \rightarrow %\text{HD}_\sigma \)
A worked example

Lexical entries:

- **resided**  \( \uparrow \text{PRED} = \text{‘RESIDE’} \)
  - \@\text{AGENT} \@\text{PAST}
  - \( \lambda e.\text{reside}(e) : (\uparrow_{\sigma} \text{EVENT}) \rightarrow \uparrow_{\sigma} \)
  - \( (\uparrow \text{DEPS REST* LOC}) \)

- **in**  \( \uparrow \text{PRED} = \text{‘IN’} \)
  - \%HD = \( (\text{DEPS REST* LOC} \in \uparrow) \)
  - \( \lambda x \lambda P \lambda e. [P(e) \land \text{location}(e, x)] : \)
    - \( (\uparrow \text{DEPS OBJ} \in \sigma) \rightarrow \%\text{HD}_{\sigma} \)
    - \%HD_{\sigma} \rightarrow \%HD_{\sigma} \)

- **in France**: \%HD = \( (\text{DEPS REST* LOC} \in \uparrow) \)
  - \( \lambda P \lambda e. [P(e) \land \text{location}(e, f)] : \)
    - \[ \%HD_{\sigma} \rightarrow \%HD_{\sigma} \rightarrow \%HD_{\sigma} \]
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Lexical entries:

- **resided** | $(\uparrow \text{PRED}) = \text{‘RESIDE’}$
  
  @AGENT @PAST
  
  $\lambda e.\text{reside}(e) : (\uparrow_{\sigma} \text{EVENT}) \rightarrow \uparrow_{\sigma}$
  
  $(\uparrow \text{DEPS REST* LOC})$

- **in** P | $(\uparrow \text{PRED}) = \text{‘IN’}$
  
  $\%\text{HD} = (\text{DEPS REST* LOC} \in \uparrow)$
  
  $\lambda x \lambda P \lambda e. [P(e) \land \text{location}(e, x)] :$
  
  $(\uparrow \text{DEPS OBJ} \in \sigma) \rightarrow [(\%\text{HD}_\sigma \text{ EVENT}) \rightarrow \%\text{HD}_\sigma]$
  
  $\rightarrow (\%\text{HD}_\sigma \text{ EVENT}) \rightarrow \%\text{HD}_\sigma$

- **in France**:
  
  $\%\text{HD} = (\text{DEPS REST* LOC} \in \uparrow)$
  
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  $[(\%\text{HD}_\sigma \text{ EVENT}) \rightarrow \%\text{HD}_\sigma] \rightarrow (\%\text{HD}_\sigma \text{ EVENT}) \rightarrow \%\text{HD}_\sigma$
Lexical entries:

- **resided** 1  \((\uparrow\text{PRED}) = \text{RESIDE}\)
  
  \(@\text{AGENT} \quad @\text{PAST}\)
  
  \(\lambda e.\text{reside}(e) : (\uparrow_\sigma \text{EVENT}) \rightarrow \uparrow_\sigma\)
  
  \((\uparrow \text{DEPS} \text{ REST}^* \text{ LOC})\)

- **in**  P  \((\uparrow\text{PRED}) = \text{IN}\)
  
  \(\%\text{HD} = (\text{DEPS} \text{ REST}^* \text{ LOC} \in \uparrow)\)
  
  \(\lambda x\lambda P\lambda e.[P(e) \land \text{location}(e, x)] :\)
  
  \((\uparrow \text{DEPS} \text{ OBJ} \in )_\sigma \rightarrow [(\%\text{HD}_\sigma \text{ EVENT}) \rightarrow \%\text{HD}_\sigma]\)
  
  \(\rightarrow (\%\text{HD}_\sigma \text{ EVENT}) \rightarrow \%\text{HD}_\sigma\)

- **for**  P  \((\uparrow\text{PRED}) = \text{FOR}\)
  
  \(\%\text{HD} = (\text{DEPS} \text{ REST}^* \text{ DUR} \in \uparrow)\)
  
  \(\lambda x\lambda P\lambda e.[P(e) \land \text{duration}(e, x)] :\)
  
  \((\uparrow \text{DEPS} \text{ OBJ} \in )_\sigma \rightarrow [(\%\text{HD}_\sigma \text{ EVENT}) \rightarrow \%\text{HD}_\sigma]\)
  
  \(\rightarrow (\%\text{HD}_\sigma \text{ EVENT}) \rightarrow \%\text{HD}_\sigma\)
A worked example 4

Macro:

$$\text{GF}(F) := \downarrow \in (\uparrow \text{DEPS} \text{REST}^* \ F)$$

(preliminary)

Syntactic rules:

- IP $\rightarrow$ NP I'
  @GF(SUBJ)

- I' $\rightarrow$ I ( NP ) ( PP )
  @GF(OBJ)  @GF({\text{OBL}B\text{EN}|\text{OBL}\text{AGENT}|\text{DUR}|\text{LOC}|...})

Which GF is selected depends on the meaning constructor, e.g. (repeated):

- $\text{in} \ P$ (\uparrow \text{PRED}) = ‘IN’
  $\%\text{HD} = (\text{DEPS} \text{REST}^* \ \text{LOC} \in \uparrow)$
  $\lambda x \lambda P \lambda e.[P(e) \land \text{location}(e, x)] :$
  $(\uparrow \text{DEPS} \ \text{OBJ} \in)_{\sigma} \rightarrow [(\%\text{HD}_{\sigma} \ \text{EVENT}) \rightarrow \%\text{HD}_{\sigma}]$
  $\rightarrow (\%\text{HD}_{\sigma} \ \text{EVENT}) \rightarrow \%\text{HD}_{\sigma}$
A worked example 4

Macro:

\[
GF(F) := \downarrow \in (\uparrow \text{DEPS REST}^* F)
\]

(preliminary)

Syntactic rules:

1. \[IP \rightarrow NP \quad I'\]
   \[@GF(\text{SUBJ})\]

2. \[I' \rightarrow I (NP \quad (PP \quad \uparrow \downarrow))\]
   \[@GF(\text{OBJ}) @GF(\{\text{OBL\_BEN} | \text{OBL\_AGENT} | \text{DUR} | \text{LOC} | \ldots\})\]

Which GF is selected depends on the meaning constructor, e.g. (repeated):

\[\text{in } P \quad (\uparrow \text{PRED}) = \text{‘IN’}\]

\[\%HD = (\text{DEPS REST}^* \text{LOC } \in \uparrow)\]

\[\lambda x \lambda P \lambda e. [P(e) \land \text{location}(e, x)] :\]

\[\rightarrow (\%HD_{\sigma} \text{ \_EVENT}) \rightarrow \%HD_{\sigma}
\]

\[\rightarrow (\%HD_{\sigma} \text{ \_EVENT}) \rightarrow \%HD_{\sigma}\]
Macros:

\[
GF(F) := \downarrow \in (\uparrow DEPS REST^{*} F)
\]

(preliminary)

Syntactic rules:

1. \( IP \rightarrow NP l' \)
   \( @GF(SUBJ) \)

2. \( l' \rightarrow l ( NP ) ( PP )\)
   \( @GF(OBJ) \)
   \( @GF(\{OBL_{BEN}|OBL_{AGENT}|DUR|LOC|\ldots\}) \)

Which GF is selected depends on the meaning constructor, e.g. (repeated):

- \( in P (\uparrow PRED) = 'IN' \)
  \( \%HD = (DEPS REST^{*} LOC \in \uparrow) \)
  \( \lambda x \lambda P \lambda e.[P(e) \land location(e, x)] : \)
  \( (\uparrow DEPS OBJ \in)_{\sigma} \rightarrow [(%HD_{\sigma} EVENT) \rightarrow %HD_{\sigma}] \)
  \( \rightarrow (\%HD_{\sigma} EVENT) \rightarrow %HD_{\sigma} \)
A worked example 4

Macro:
- $GF(F) := \downarrow \in (\uparrow DEPS REST^* F)$

Syntactic rules:
- $IP \rightarrow NP \quad I'$
  $\quad @GF(SUBJ)$
- $I' \rightarrow I \quad (NP \quad (PP \quad \uparrow DEPS OBJ \quad \uparrow DEPS \{OBL_{BEN}|OBL_{AGENT}|DUR|LOC|\ldots\})^*)$

Which GF is selected depends on the meaning constructor, e.g. (repeated):
- in $P$ ($\uparrow PRED) = \text{IN}$
  $\%HD = (\uparrow DEPS REST^* LOC \in \uparrow)$
  $\lambda x \lambda P \lambda e.[P(e) \land location(e,x)] :$
  $\quad (\uparrow DEPS OBJ \in )_\sigma \rightarrow [(%HD_\sigma EVENT) \rightarrow %HD_\sigma]$
  $\rightarrow (\%HD_\sigma EVENT) \rightarrow \%HD_\sigma$
Via a more complex \textbf{GF macro} (but resides in one place):

\begin{itemize}
  \item HGFS-OBJ $\equiv$ SUBJ
  \item HGFS-OBJTH $\equiv$ \{HGFS-OBJ$|$OBJ\}
  \item HGFS-OBLSO $\equiv$ \{HGFS-OBJTH$|$OBJ$_{\text{THEME}}$\}
  \item HGFS-OBLGO $\equiv$ \{HGFS-OBLSO$|$OBL$_{\text{SOURCE}}$\}
  \item $\ldots$
  \item $\text{GF}(F) := \{ F =_{c} \text{SUBJ} \land \downarrow \in (\uparrow \text{DEPS} \ F) \mid$
  \item \hspace{1cm} $F =_{c} \text{OBJ} \land \downarrow \in (\uparrow \text{DEPS} \ \text{REST}^{*} \ F) \mid$
  \item \hspace{2cm} (\leftarrow \{\text{HGFS-OBJ}\})
  \item \hspace{1cm} $F =_{c} \text{OBJ}_{\text{THEME}} \land \downarrow \in (\uparrow \text{DEPS} \ \text{REST}^{*} \ F) \mid$
  \item \hspace{2cm} (\leftarrow \{\text{HGFS-OBJTH}\})
  \item \hspace{1cm} $F =_{c} \text{OBL}_{\text{SOURCE}} \land \downarrow \in (\uparrow \text{DEPS} \ \text{REST}^{*} \ F) \mid$
  \item \hspace{2cm} (\leftarrow \{\text{HGFS-OBLSO}\})
  \item \hspace{1cm} $F =_{c} \text{OBL}_{\text{GOAL}} \land \downarrow \in (\uparrow \text{DEPS} \ \text{REST}^{*} \ F) \mid$
  \item \hspace{2cm} (\leftarrow \{\text{HGFS-OBLGO}\})
  \item $\ldots\}$
\end{itemize}
Another example (out of reach with AAD in place?):

- Waldrum resided and created art in New Mexico.

Outline of the analysis:

- `created` combines with its direct object (‘satisfying’ the @PATIENT macro of `created`),
- the result is coordinated with `resided`,
- the result of coordination combines with the locative phrase,
- constraints involving REST* are evaluated separately on each conjunct, and LOC ends up as:
  - the 2nd element of the DEPS of `resided`,
  - and the 3rd element of the DEPS of `created`,
- the subject combines with the coordinated phrase, i.e., with each conjunct (‘satisfying’ the @AGENT macro of each verb).
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- the subject combines with the coordinated phrase, i.e., with each conjunct (‘satisfying’ the @AGENT macro of each verb).
Another kind of example (out of reach with AAD in place?):

- Waldrum resided and created art in New Mexico.

Outline of the analysis:

- *created* combines with its direct object (‘satisfying’ the @PATIENT macro of *created*),
- the result is coordinated with *resided*,
- the result of coordination combines with the locative phrase,
- constraints involving REST* are evaluated separately on each conjunct, and LOC ends up as:
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**Another example**

*Waldrum resided and created art in New Mexico.*

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\begin{align*}
\text{PRED} & \quad \text{'RESIDE'} \\
\text{TENSE} & \quad \text{PAST} \\
\text{DEPS} & \quad \left\langle \text{SUBJ:} \ 1, \ \text{CASE} \ \text{NOM} \right\rangle, \ \text{LOC:} \ 2 \\
\text{PRED} & \quad \text{'CREATE'} \\
\text{TENSE} & \quad \text{PAST} \\
\text{DEPS} & \quad \left\langle \text{SUBJ:} \ 1, \ \text{OBJ:} \ \left\langle \text{PRED} \ 'ART', \ \text{CASE} \ \text{ACC}, \ \text{LOC:} \ 2 \right\rangle \right\rangle \\
\text{COORD-FORM} & \quad \text{AND}
\end{align*}
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\[
\begin{align*}
\text{PRED} & \quad \text{‘RESIDE’} \\
\text{TENSE} & \quad \text{PAST} \\
\text{DEPS} & \quad \left< \text{SUBJ: } ^{[1]} \right. \\
\phantom{\text{DEPS}} & \quad \left< \text{PRED} \quad \text{‘Waldrum’} \right>, \text{ LOC: } ^{[2]} \\
\phantom{\text{DEPS}} & \quad \left< \text{CASE} \quad \text{NOM} \right> \\
\text{PRED} & \quad \text{‘CREATE’} \\
\text{TENSE} & \quad \text{PAST} \\
\text{DEPS} & \quad \left< \text{SUBJ: } ^{[1]}, \text{ OBJ: } ^{[1]} \right. \\
\phantom{\text{DEPS}} & \quad \left< \text{PRED} \quad \text{‘ART’} \right>, \text{ LOC: } ^{[2]} \\
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Conclusions:

- **AAD is ill-founded** (at least not operational),
- probably not needed in LFG (are there any analyses *relying* on it?),
- creates unnecessary problems for some analyses (should I treat the agentive *by*-phrase as an argument or an adjunct?, etc.),
- in LFG it surfaces only in f-structure feature geometry,
- removing this last vestige of AAD in LFG is easy, given recent developments,
- and beneficial for LFG:
  - functional hierarchy is made explicit (with DEPS a natural locus of analyses relying on this hierarchy),
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Thank you for your attention!


