Morphological Marking of Constituent Questions.
A Case for Nonlocal Amalgamation

HPSG 2021
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Introduction summary

- **Data:** Constituent (*wh*-) questions cross-linguistically
- **Project:** The Grammar Matrix
  - Implemented system of HPSG grammars using one "core"
  - Restricted version of formalism, esp. wrt lists [1]

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[1] Copestake 2000
[2] Bouma et al. 2001; Ginzburg and Sag 2000

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    - Heads "append" arguments' nonlocal features

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- ...or, reanalyze fronting with flexible word order?
- ...or/and, revisit arguments/adjuncts distinction

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[1] Copestake 2000

[2] Bouma et al. 2001; Ginzburg and Sag 2000

Data: Constituent questions

Nonloc. amalg. for morph. ques. marking

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- Questions about *who* did *what to whom where*, etc.
- Different marking strategies across 🌐 languages, including:
  - Question phrase fronting
  - Morphological marking

(1) Gde   kto   chto
    where   who.NOM   what.ACC

      vidit?
      see.3SG
    'Who sees what where?'
    (Russian [rus]; IE)[3]

(2) eeva   iche   -ža   -m?
    what   see   -FUT.Q   -1SG.Q
    'What will I see?'
    (Negidal [neg]; Tungusik)[4]

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[3]   Constructed by a native speaker of Russian.
[4]   Hölzl 2018

Data: Constituent questions

- ▶ Fronting can be long distance
- ▶ Morphological marking can be distinct in polar vs. wh-

(3) Gde   kto   chto   my
     where   who.NOM   what.ACC 1PL.NOM
     vyjasnili   vidit?
     find.out.PL.PAST see.3SG
     'Who did we find out sees what where?' [rus][5]

(4) ačaq=qa   dudu·k
     who=CONTENT.3SG   sing
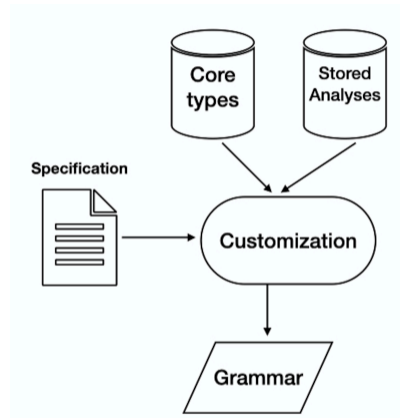   'Who is singing?' (Makah [myh]; Wakashan)[6]

- ▶ **Goal:** Have a system of analyses for a range of phenomena such as above
  - ▶ All grammars share the same core

---

[5] Constructed by a native speaker of Russian.
[6] Davidson 2002

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The Grammar Matrix

- Meta-grammar engineering framework[7]

- Input: Typological specification, lexicon, morphological rules

- Output: Implemented HPSG grammar fragment

  - Parse and generate sentences
  - Output syntactic and **semantic** representations

- Many syntactic phenomena are supported[8]

  - Most recently: *wh*-questions[9]

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7   https://matrix.ling.washington.edu/customize/matrix.cgi

8   Zamaraeva, Howell, et al. 2019; Howell and Zamaraeva 2018; Saleem 2010; Song 2014; Nielsen 2018; Drellishak and Bender 2005; Crowgey 2013; Bender and Flickinger 2005; Zamaraeva 2021

9   Zamaraeva 2021; Zamaraeva and Emerson 2020

DELPH-IN formalism

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- A restricted version of HPSG[10]
- Unification the only native operation
  - i.e. no shuffle operator, no linearization
  - Number and order of daughters are fixed (lists have fixed, bounded length)
  - List append has to be explicitly encoded[11]

$$
\begin{bmatrix}
append\text{-}list \\
\text{LIST} \quad \boxed{0}\,list \\
\text{APPEND} \quad
\begin{bmatrix}
list \\
\text{APPEND-RESULT } \boxed{0}
\end{bmatrix}
\end{bmatrix}
$$

---

10   Copestake 2000
11   Copestake 2000; Zamaraeva and Emerson 2020; Emerson 2017, 2019

List-valued features in DELPH-IN HPSG

- ▶ Valence (SUBJ, COMPS, adjuncts (MOD))
  - ▶ No DEPS list combining arguments and adjuncts
- ▶ Semantics (RELS, CONT, ICONS)
- ▶ Nonlocal (SLASH, QUE, REL)
  - ▶ QUE necessary for *wh*-question semantics and for pied piping; SLASH for any kind of fronting/dislocation

SLASH and QUE: Nonlocal dependencies

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(5) Which person's (son's) dog (do you think) sleeps? [eng]

▶ SLASH creates LDD with the verb argument[12]

▶ QUE creates LDD with the *wh*-word

  ▶ non-*wh* words have empty QUE

  ▶ (Perhaps a better name: WH[13])

$$S_{wh-ques}$$
$$\begin{bmatrix} \text{SLASH} & \langle\,\rangle \\ \text{QUE} & \langle\,\rangle \end{bmatrix}$$

NP — $S_{ex-subj}$

NP: $\begin{bmatrix} \text{LOCAL} & \boxed{0} \\ \text{QUE} & \langle\!\langle \boxed{1} \rangle\!\rangle \end{bmatrix}$

$S_{ex-subj}$: $\begin{bmatrix} \text{COMPS} & \langle\,\rangle \\ \text{SLASH} & \langle\!\langle \boxed{0} \rangle\!\rangle \end{bmatrix}$

D^{14} — N

D^{14}: $\begin{bmatrix} \text{QUE} & \langle\!\langle \boxed{1} \rangle\!\rangle \end{bmatrix}$

N | *dog*

VP | *sleeps*

PP: $\begin{bmatrix} \text{QUE} & \langle\!\langle \boxed{1} \rangle\!\rangle \end{bmatrix}$

NP — P

NP: $\begin{bmatrix} \text{QUE} & \langle\!\langle \boxed{1} \rangle\!\rangle \end{bmatrix}$

P | *'s*

D — N

D: $\begin{bmatrix} \text{QUE} & \langle\!\langle \boxed{1} \rangle\!\rangle \end{bmatrix}$

N | *person*

which

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[12] Pollard and Sag 1994

[13] Ginzburg and Sag 2000

Nonlocal amalgamation[15]

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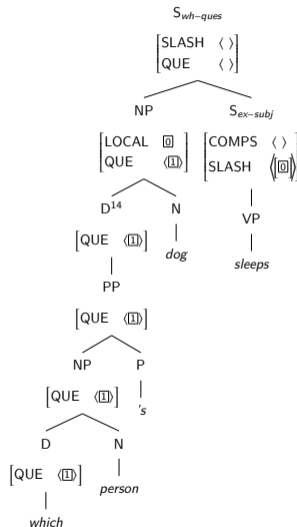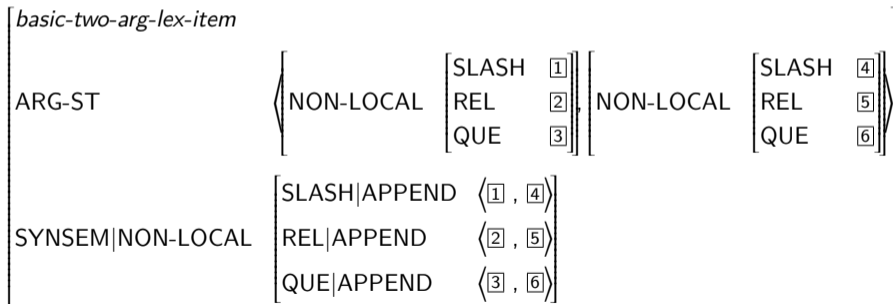Analysis with nonlocal amalgamation
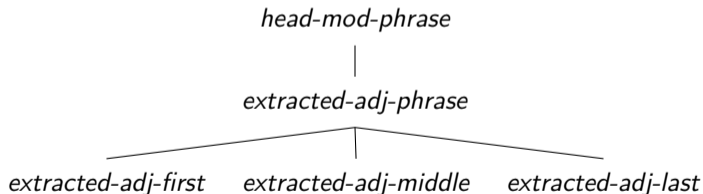Conclusion
References

- Idea: Head's NONLOCAL is the union of the daughters' NONLOCALs
- Motivation:
  - Fewer extraction rules required (in theory)
  - *easy*-adjectives: simply stipulate the argument has a gap (nonempty SLASH)
  - LDD can be encoded locally throughout the derivation (e.g. Chamorro)

$$
\begin{bmatrix}
\textit{basic-two-arg-lex-item} \\
\\
\text{ARG-ST} \quad \left\langle \begin{bmatrix} \text{NON-LOCAL} \begin{bmatrix} \text{SLASH} & \boxed{1} \\ \text{REL} & \boxed{2} \\ \text{QUE} & \boxed{3} \end{bmatrix} \end{bmatrix}, \begin{bmatrix} \text{NON-LOCAL} \begin{bmatrix} \text{SLASH} & \boxed{4} \\ \text{REL} & \boxed{5} \\ \text{QUE} & \boxed{6} \end{bmatrix} \end{bmatrix} \right\rangle \\
\\
\text{SYNSEM|NON-LOCAL} \begin{bmatrix} \text{SLASH|APPEND} & \langle \boxed{1}, \boxed{4} \rangle \\ \text{REL|APPEND} & \langle \boxed{2}, \boxed{5} \rangle \\ \text{QUE|APPEND} & \langle \boxed{3}, \boxed{6} \rangle \end{bmatrix}
\end{bmatrix}
$$

---

[15] Bouma et al. 2001

Extraction rules in DELPH-IN

- Extraction rules may not be needed for English but they probably are needed cross-linguistically
    - E.g. valence-changing morphology
- Bouma et al.'s analysis relies on DEPS (arguments and adjuncts together)
    - Not adopted in DELPH-IN; e.g. counting adjuncts is hard
- **Bottom line**: DELPH-IN maintains extraction rules
    - ...but NA is used in e.g. the English Resource Grammar,[16] for *easy*-adjectives

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[16]   Flickinger 2000, 2011

Multiple question fronting in DELPH-IN HPSG[17]

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- With the **combination** of DELPH-IN lists and NA:
- Extraction rules merely specify some list is nonempty
    - They do not extend or combine SLASH sets/lists
    - Need to say: An adjunct is extracted before/after/between the arguments
- Implementing multiple question phrase fronting with flexible word order thus necessitates **even more** extraction rules

head-mod-phrase
|
extracted-adj-phrase

extracted-adj-first   *extracted-adj-middle*   *extracted-adj-last*

---

17   Zamaraeva and Emerson 2020

Summary of introduction

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- ▶ Goal: Have a system of analyses (the Grammar Matrix) covering multiple question phrase fronting **as well** as other phenomena
  - ▶ ...cross-linguistically, way beyond just English or just IE languages

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- Zamaraeva and Emerson (2020) argued that NA complicates the system and should be removed
    - If you extract explicitly, append NONLOCAL explicitly to avoid extra rules

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- ▶ This talk: A counterpoint:
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  - ▶ …Much simpler with NA!

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  - ...Much simpler with NA!
    - ...for a certain typological profile at least

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Morphologically marked interrogatives

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(6) ožа-va   iche-žee-v
     track-ACC see-FUT-1SG
     'I will see the tracks.' [neg][18]

(7) ii-jə-m   =i?
    enter-FUT.Q-1SG.Q =Q
    'Shall I come in?' [neg]

(8) eeva   iche-žа-m?
    what   see-FUT.Q-1SG.Q
    'What will I see?' [neg]

(9) ʔačaq=qa:ł   dudu'k
    who=CONTENT.3SG   sing
    'Who is singing?' [myh][19]

(10) dudu'k=ˈaλ=qa:k=s
     sing=TEMP=POLAR=1SG
     'Am I singing?' [myh]

---

[18] Hölzl 2018
[19] Davidson 2002

Morphologically marked interrogatives: Typology

- Special paradigm(s) for interrogatives:
    - Polar and constituent questions may have **distinct** paradigms
    - In DELPH-IN HPSG:
        - Modeling the (i) vs (ii),(c) distinction is easy with or without NA
        - Modeling (a)–(b) distinction without NA is **not trivial** without NA

Indicative vs. interrogative, NA does not matter

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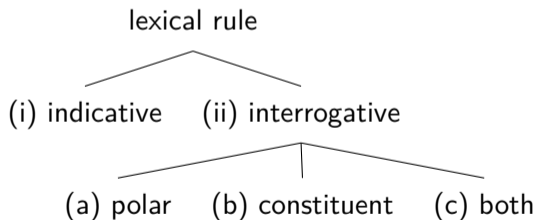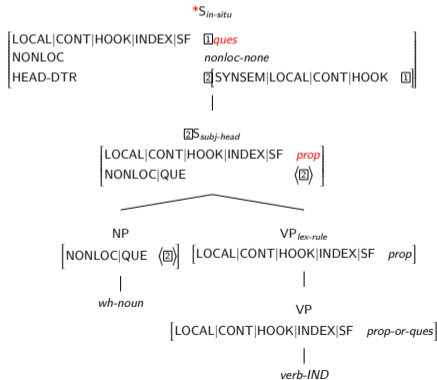Analysis with nonlocal amalgamation

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- Distinction between (i) indicative and (ii) interrog. lex. rules is easy
  - (c) by extension (same as (ii))
- The sentential force SF semantic feature will block any interrogative phrase structure rule

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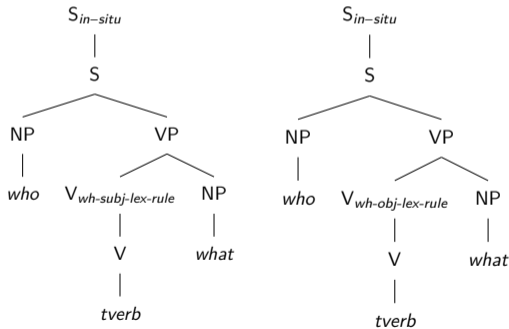Analysis with
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Analysis without nonlocal amalgamation: (a) vs (b)

- Lex. rules for *wh-* (and not polar) questions need to explicitly posit which argument of the head is or isn't *wh*
  - No way to just say: **Some** argument is *wh* (in DELPH-IN HPSG)

$$
\begin{bmatrix}
\textit{lex-rule} \\
\text{INFLECTED} \quad \textit{infl-satisfied}
\end{bmatrix}
$$

$$
\begin{bmatrix}
\textit{indicative-lex-rule} \\
\text{SYNSEM|SF} \quad \textit{prop}
\end{bmatrix}
\qquad
\begin{bmatrix}
\textit{interrogative-lex-rule} \\
\text{SYNSEM|SF} \quad \textit{ques}
\end{bmatrix}
$$

polar-lex-rule   *wh-subj-lex-rule*   *wh-obj-lex-rule*

Frame Title
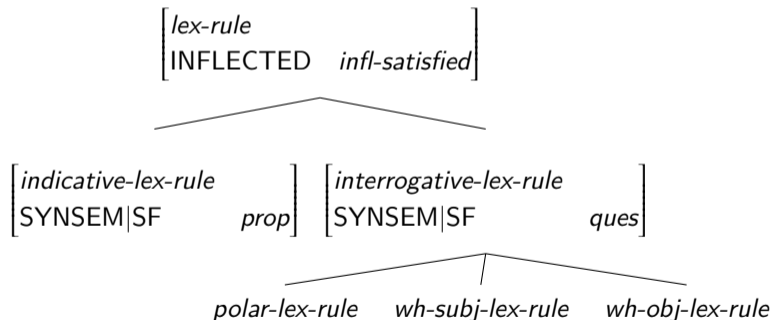
- But, the *wh-obj-lex-rule* will apply spuriously!
  - ...in languages where there is only one morpheme to mark any *wh*-question
  - Cannot constrain it's SUBJ to be empty (saturated)
  - ...would violate the assumption that lexical rules apply before phrasal

Analysis without nonlocal amalgamation: (a) vs (b)

$$
\begin{bmatrix}
\textit{non-wh-cons} \\
\text{FIRST} \quad \begin{bmatrix} \textit{synsem} \\ \text{NON-LOCAL.QUE.LIST} \quad \langle\,\rangle \end{bmatrix} \\
\text{REST} \qquad \textit{non-wh-list}
\end{bmatrix}
$$

$$
\begin{bmatrix}
\textit{polar-lex-rule} \\
\text{SYNSEM|LOCAL|CAT|VAL} \begin{bmatrix} \text{SUBJ} \quad \langle[\text{NON-LOCAL|QUE|LIST} \quad \langle\,\rangle]\rangle \\ \text{COMPS} \quad \textit{non-wh-list} \end{bmatrix}
\end{bmatrix}
$$

$$
\begin{bmatrix}
\textit{wh-subj-lex-rule} \\
\text{SYNSEM|LOCAL|CAT|VAL|SUBJ} \quad \langle[\text{NON-LOCAL|QUE|LIST} \quad \textit{cons}]\rangle
\end{bmatrix}
$$

$$
\begin{bmatrix}
\textit{wh-obj-lex-rule} \\
\text{SYNSEM|LOCAL|CAT|VAL} \begin{bmatrix} \text{SUBJ} \quad \textit{non-wh-list} \\ \text{COMPS} \quad \langle[\text{NON-LOCAL|QUE|LIST} \quad \textit{cons}]\rangle \end{bmatrix}
\end{bmatrix}
$$

Analysis with nonlocal amalgamation

- With NA, **can** say: **some** arg is *wh*!
- It is the same as to say QUE *cons*!
- For (c), just leave QUE underspecified
- No need to think about number or order of args!
- No need to posit any additional types beyond the following two:

$$\begin{bmatrix} polar\text{-}lex\text{-}rule \\ \text{SYNSEM|SF} & ques \\ \text{DTR|SYNSEM|NON-LOCAL|QUE|LIST} & \langle\,\rangle \end{bmatrix}$$

$$\begin{bmatrix} wh\text{-}lex\text{-}rule \\ \text{SYNSEM|SF} & ques \\ \text{DTR|SYNSEM|NON-LOCAL|QUE|LIST} & cons \end{bmatrix}$$

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- Presented an analysis of morphological marking in DELPH-IN HPSG
    - Implemented as part of the Grammar Matrix[20]
    - Implementation tested on Makah [myh] (Wakashan) and pseudolangages[21]
- In DELPH-IN HPSG, treatment of morphological marking and fronting of questions[22]seem to be in competition
- Nonlocal amalgamation[23]seems particularly important for morphological marking
    - Analysis is easy both conceptually and in terms of implementation
- It complicates multiple fronting with flexible word order but perhaps this indicates more work on word order is required?
- ...or revisiting the arguments/adjuncts distinction is in order?[24]

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[20] Bender, Flickinger, and Oepen 2002; Bender, Drellishak, et al. 2010

[21] Zamaraeva 2021

[22] Zamaraeva and Emerson 2020

[23] Bouma et al. 2001

[24] Przepiórkowski 2016

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