Topic-Comment Frames in HPSG

Gert Webelhuth

Georg-August University Göttingen

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English Fronting

Gundel 1985, 88

There are two different types of OSV sentences in English:

Topicalization of Focus:

- primary stress falls on the sentence-initial object

(1) a. What do you like?
b. BEANS I like

Topicalization of Topic:

- initial object receives a high pitched accent
- primary stress falls on some other constituent in the sentence

(2) a. How do you feel about beans?
b. Beans I LIKE

German behaves differently

Fronted objects need not carry any topic or focus pitch accent:

(3) a. Mich FRIERT.
b. Mich hat etwas GESTOCHEN.
c. Mich hat heute jemand vom FINANZAMT angerufen

Overview of this Talk

The Main Goal: to make the difference in form-function correspondence between the 3 English and German fronting constructions displayed above expressible in HPSG.

Difficulties:

1. There is as yet no theory of discourse and information structure in HPSG that is sufficiently comprehensive to capture the usage generalizations of fronting in English and German (good beginnings by Kordula de Kuthy!).

Analytic strategy

1. to associate a semantic representation format with the syntactic machinery of HPSG that allows direct reference to properties
2. to design the semantic representations in such a way that it can capture both
   - 2.1 the truth-conditional content of signs, and
   - 2.2 the way this content is structured into topic and comment and background and focus.

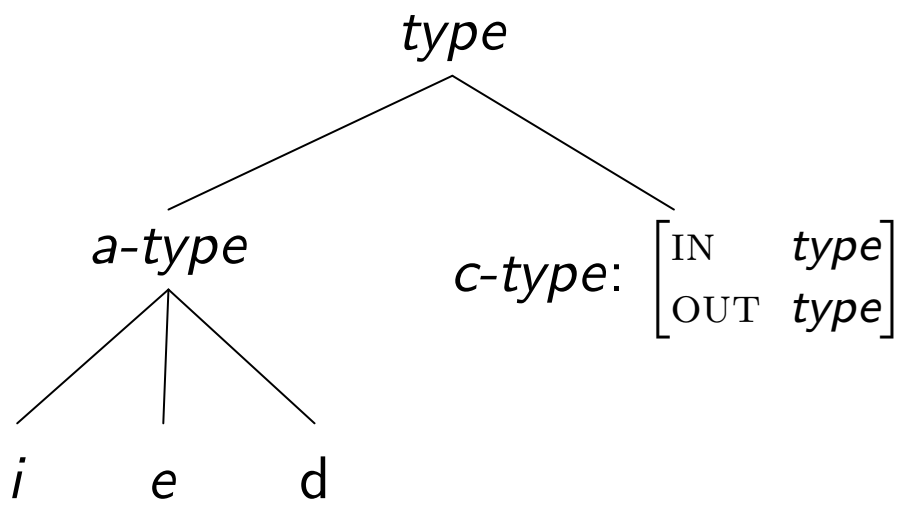
More concretely:

1. choice of semantic representation format: lambda-DRT, plus
2. a watered-down variant of Krifka 1992's theory of topic-comment articulation
3. incorporation of ideas of Sailer, de Kuthy, Jacobs, Büring, and others

Incorporating lambda-DRT into HPSG

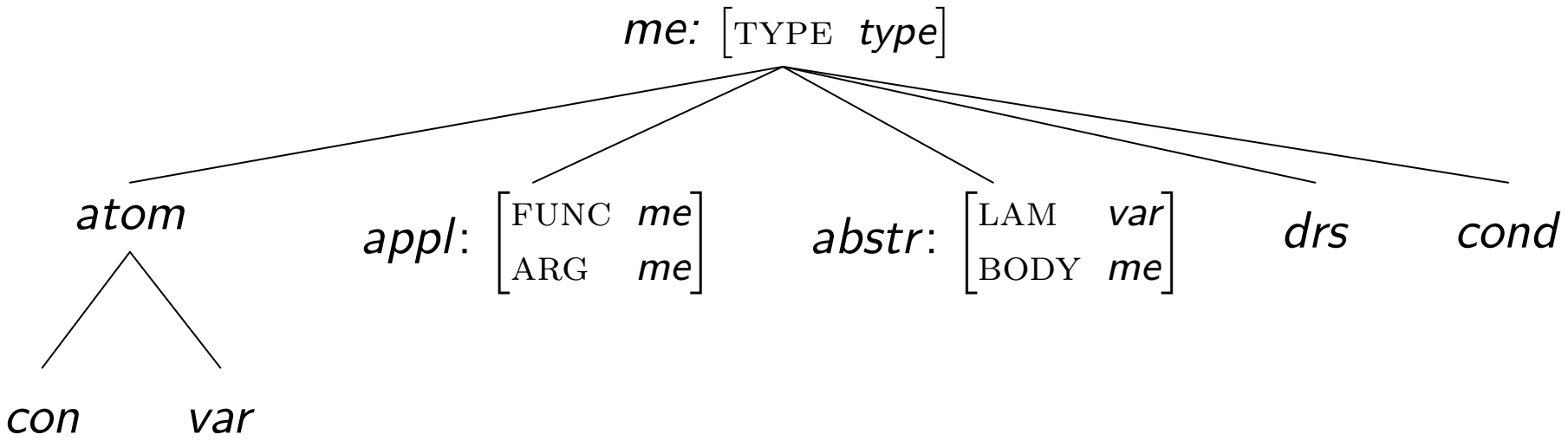
The structure of *loc*

$$\begin{bmatrix} \textit{loc} & \\ \textsc{cat} & \textit{cat} \\ \textsc{cont} & \begin{bmatrix} \textit{me} & \\ \textsc{type} & \textit{type} \end{bmatrix} \end{bmatrix}$$

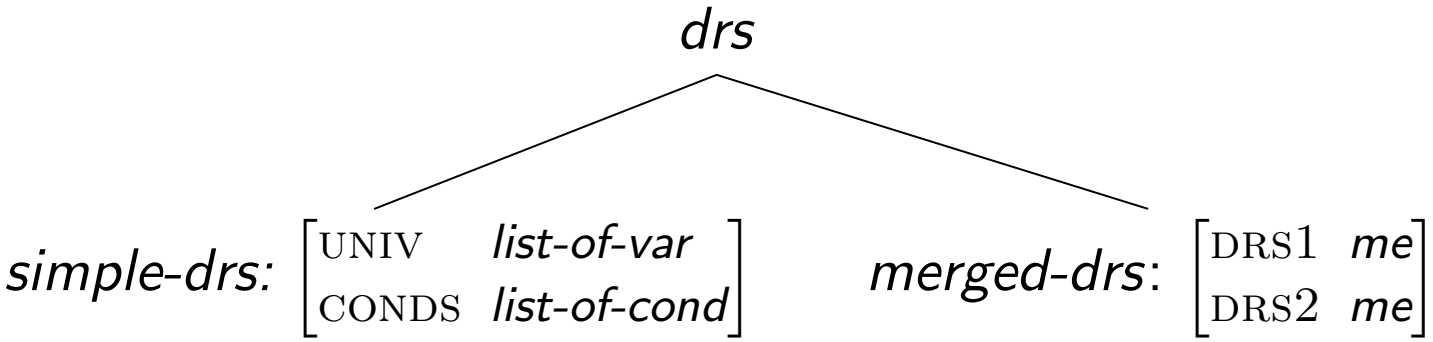


i = individual, e = eventuality, d = DRS

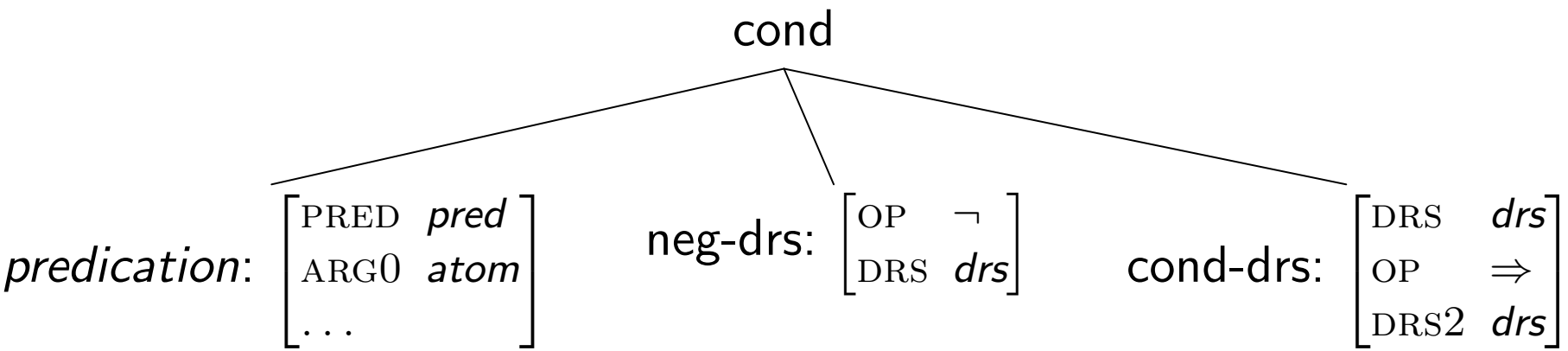
Subtypes of *me*



Subtypes of *me*



Abbr.: $\boxed{1}+\boxed{2} =_{abbr}$ $\begin{bmatrix} \textit{merged-drs} \\ \text{DRS1} & \boxed{1} \\ \text{DRS2} & \boxed{2} \end{bmatrix}$



Examples of contents

Fido:
$$\begin{bmatrix} \textit{word} \\ \textsc{phon} \ \langle \textit{fido} \rangle \\ \textsc{ss} \quad \begin{bmatrix} \textsc{loc} \ \begin{bmatrix} \textsc{cont} \ \begin{bmatrix} \textsc{type} \ i \\ \textit{fido} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

- *fido* is a constant of type i.
- see Muskens 1994, *A Compositional Discourse Representation Theory*.

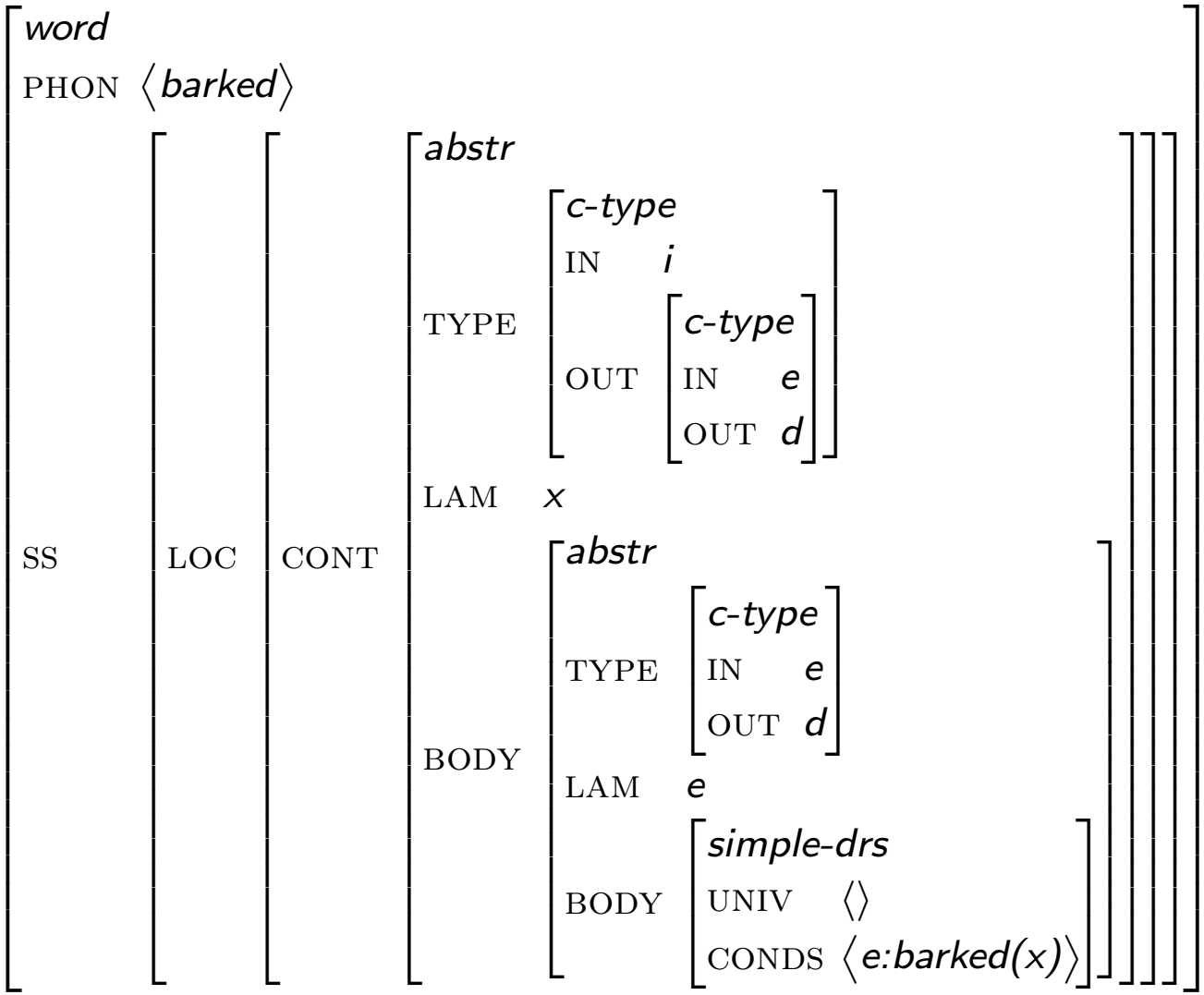
Examples of contents

Fido:

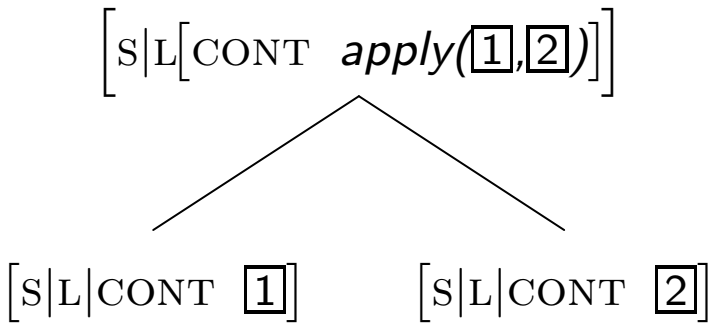
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \ \langle \textit{fido} \rangle \\ \\ \\ \\ \\ \\ \\ \\ \text{SS} \quad \text{LOC} \quad \text{CONT} \quad \begin{bmatrix} \textit{abstr} \\ \\ \text{TYPE} \quad \begin{bmatrix} \textit{c-type} \\ \text{IN} \quad \begin{bmatrix} \text{IN} & \textit{i} \\ \text{OUT} & \textit{d} \end{bmatrix} \\ \text{OUT} \quad \textit{d} \end{bmatrix} \\ \text{LAM} \quad \textit{P} \\ \\ \text{BODY} \quad \begin{bmatrix} \textit{appl} \\ \text{FUNC} \quad \textit{P} \\ \text{ARG} \quad \textit{fido} \end{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \end{bmatrix} \end{bmatrix}$$

Examples of contents

barked:



Semantic composition



$$\text{apply}(1\begin{bmatrix}\text{TYPE} & \begin{bmatrix}\text{IN} & 3\\ \text{OUT} & 4\end{bmatrix}\end{bmatrix}, 2[\text{TYPE}\ 3]) = \begin{bmatrix}\textit{appl}\\ \text{TYPE} & 4\\ \text{FUNC} & 1\\ \text{ARG} & 2\end{bmatrix}$$

$$\text{apply}(2[\text{TYPE}\ 3], 1\begin{bmatrix}\text{TYPE} & \begin{bmatrix}\text{IN} & 3\\ \text{OUT} & 4\end{bmatrix}\end{bmatrix}) = \text{apply}(1,2).$$

Binding of the event variable

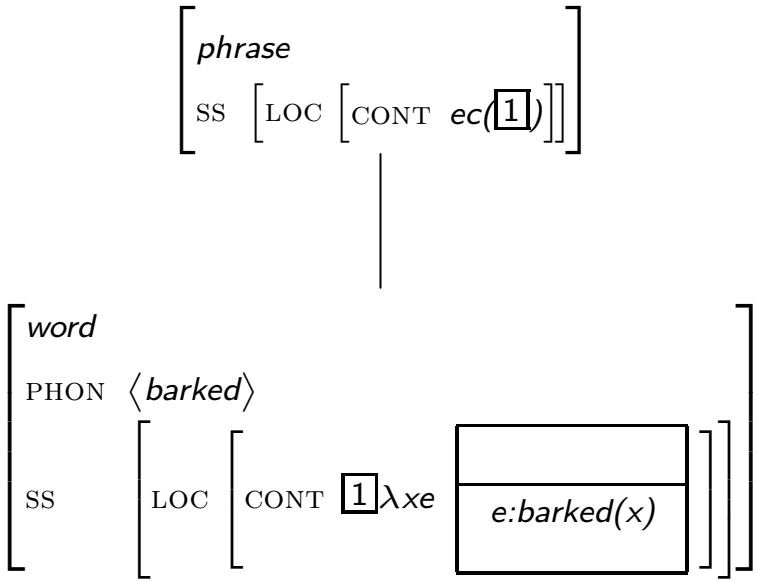
$$\left[\begin{array}{ll} \textit{phrase} & \\ \text{S} & \left[\begin{array}{ll} \text{LOC} & \left[\begin{array}{ll} \text{CAT} & \boxed{1} \\ \text{CONT} & \textit{ec}(\boxed{2}) \end{array}\right] \\ \text{NLOC} & \boxed{3} \end{array}\right] \end{array}\right]$$

$$\left[\begin{array}{ll} \text{S} & \left[\begin{array}{ll} \text{LOC} & \left[\begin{array}{ll} \text{CAT} & \boxed{1} \\ \text{CONT} & \boxed{2} \end{array}\right] \\ \text{NLOC} & \boxed{3} \end{array}\right] \end{array}\right]$$

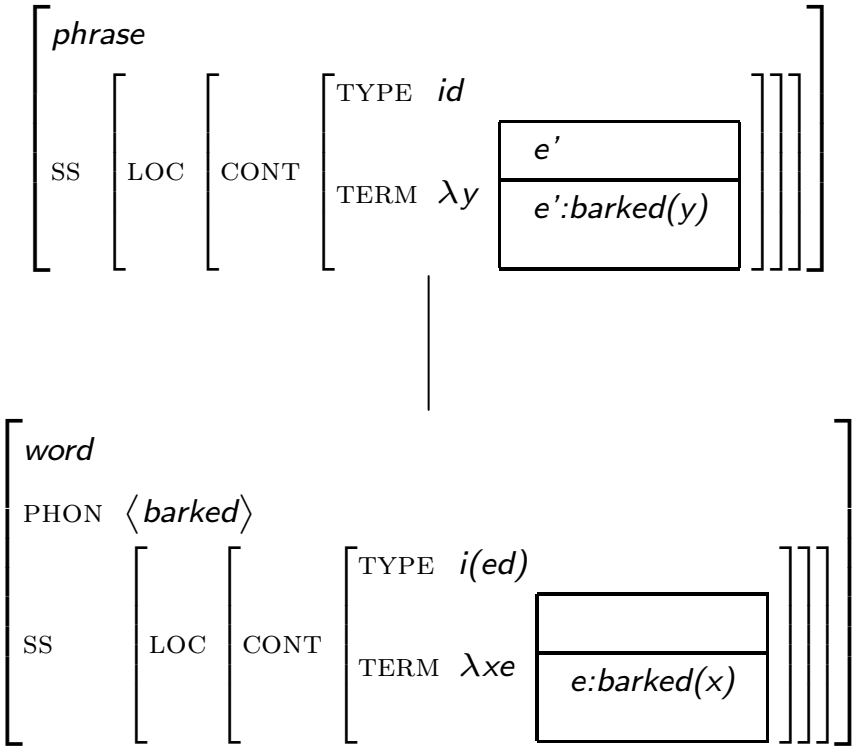
$$\text{ec}\left(\left[\begin{array}{ll} \text{TYPE}|\text{OUT}^* & \left[\begin{array}{ll} \text{IN} & e \\ \text{OUT} & d \end{array}\right] \\ \lambda x_1 \ldots x_n \lambda e \text{D} & \end{array}\right]\right) =$$

$$\left[\lambda y_1 \ldots y_n \left(\begin{array}{|c|} \hline e' \\ \hline \\ \hline \end{array} + \lambda x_1 \ldots x_n \lambda e \text{D}(y_1 \ldots y_n, e') \right)\right]$$

Existentential closure of *barked*

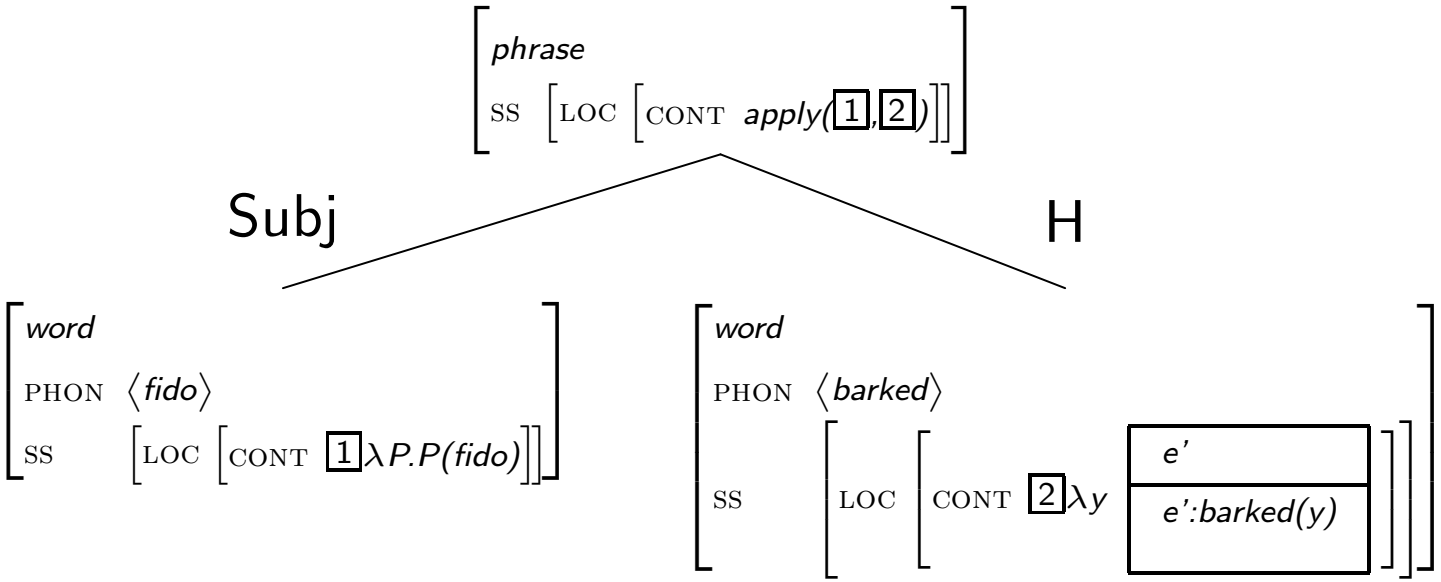


Existentential closure of *barked*,2

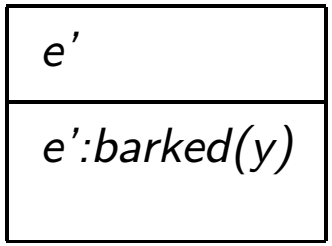


Fido barked

Function-argument application:



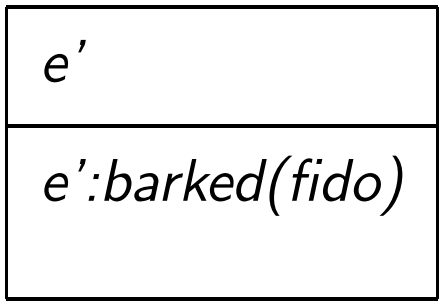
Fido barked

apply(λP.*P(fido)*, λy 

) =

$$\begin{bmatrix} \textit{appl} & \\ \text{FUNC} & \lambda \textit{P.P(fido)} \\ \text{ARG} & \lambda y \; \boxed{\begin{array}{|l} \textit{e'} \\ \hline \textit{e':barked(y)} \\ \\ \end{array}} \end{bmatrix}$$

which reduces to



Topic-comment structures

Krifka 1992:

- The content of a sentence is structured into a topic and a comment.
- Both topic and comment may themselves be structured into background and focus to signal that the topic or comment is considered in contrast to a set of salient comparable alternatives in the context of utterance.

The truth-functional contribution of a sign is obtained from its information structure as follows:

1. For background and focus: apply the background to the focus.
2. For the information structure as a whole: apply the comment to the topic.

This means that the background of the comment contains bound variables "representing" the focus of the comment and the topic!

Examples of informationally structured expressions

General structure:

istr: $< comm, top >$ cont: comm(top).

Example: $[_{top}$ Fido$]$ $[_{comm}$ BARKED$]$

istr: $< \lambda x_i.bark(x), fido_i >$ cont: bark(fido).

Example: $[_{comm}$ FIDO$]$ $[_{top}$ barked$]$

istr: $< \lambda P_{id}.P(fido), \lambda x_i.bark(x) >$ cont: bark(fido).

Examples of informationally structured expressions, 2

The comment and the topic may each be structured into background and focus:

istr: $< < _{comm}\ bg_{comm}, foc_{comm} >, < _{top}\ bg_{top}, foc_{top} > >$

cont: $[(\mathrm{bg}_{comm}(\mathrm{foc}_{comm})](\mathrm{bg}_{top}(\mathrm{foc}_{top}))$

Example: [$[_{contr-top}$ SANDY] $[_{comm}$ $[_{ncontr}$ likes] $[_{contr}$ JILL]]]

istr: $<<\lambda z \lambda x.\mathrm{likes}(x,z),\mathrm{jill}>, <\lambda \mathrm{v}_i.\mathrm{v},\mathrm{sandy}>>$

Truth-functional content:

$[\lambda z \lambda x.\mathrm{likes}(x,z)](\mathrm{jill}) = \lambda x.\mathrm{likes}(x,\mathrm{jill})$

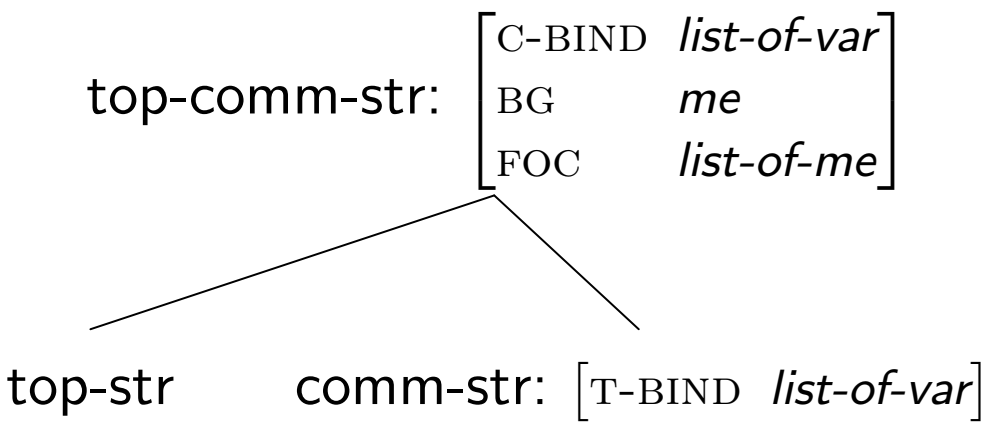
$[\lambda \mathrm{v}_i.\mathrm{v}](\mathrm{sandy}) = \mathrm{sandy}$

$[\lambda x.\mathrm{likes}(x,\mathrm{jill})](\mathrm{sandy}) = \mathrm{likes}(\mathrm{sandy},\mathrm{jill})$.

Adding features to *loc* to create an information structure

$$
\begin{bmatrix}
\textit{loc} & & \\
\text{CAT} & \textit{cat} & \\
\text{CONT} & \textit{me} & \\
\text{IST} & \begin{bmatrix}
\textit{istr} & & \\
\text{COMM} & \begin{bmatrix}
\textit{comm-str} & \\
\text{T-BIND} & \textit{list-of-var} \\
\text{C-BIND} & \textit{list-of-var} \\
\text{BG} & \textit{me} \\
\text{FOC} & \textit{list-of-me}
\end{bmatrix} & \\
\text{TOP} & \textit{list-of-}\left(\begin{bmatrix}
\textit{top-str} & \\
\text{C-BIND} & \textit{list-of-var} \\
\text{BG} & \textit{me} \\
\text{FOC} & \textit{list-of-me}
\end{bmatrix}\right)
\end{bmatrix} &
\end{bmatrix}
$$

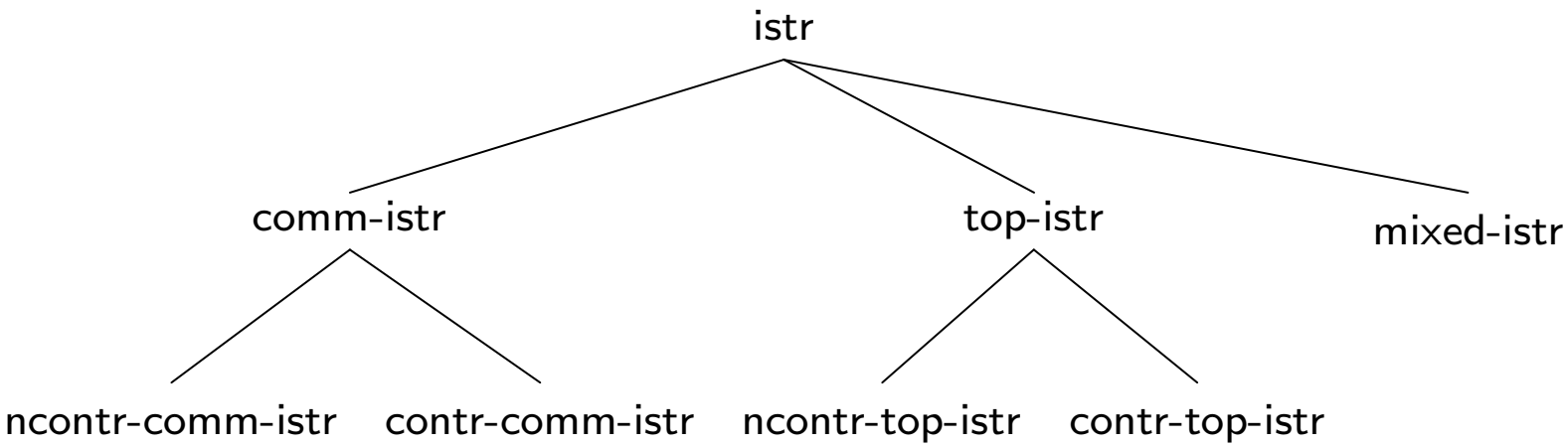
Some types and constraints



The Contrast Constraint In every feature structure of type *top-comm-str*, there is a bijective relationship between the c-bound variables inside the value of BG and the members of FOC

The Topic Constraint In every feature structure of type *istr*, there is a bijective relationship between the t-bound variables inside the value of COMM|BG and the members of TOP

Subtypes of *istr*



Constraint on *comm-istr*

comm-istr $\longrightarrow \left[\text{TOP } \langle\rangle\right]$

Example:

$$\begin{bmatrix} \text{COMM} & \begin{bmatrix} \text{T-BIND} & \langle\rangle \\ \text{C-BIND} & \langle\rangle \\ \text{BG} & \textit{fido} \\ \text{FOC} & \langle\rangle \end{bmatrix} \\ \text{TOP} & \langle\rangle \end{bmatrix}$$

Constraint on *top-istr*

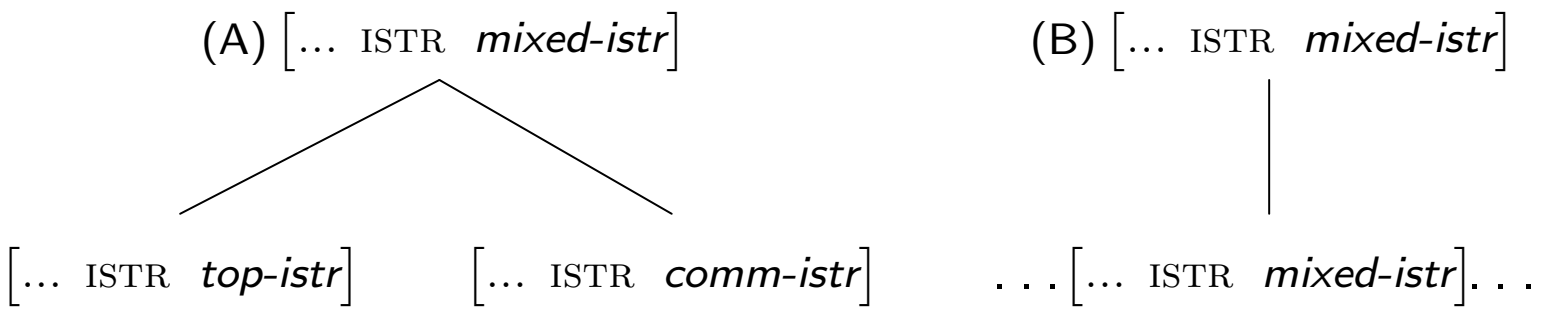
top-istr $\longrightarrow \left[\text{TOP} \;\; \textit{ne-list}\right]$

Example:

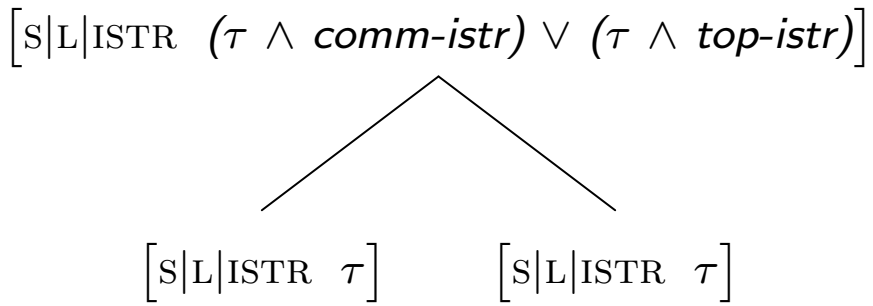
$$\left[\begin{array}{ll} \text{COMM} & \left[\begin{array}{ll} \text{T-BIND} & \langle \boxed{1} \rangle \\ \text{C-BIND} & \langle\rangle \\ \text{BG} & \boxed{1}\ \textit{var} \\ \text{FOC} & \langle\rangle \end{array}\right] \\ \text{TOP} & \left\langle \left[\begin{array}{ll} \text{C-BIND} & \langle\rangle \\ \text{BG} & \textit{fido} \\ \text{FOC} & \langle\rangle \end{array}\right] \right\rangle \end{array}\right]$$

Constraints on words and phrases

The *mixed-istr* Constraint If the ISTR of a phrase is of type *mixed-istr*, then either (A) the phrase has one daughter whose ISTR is of type *top-ist* and another one whose ISTR is of type *comm-ist* or (B) the phrase has a daughter whose ISTR is of type *mixed-istr* or

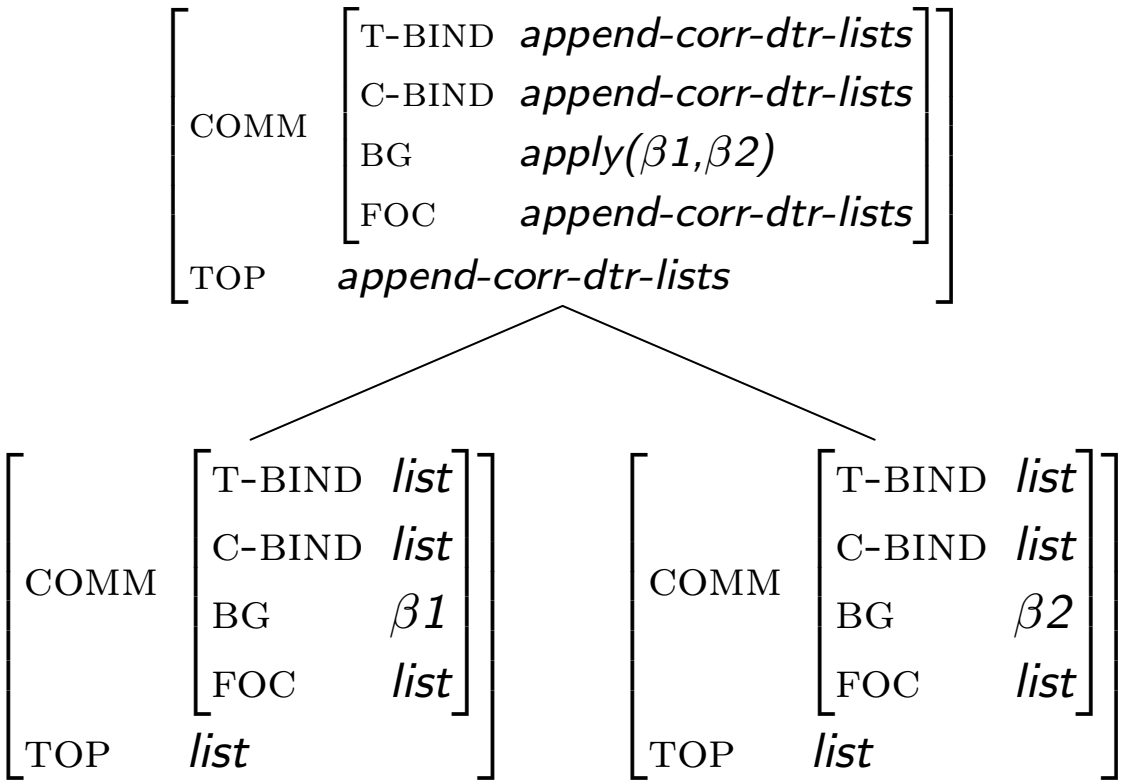


The Phrasal Uniformity Constraint If the ISTR of a phrase is of type τ, for τ a subtype of *comm-istr* or *top-istr*, then the ISTR of each daughter likewise is of type τ.



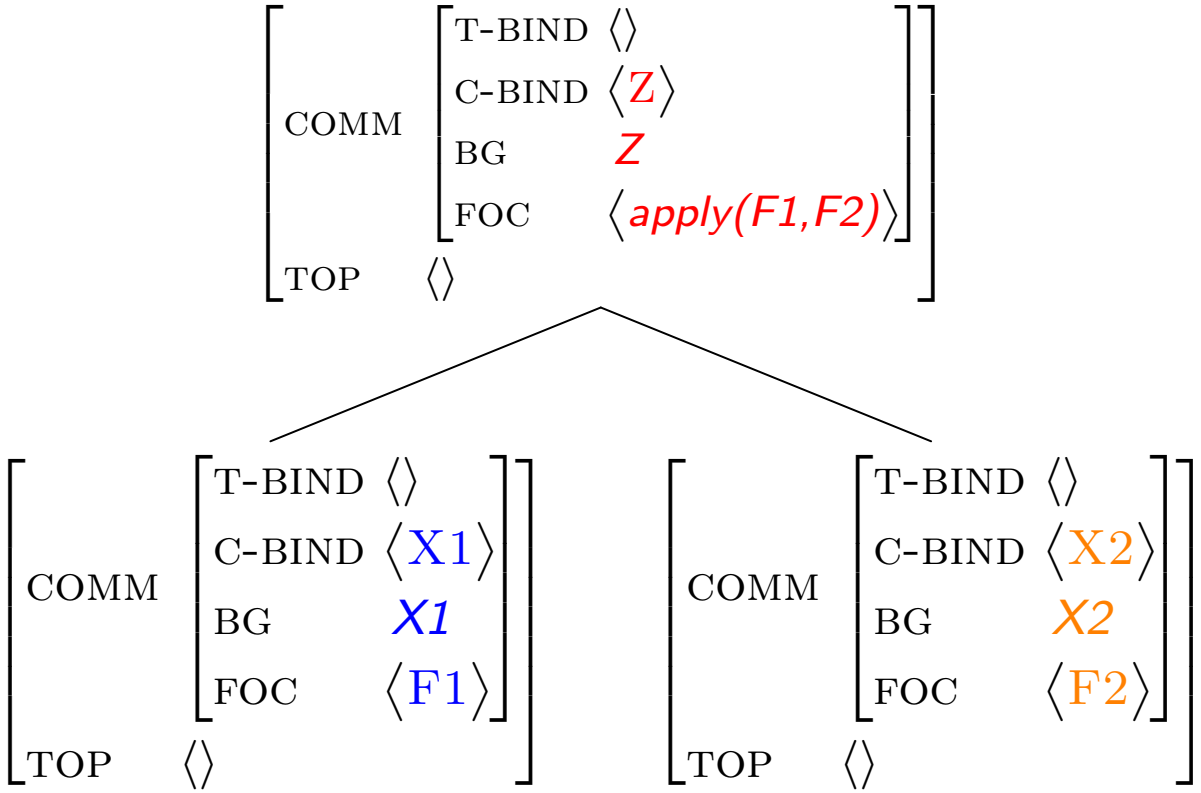
Principles for computing the ISTR of phrases

General case:



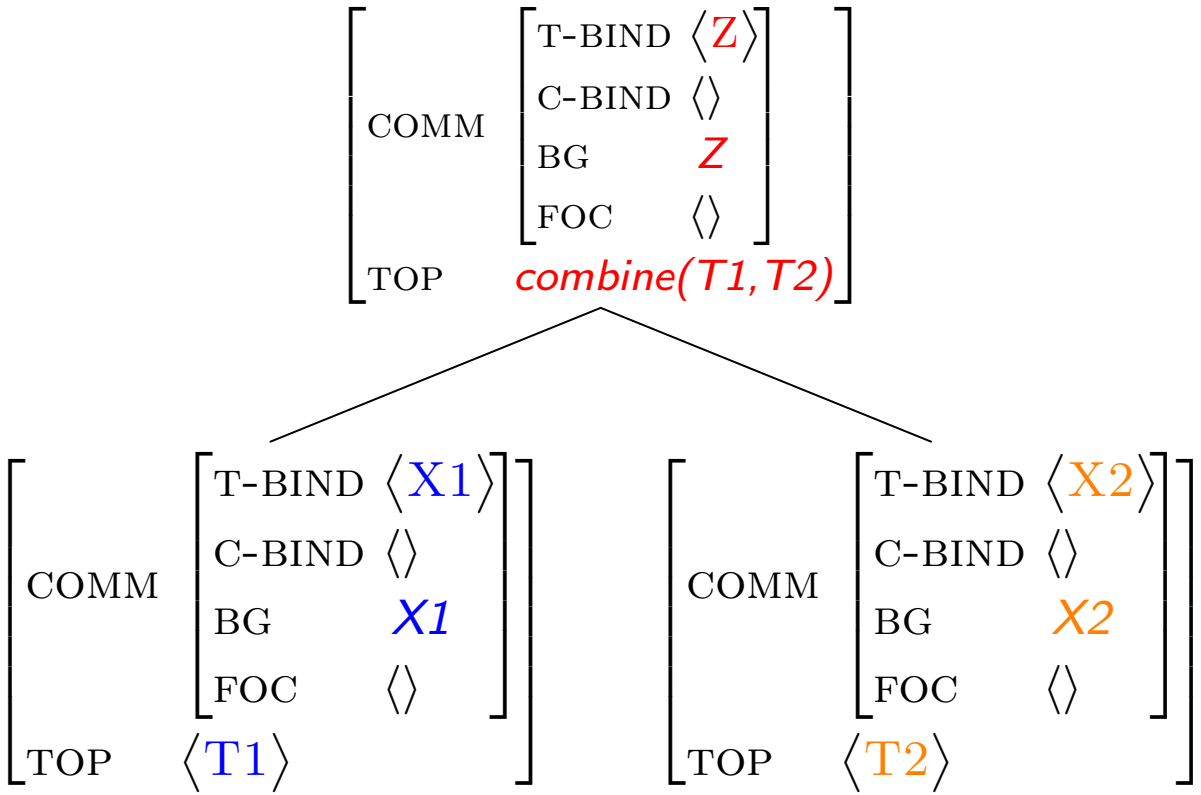
Principles for computing the ISTR of phrases, 2

Special case 1: both daughters have a c-bound background:



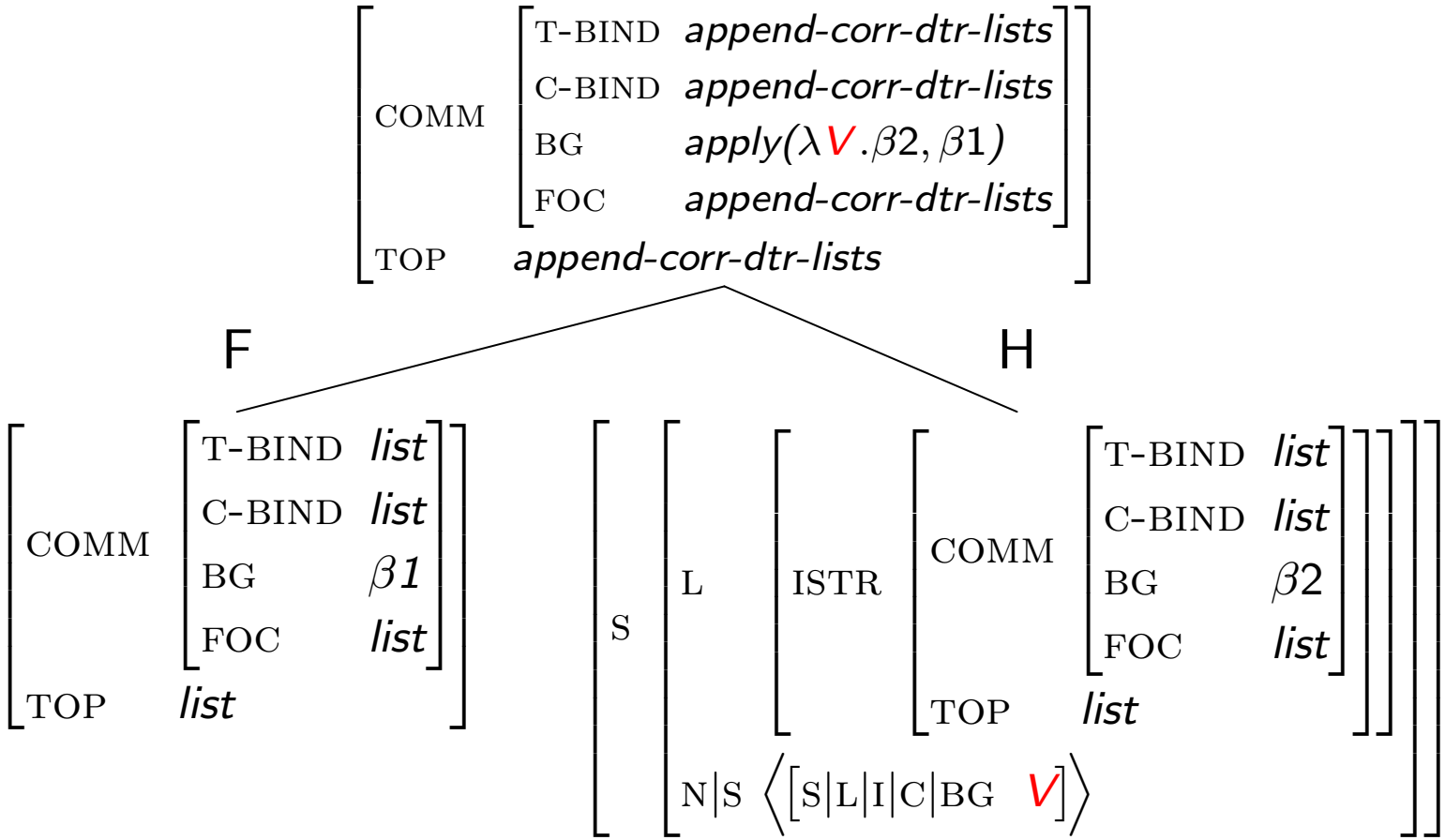
Principles for computing the ISTR of phrases, 3

Special case 2: both daughters have a t-bound background:



Principles for computing the ISTR of phrases, 4

Special case 3: Head-filler phrases



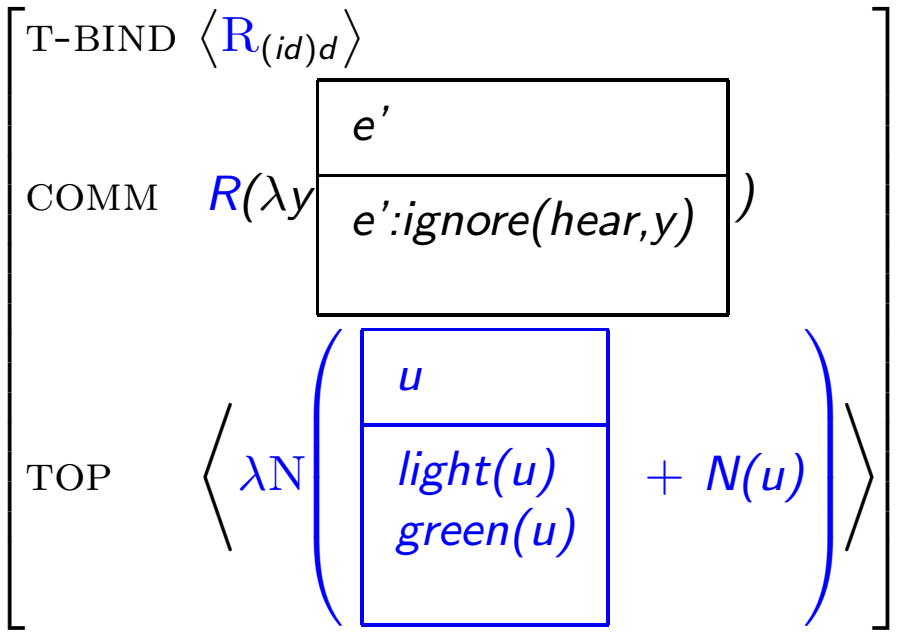
Derivation of *A GREEN light you IGNORE*

Text: A RED light you stop the MACHINE. A GREEN light you IGNORE.

Assumptions:

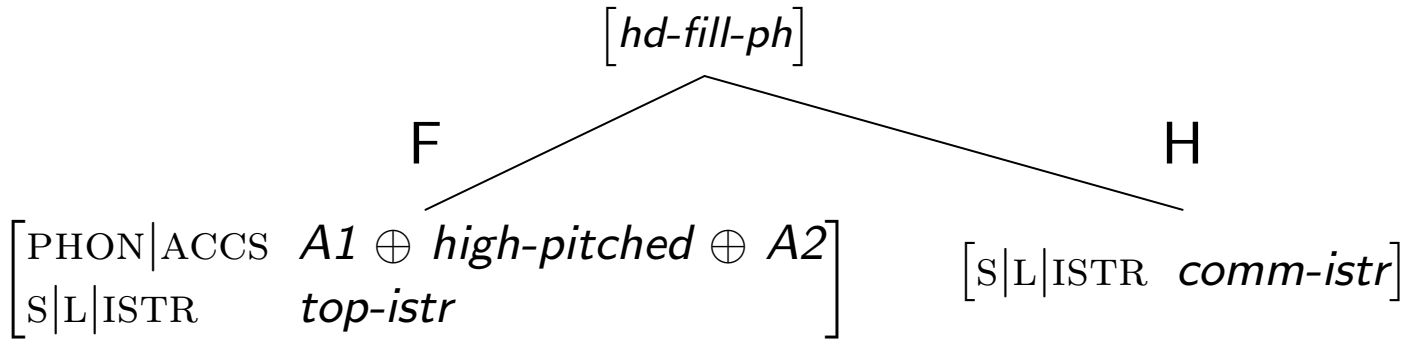
[$_S$ [$_{top}$ *A* GREEN$_{foc}$ *light*]$_i$ [$_{comm}$ *you* IGNORE$_{foc}$ t_i]]

Desired topic-comment structure:



The Fronting Construction

front-ph $\Longrightarrow$



Constraint The nuclear accent of an expression is contributed by a subexpression whose ISTR is of type *comm-istr*.

Derivation of *A GREEN light you IGNORE*, 2

$$[\mathrm{t}]: \begin{bmatrix} & \begin{bmatrix} \text{T-BIND} & \langle\rangle \\ \text{C-BIND} & \langle\rangle \\ \text{BG} & \begin{bmatrix} q1 \\ \text{TYPE} & q \end{bmatrix} \\ \text{FOC} & \langle\rangle \end{bmatrix} \\ \text{TOP} & \langle\rangle \end{bmatrix}$$

Derivation of *A GREEN light you IGNORE*, 3

$[\text{ignore}]_{contr-comm}$:

$$\begin{bmatrix} \text{COMM} & \begin{bmatrix} \text{T-BIND} & \langle\rangle \\ \text{C-BIND} & \langle T0_{q(i(ed))} \rangle \\ \text{BG} & T0 \\ \text{FOC} & \left\langle \lambda Q \lambda x \lambda e.Q(\lambda y \begin{array}{|c|}\hline \\ \hline e{:}ignore(x,y) \\ \\ \hline \end{array}) \right\rangle \end{bmatrix} \\ \text{TOP} & \langle\rangle \end{bmatrix}$$

[ec(ignore)]:

$$\begin{bmatrix} \text{COMM} & \begin{bmatrix} \text{T-BIND} & \langle\rangle \\ \text{C-BIND} & \langle T1_{q(id)} \rangle \\ \text{BG} & T1 \\ \text{FOC} & \left\langle \lambda Q \lambda x.Q(\lambda y \begin{array}{|l|}\hline e' \\ \hline e'{:}ignore(x,y) \\ \hline \end{array}) \right\rangle \end{bmatrix} \\ \text{TOP} & \langle\rangle \end{bmatrix}$$

Derivation of *A GREEN light you IGNORE*, 4

[ec(ignore) t]:

$$\begin{bmatrix} \text{COMM} & \begin{bmatrix} \text{T-BIND} & \langle\rangle \\ \text{C-BIND} & \langle \text{T1}_{q(id)} \rangle \\ \text{BG} & \textit{T1(q1)} \\ \text{FOC} & \left\langle \lambda Q \lambda x.\text{Q}(\lambda y \begin{array}{|l} \hline e' \\ \hline e'\text{:ignore}(x,y) \\ \hline \end{array}) \right\rangle \end{bmatrix} \\ \text{TOP} & \langle\rangle \end{bmatrix}$$

[you]$_{ncontr-comm}$:

$$\begin{bmatrix} \text{COMM} & \begin{bmatrix} \text{T-BIND} & \langle\rangle \\ \text{C-BIND} & \langle\rangle \\ \text{BG} & \textit{hear} \\ \text{FOC} & \langle\rangle \end{bmatrix} \\ \text{TOP} & \langle\rangle \end{bmatrix}$$

Derivation of *A GREEN light you IGNORE*, 5

[you ec(ignore) t]:

$$\begin{bmatrix} \text{COMM} & \begin{bmatrix} \text{T-BIND} & \langle\rangle \\ \text{C-BIND} & \langle T1_{q(id)} \rangle \\ \text{BG} & T1(q1)(hear) \\ \text{FOC} & \left\langle \lambda Q \lambda x.Q(\lambda y \begin{array}{|c|}\hline e' \\ \hline e':ignore(x,y) \\ \hline \end{array}) \right\rangle \end{bmatrix} \\ \text{TOP} & \langle\rangle \end{bmatrix}$$

$[light]_{ncontr-top}$:

$$\begin{bmatrix} \text{COMM} & \begin{bmatrix} \text{T-BIND} & \langle R_{id} \rangle \\ \text{C-BIND} & \langle\rangle \\ \text{BG} & R \\ \text{FOC} & \langle\rangle \end{bmatrix} \\ \text{TOP} & \left\langle \begin{bmatrix} \text{C-BIND} & \langle\rangle \\ \text{BG} & \lambda z \begin{array}{|c|}\hline \\ \hline light(z) \\ \hline \end{array} \\ \text{FOC} & \langle\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

Derivation of *A GREEN light you IGNORE*, 6

$$[\text{green}]_{contr-top}: \begin{bmatrix} \text{COMM} & \begin{bmatrix} \text{T-BIND} & \langle \text{M}_{(id)(id)} \rangle \\ \text{C-BIND} & \langle\rangle \\ \text{BG} & M \\ \text{FOC} & \langle\rangle \end{bmatrix} \\ \text{TOP} & \left\langle \begin{bmatrix} \text{C-BIND} & \langle \text{M2}_{(id)(id)} \rangle \\ \text{BG} & M2 \\ \text{FOC} & \left\langle \lambda P \lambda \text{v} \left(\begin{array}{|c|} \hline \\ \hline green(v) \\ \hline \end{array} + \text{P(v)} \right) \right\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

Derivation of *A GREEN light you IGNORE*, 7

$$[\mathrm{a}]_{ncontr-top}: \begin{bmatrix} \text{COMM} & \begin{bmatrix} \text{T-BIND} & \langle \mathrm{D}_{(id)((id)q)} \rangle \\ \text{C-BIND} & \langle\rangle \\ \text{BG} & D \\ \text{FOC} & \langle\rangle \end{bmatrix} \\ \text{TOP} & \left\langle \begin{bmatrix} \text{C-BIND} & \langle\rangle \\ \text{BG} & \lambda M \lambda N \left(\begin{array}{|c|}\hline u \\ \hline \\ \hline \end{array} + M(u) + N(u) \right) \\ \text{FOC} & \langle\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

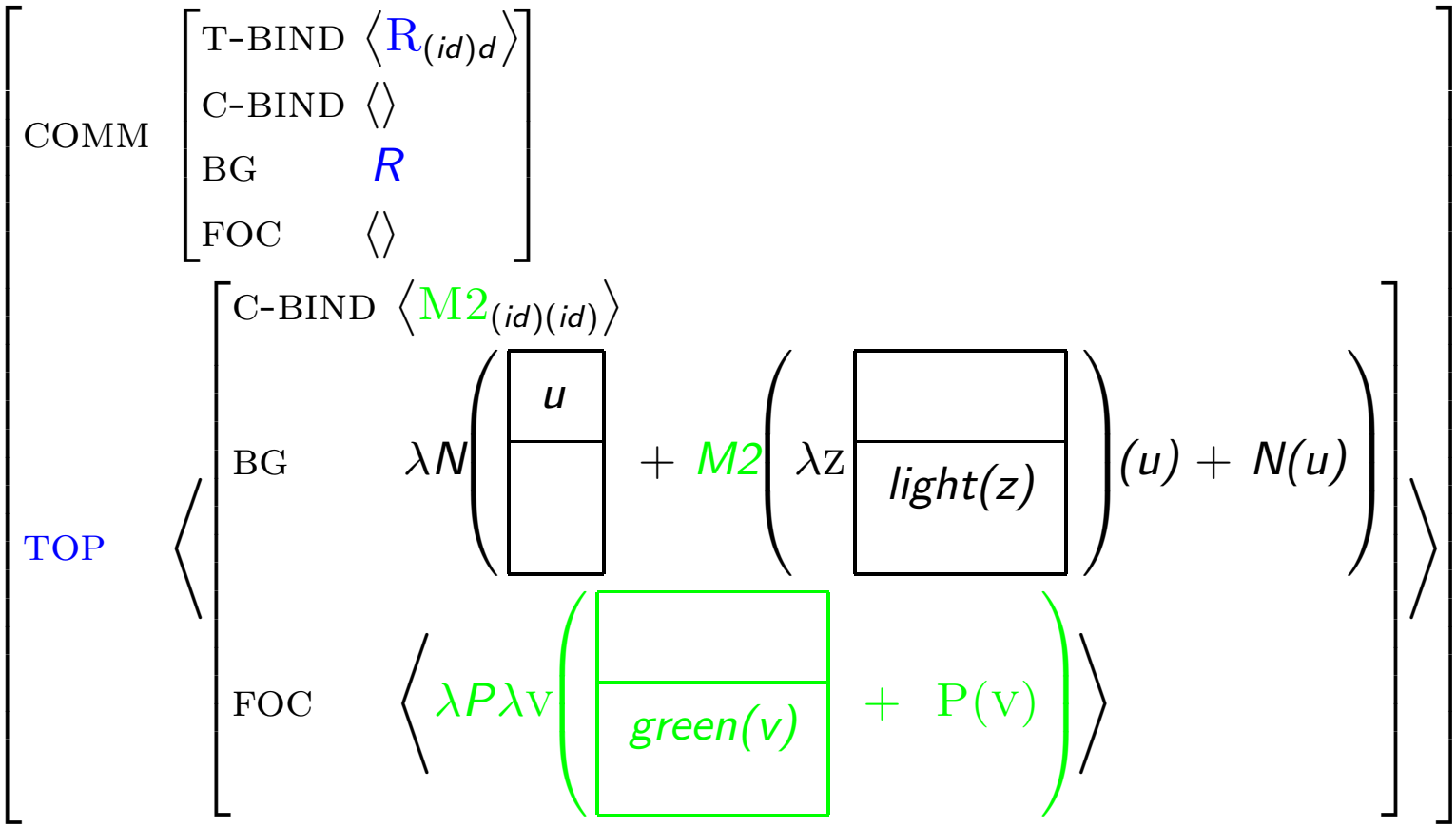
Derivation of *A GREEN light you IGNORE*, 8

[green light]:

$$\left[\begin{array}{ll}
\text{COMM} & \left[\begin{array}{ll}
\text{T-BIND} & \langle \mathrm{O}_{id} \rangle \\
\text{C-BIND} & \langle\rangle \\
\text{BG} & O \\
\text{FOC} & \langle\rangle
\end{array}\right] \\
\text{TOP} & \left\langle \left[\begin{array}{ll}
\text{C-BIND} & \langle \mathrm{M2}_{(id)(id)} \rangle \\
\text{BG} & M2\left(\lambda \mathrm{Z} \left[\begin{array}{|l} \hline \\ light(z) \\ \\ \hline \end{array}\right] \right) \\
\text{FOC} & \left\langle \lambda P \lambda \mathrm{v} \left(\left[\begin{array}{|l} \hline \\ green(v) \\ \\ \hline \end{array}\right] + \mathrm{P(v)} \right) \right\rangle
\end{array}\right] \right\rangle
\end{array}\right]$$

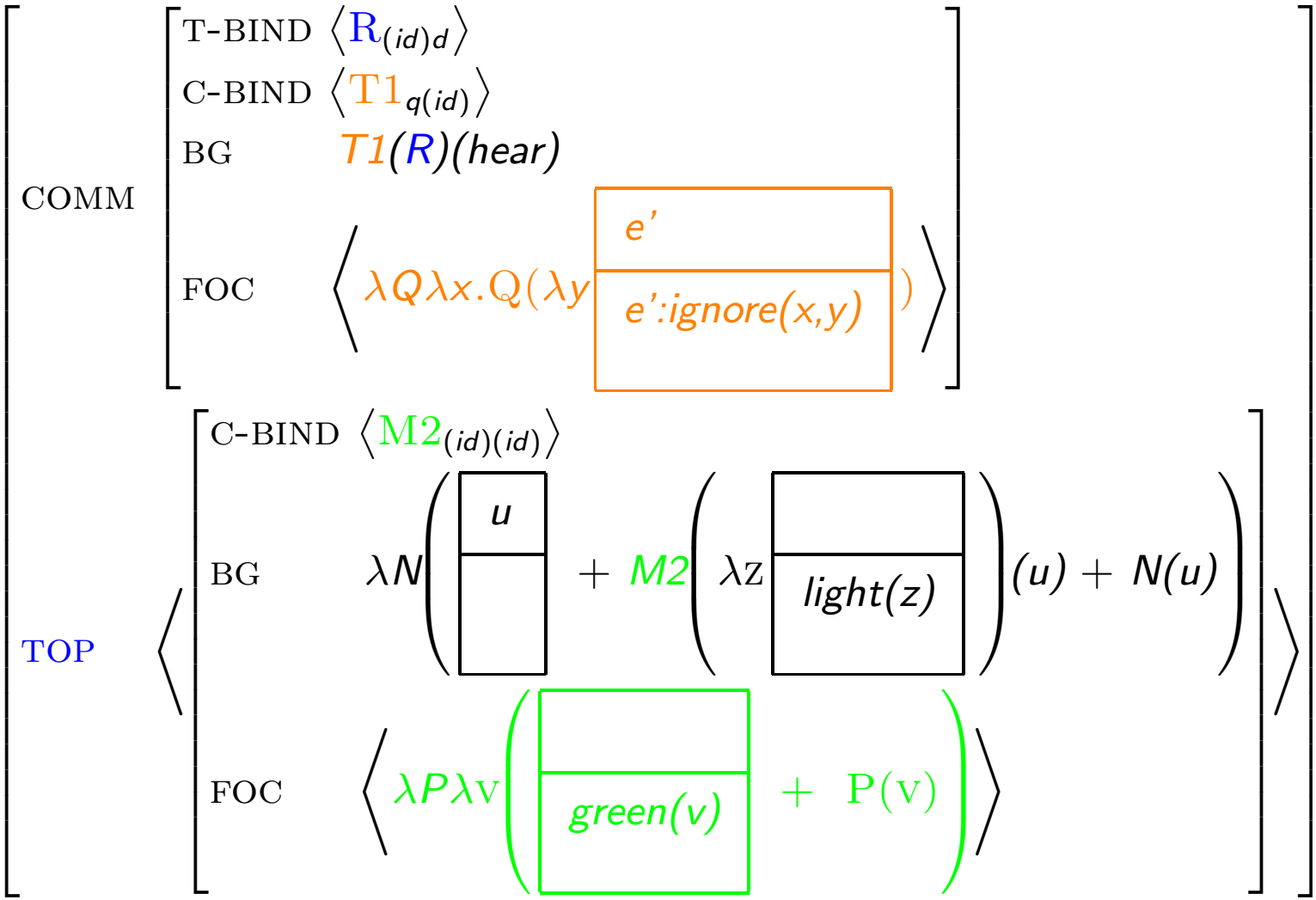
Derivation of *A GREEN light you IGNORE*, 9

[a green light]:



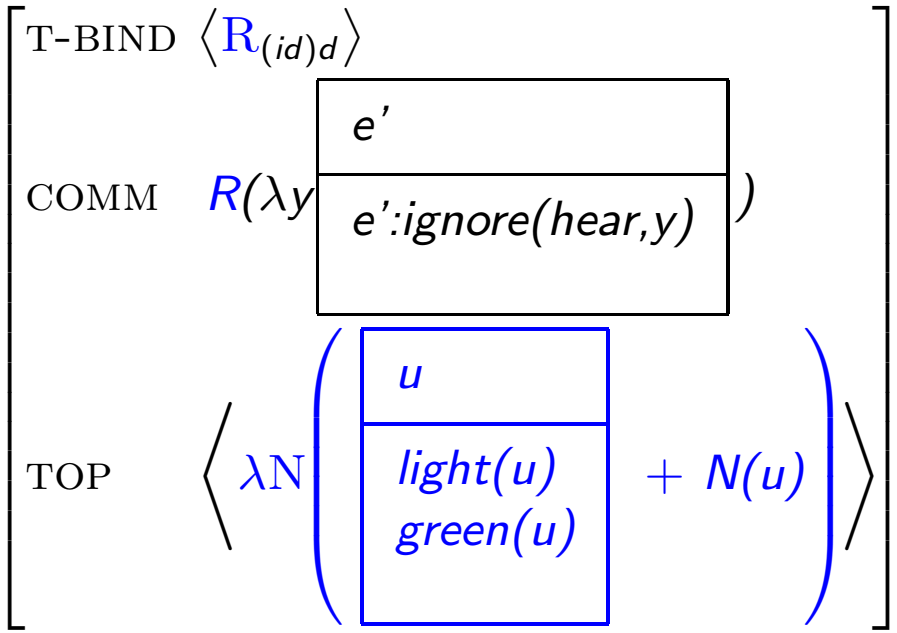
Derivation of *A GREEN light you IGNORE*, 10

[a green light you ec(ignore) t]:



Derivation of *A GREEN light you IGNORE*, 11

[a green light you ec(ignore) t]:



Conclusion

What we (hopefully) have:

an HPSG syntax that

- compositionally derives discourse representation structures
- stratified into topic-comment and background-focus

What this framework can (hopefully) be used for:

to capture the rich dependencies between

- sentence form
- sentence meaning, and
- information structure.

The End