Composing pair-list readings:
Multi-*wh* questions versus questions with quantifiers

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Which and which readings of questions should be treated uniformly?

A:	**Which boy** invited which girl?	Multi-*wh*	PL
B:	Which girl did **every boy** invite?	∀-question	PL
C:	Which girl did **one of the boys** invite?	∃-question	Choice

PL readings of multi-*wh* and ∀-questions are commonly treated to be semantically identical (Dayal 1996, 2002; Fox 2012, a.o.).
But, only ∀-questions are truly subject to **domain exhaustivity**:

(1) (100 candidates are competing for 3 jobs.)
√ Guess which candidate will get which job.
\# Guess which job will every candidate get.

(2) (4 kids are playing Musical Chairs and are competing for 3 chairs.)
Guess which of the 4 kids will sit on which of the 3 chairs.
$\not\rightsquigarrow$ Each of the 4 kids will sit on one of the 3 chairs.

☞ PL readings of multi-*wh* and ∀-questions are semantically different.

PL readings of ∀-questions and choice readings of ∃-questions are subject to the same **subject-object asymmetry** (Chierchia 1991, 1993):

(3) Which boy invited **one/each of the girls**? ×Choice/ ×PL

☞ Quantifying-into question readings (B and C) have probably the same LFs.

Composing functional readings

The restriction of *which A* contains **individuals in** *A* and **functions to** *A*.

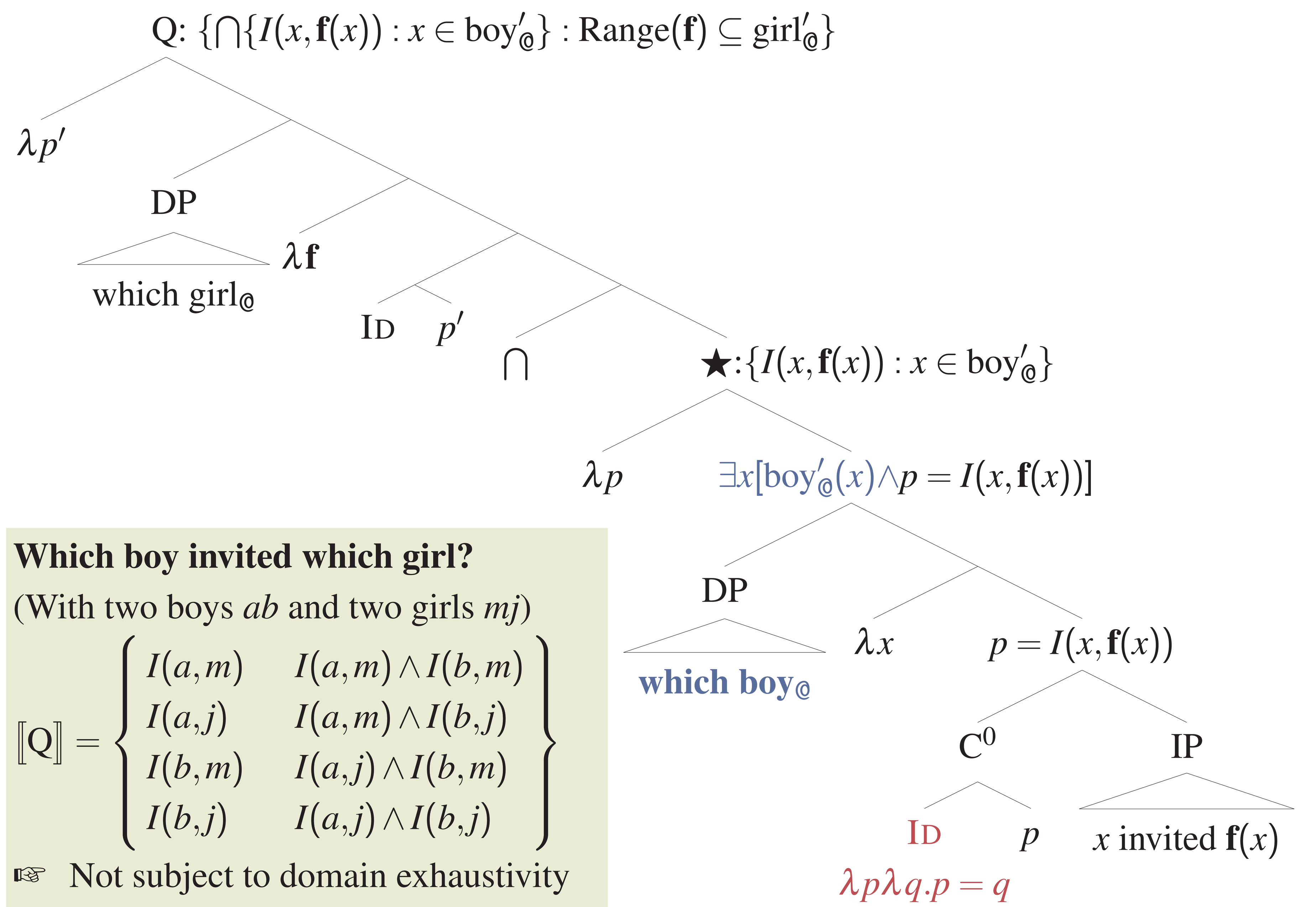
(4) $[\![\text{which}]\!](A) = \lambda P.\exists\alpha \in (A \cup \{\mathbf{f} : \text{Range}(\mathbf{f}) \subseteq A\})[P(\alpha) = 1]$

A *wh*-question takes an individual/functional reading only if the *wh*-trace is individual/functional:

(5) "Which girl did John invite?" "Anna"/"His girlfriend"
a. **Individual**
'Which girl x is s.t. every boy invited x?'
λp [which girl λx [[ID p] [every boy invited x]]]
b. **Functional**
'Which function $\mathbf{f}$ to girl′ is s.t. every boy x invited $\mathbf{f}(x)$?'
λp [which girl $\lambda\mathbf{f}$ [[ID p] [every boy x invited $\mathbf{f}(x)$]]]

I treat PL and choice readings as special functional readings: the trace of the *wh*-object is functional; its argument variable is bound by the *wh*-/∀-/∃-subject. (Engdahl 1980, 1986; Gr&S 1984; Chierchia 1993; Dayal 1996, 2016)

Composing pair-list readings of multi-*wh* questions

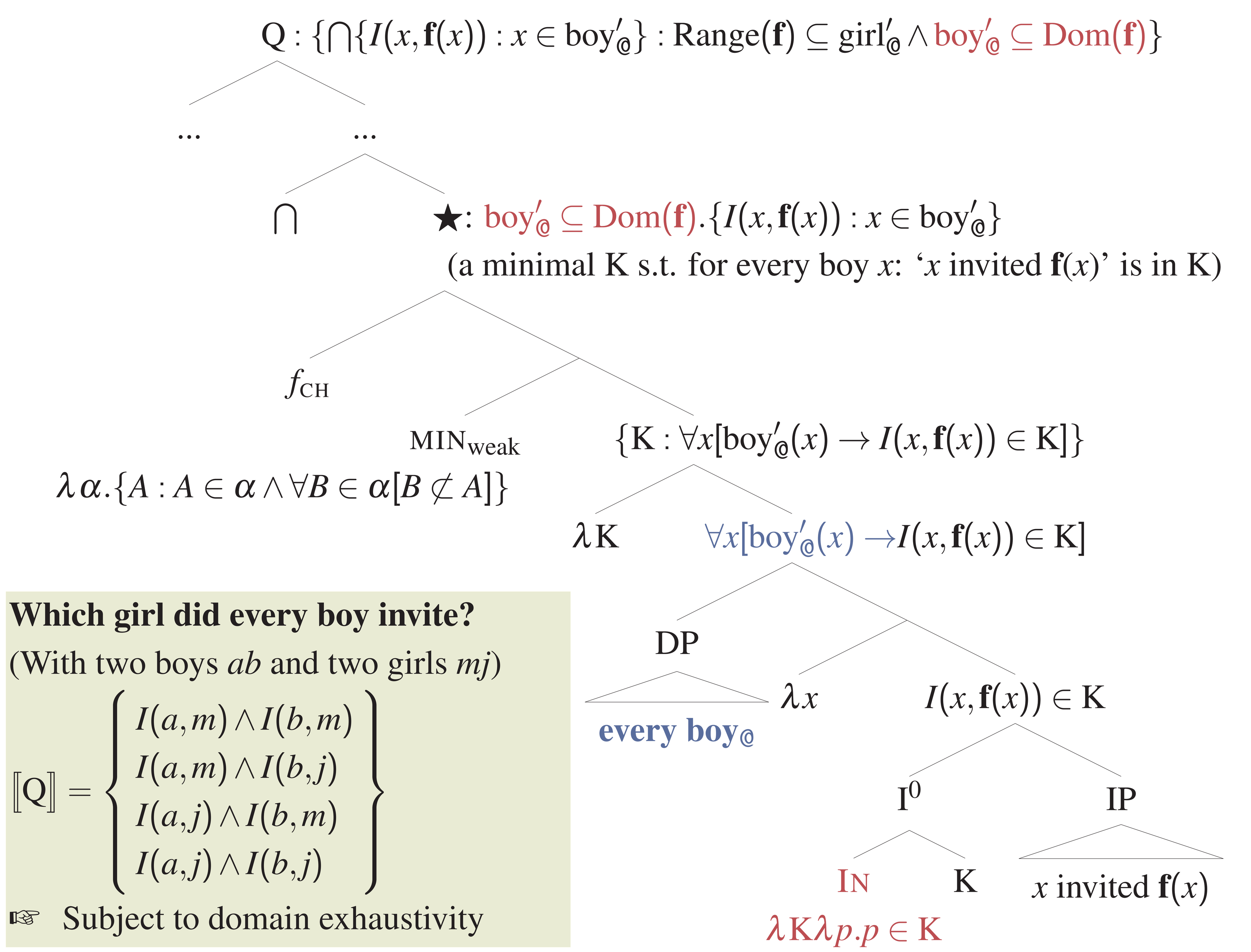


Which boy invited which girl?
(With two boys *ab* and two girls *mj*)

$$[\![Q]\!] = \left\{\begin{array}{ll} I(a,m) & I(a,m)\wedge I(b,m) \\ I(a,j) & I(a,m)\wedge I(b,j) \\ I(b,m) & I(a,j)\wedge I(b,m) \\ I(b,j) & I(a,j)\wedge I(b,j) \end{array}\right\}$$

☞ Not subject to domain exhaustivity

Composing pair-list readings of ∀-questions



Which girl did every boy invite?
(With two boys *ab* and two girls *mj*)

$$[\![Q]\!] = \left\{\begin{array}{l} I(a,m)\wedge I(b,m) \\ I(a,m)\wedge I(b,j) \\ I(a,j)\wedge I(b,m) \\ I(a,j)\wedge I(b,j) \end{array}\right\}$$

☞ Subject to domain exhaustivity

Comparing the derivations of the two pair-list readings

- *Which boy* ∃-quantifies into an **identity** relation (Karttunen 1977), while *every boy* ∀-quantifies into a **membership** relation (inspired by Fox 2012).
- At node ★, both derivations return $\{x$ invited $\mathbf{f}(x)$: $x \in \text{boy}'_@\}$. But the one in ∀-question also presupposes that **f** is defined for every boy, yielding a domain exhaustivity effect.

Extending to choice readings of ∃-questions

(6) Which girl did one of the boys invite? (With two boys *ab* and two girls *mj*)
a. $[\![\bigstar]\!] = f_{\text{CH}}[\text{MIN}_{\text{weak}}\{K : \exists x[\text{boy}'_@(x) \wedge I(x,\mathbf{f}(x)) \in K]\}]$
$= f_{\text{CH}}\{\{I(x,\mathbf{f}(x))\} : x \in \text{boy}'_@\}$
b. $[\![Q]\!] = \{I(a,m), I(a,j)\}$ or $\{I(b,m), I(b,j)\}$

- It takes a choice reading, because: there are **multiple** minimal sets containing one proposition of the form 'boy x invited $\mathbf{f}(x)$', each of which yields a possible Q.
- It doesn't take a pair-list reading, because: all the eligible minimal sets are **singletons**.

FAQs

1. Why not defining questions with PL readings as **families of questions** (as in Hagstrom 1998, Fox 2012, Nicolae 2013, Kotek 2014, a.o.)?

(7) $[\![Q_{\text{multi-wh}}]\!] = [\![Q_\forall]\!] = \{[\![\text{which girl did } x \text{ invite?}]\!] : x \in \text{boy}'_@\}$

This approach unavoidably predicts the PL readings of multi-*wh* and ∀-questions semantically equivalent, and hence cannot capture their contrast wrt domain exhaustivity.

2. How can we account for the following **quantificational variability** (QV) effects?

(8) John mostly knows [$_Q$ which girl every boy invited].
... [$_Q$ which boy invited which girl].
⇝ Most p [p is a true atomic proposition 'boy x invited girl y'] [John knows p]

Defining questions as sets of conjunctive propositions, we cannot define the domain of *mostly* because conjuncts of a conjunction cannot be recovered. (Lahiri p.c. to Dayal). Alternatively, I pursue a **category approach** and define question as a λ-abstract. The domain of *mostly* is defined based on the atomic parts of functions. (Xiang 2016)

(9) a. $[\![Q_{\text{multi-wh}}]\!] = \lambda\mathbf{f}[\text{Range}(\mathbf{f}) \subseteq \text{girl}'_@.\bigcap\{I(x,\mathbf{f}(x)) : x \in \text{boy}'_@\}]$
b. $[\![Q_\forall]\!] = \lambda\mathbf{f}[\text{Range}(\mathbf{f}) \subseteq \text{girl}'_@ \wedge \text{Dom}(\mathbf{f}) \supseteq \text{boy}'_@.\bigcap\{I(x,\mathbf{f}(x)) : x \in \text{boy}'_@\}]$

Example: Let **f** be the complete true short answer of $Q_{\text{multi-wh}}$, then the QV inference is:

(10) Most $\mathbf{f}'[\mathbf{f}' \in \text{AT}(\mathbf{f})][\text{John knows } [\![Q_{\text{multi-wh}}]\!](\mathbf{f}')]$

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