Quantifier Raising as Restrictor Sharing – Evidence from Hydra and Extraposition with Split Antecedents

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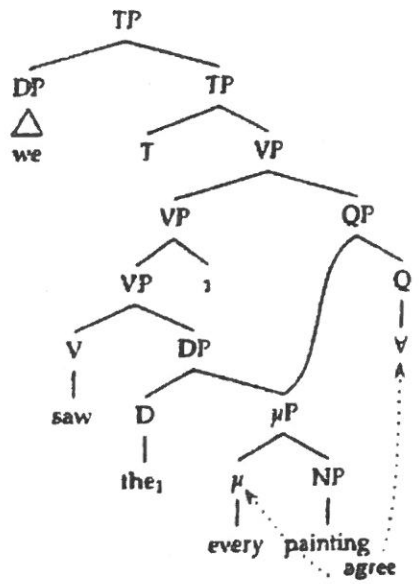
1. Goals

- To provide an account of Hydra and Extraposition with Split Antecedents, along the lines of Zhang 2007.
- To explain how the account argues for the following conclusions (Johnson 2011):
  a. Quantifier Raising involves "movement" not of a QP but of the quantifiers restrictor.[1] More specifically:
     1. Quantifier words are covert and "late merged" in the QPs scope position
     2. Quantifier words are morphologically realized on lower heads in the QP.
  b. This should be embedded in a theory in which a moved constituent has more than one mother (multi-dominance).
- To provide a semantics for the lower hosting head (inspired by Champollion 2015).

(0) We saw every painting



Hydra

(1) Every man and (every) woman that I introduced to each other went together on a date.
$\forall X[[\exists y \exists z$ man(x) & woman(y) & $[X = y \oplus z]$ & I introduced X to each other
→ X went together on a date.

ESA (Extraposition with Split Antecedents)

(2) A man entered the room and a woman walked out who were quite similar.

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[1] See Sportiche (2004) for a similar proposal for A movement.

2. Basic Hydra

(3) Every man and woman that I introduced to each other went together on a date.
$\forall X[[\exists y \exists z$ man(y) & woman(z) & $[X = y \oplus z]$ & I introduced X to each other]
$\rightarrow$ X went together on a date].

Link: this meaning is expected *man and woman* can be interpreted as a predicate that is true of a plural individual if the plural individual is the sum of two individuals one of which is a man and the other is a woman.

(4) $[\![\text{and}_{Link}]\!] = \lambda P_{et}.\lambda Q_{et}.\lambda X.\ \exists y \exists z\ (X=y \oplus z)\ \&\ P(y)=P(z)=1.$

equivalently

(5) $[\![\text{and}_{Link}]\!]\ (P)(Q) \quad = \{x \oplus y: x \in P\ \&\ y \in Q\}$

Needed also for simpler sentences.

(6) Every/a man and woman met.

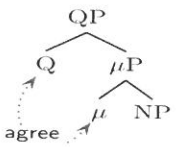
Still not accounted for:

(7) Every man and every woman that I introduced to each other went together on a date.

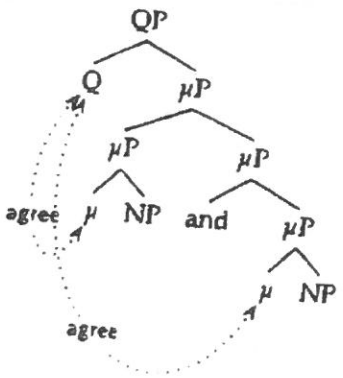
Conclusion: *every* is not the spell-out of the universal quantifier $\forall$ (as Johnson suggested).

Instead, $\forall$ can be spelled out on the head of its complement with which it agrees (or is morphologically-fused).

(8) **Structure of QP/DP**



(9) **Structure of QP/DP with μP coordination**



(10) **Phonology of μ**
μ → *every* if agrees with ∀
μ → *some* if agrees with ∃ …,etc.

If μ is semantically vacuous, we have an account of Hydra.

Prediction (facts observed by Link): Hydra requires μP coordination and ATB Agreement. Hence, it will only be acceptable with the same Q features are spelled out on two μPs.

(11) a. Each man and each woman that I introduced to each other went together on a date.
c. A man and a woman that I introduced to each other went together on a date.
d. No man and no woman that I introduced each other went together on a date.
c. Most men and most women that I introduced to each other went together on a date.

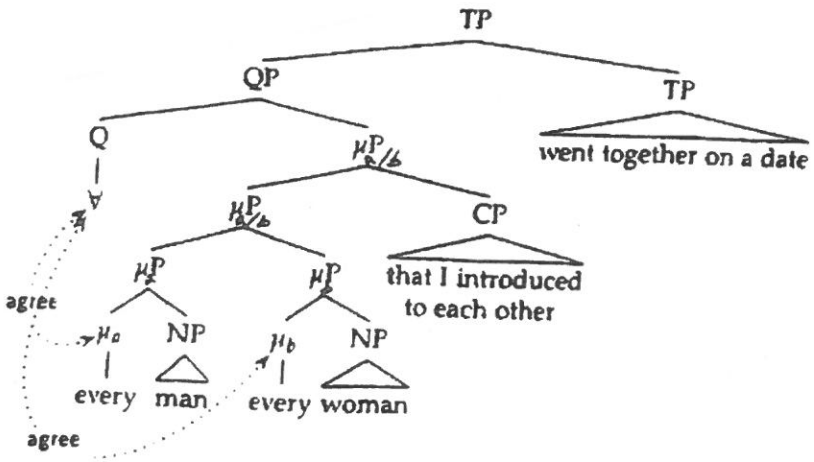
(12) a. *A man and each woman that I introduced to each other went together on a date.
b. *most men and a woman that I introduced to each other went together on a date.
c. *most men and no woman that I introduced to each other went together on a date.
d. *Every man and no woman that I introduced to each other went together on a date.

Possible assumption about the representation of coordination: Usually phrases have just one head, except when two phrases of the same category are merged with each other, in which case they are doubly headed and the second phrase (in English but not in languages with asyndetic coordination) is preceded by the word *and*. [In other words, English actually has asyndetic coordination, like Sarcee, Johannessen 1993. But coordination is just spelled out differently in the two languages. See Winter (1995).]

With this assumption the rule of ATB agreement is simple to state

(13) **Q μ agreement**:
Q agrees (morphologically-fused-with) every head of its sister.

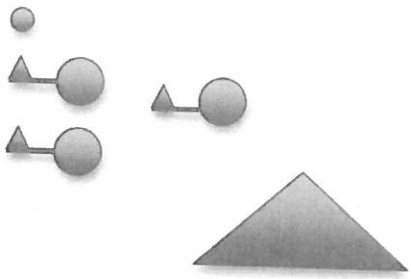
(14) Every man and every woman that I introduced to each other went together on
LF: [∀ [[μ man] [μ' woman] RC]] went together on a date.



3. ESA – Perlmutter and Ross (1970)

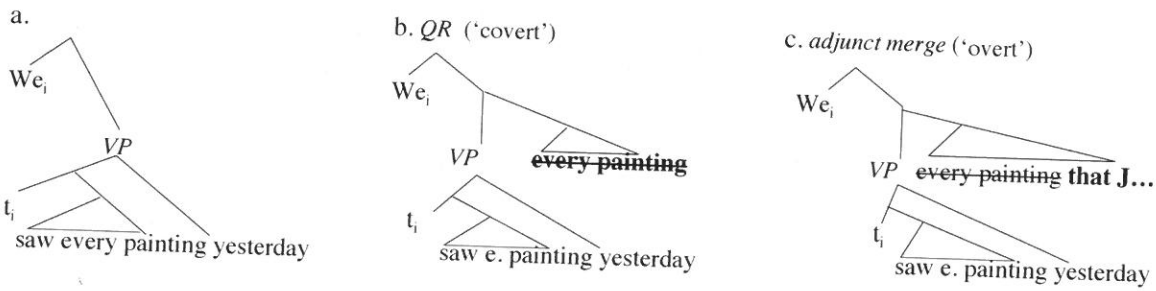
(15) a. A man entered the room and a woman walked out who were quite similar.
b. Every man is smiling and every woman is frowning who came in together.

(16) Every triangle is small and every circle is big that are connected to each other by a line.



3.1. Background – Extraposition as "Late Merge" of Relative Clauses

(17) We saw every painting yesterday that John talked about.



Interpreted by trace conversion: "There is a painting that John talked about, such that we saw that painting yesterday"

One of the Arguments for QR

(18) **Williams's generalization (WG):** When an adjunct β is "extraposed" from a "source QP" α, the scope of α is at least as high as the attachment site of β (the extraposition site).[2]

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[2] By the source QP, we mean the minimal QP that dominates the item that β modifies. (18) is a slight modification (due to Fox and Nissenbaum 1999) of the original statement of the generalization (Williams 1974, chapter 4). Williams (in contrast to F&N) did not restrict himself to adjuncts, perhaps because he focused on comperative- and result-extraposition, where, as Bhatt and Pancheva argue, complements pattern with NP adjuncts (for reasons having to do with the nature of Trace Conversion).

(19) a. I read a/every book before you did.
b. I read a/every book that John had recommended before you did.
c. I read a/every book before you did that John had recommended.

(19a,b) show an ambiguity that is explained in terms of the relative scope of the object quantifier and the *before*-clause (see Sag 1976 and Williams 1977). (19c) has only the interpretation in which the object quantifier has wide scope.

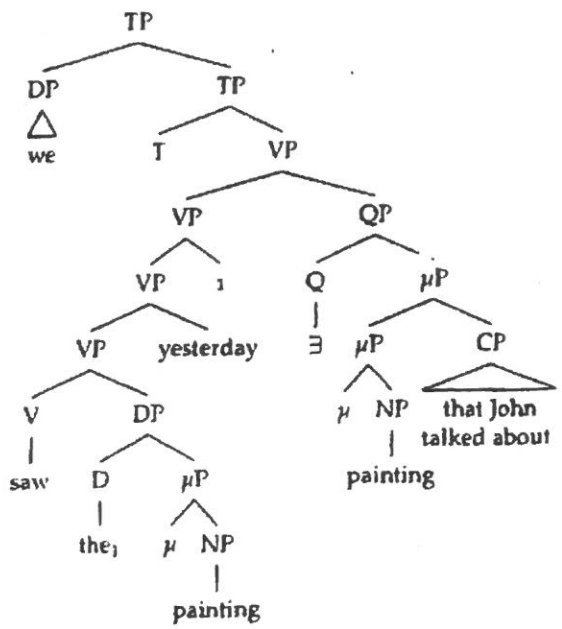
3.2. Restatement with Late Merge of a covert Quantifier

All QR involves "Late Merge" of a Quantifier. If movement involves multiple positions for a single item (i.e., multi-dominance), such late merge can be thought of as involves sharing of a nominal phrase by a Q head and an indexed definite article.

(20)**The Syntax of Variable Binding**[3]
When a head, μ, has maximal projections μP_1 and μP_2 (possibly but not necessarily identical), such that μP_1 is sister of D_1 and μP_2 is sister of D_2, if $[D_2\ \mu P_2]$ c-commands $[D_1\ \mu P_1]$, D_1 must be *the*$_i$ where i is bound by $[D_2\ \mu P_2]$. (In the Heim and Kratzer notation, i is the binder index – one of the two daughters of the sister of $[D_1\ \mu P_1]$.)

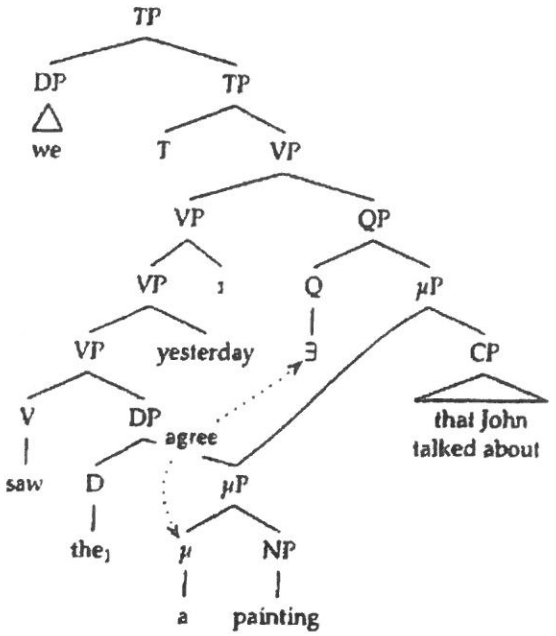
(21) We saw a painting yesterday that John talked about.

Version with no multi-dominance (copy theory)



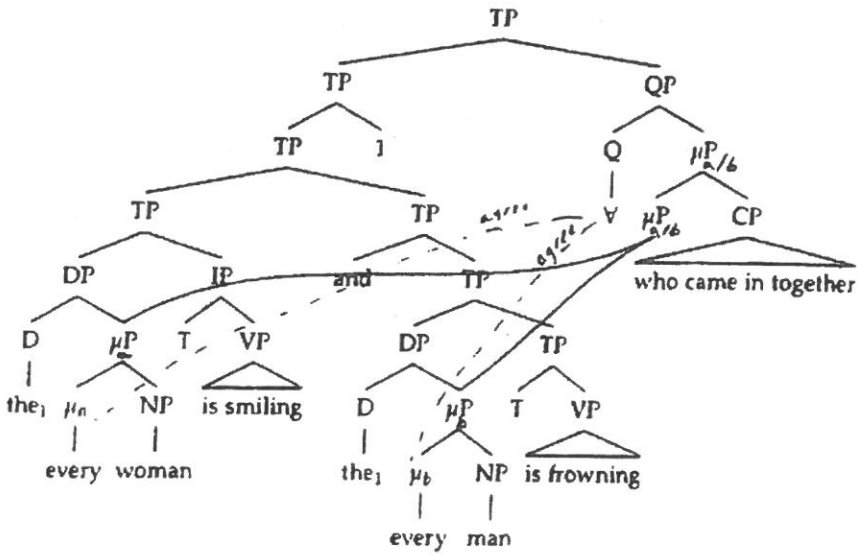
[3] This is not Johnson's rule, but rather a possible way of filling in something implicit in Johnson's paper.

Version with Multi-Dominance (needed for agreement between spelled-out μ and Q)



3.3. SAE – Forming a DP from silent pieces in a scope position

(15b) Every man is smiling and every woman is frowning who came in together.



LF: [∀ [[μ man] [μ' woman] RC]]
λx. the_x μ man is smiling and the_x μ' woman is frowning.

For every man woman pair X, such that RC is true of X
the man part of X is smiling and the woman part of X is frowning.

(22) Pronoun/Trace Rule[4]
$[\![the_i]\!]^g = \lambda P$. the maximal individual, x, such that $x \leq g(i)$ and $P(x)=1$.

Possible independent motivation for this rule is given by the following:

(23) A friend of every woman and man who agreed to dance with each other thinks that the woman is better than the man.

What we see in the LF are two μPs that are merged together but are not spelled out adjacent to each other.

Assumption about the representation of coordination (revised): Usually phrases have just one head, except when two phrases of the same category are merged with each other, in which case they are doubly headed and the second one (in English but not in languages with asyndetic coordination) is preceded by the word *and* **when the two are spelled out adjacent to each other**.

What we see in (15) is a case where two NPs are combined together but are not spelled out adjacent to each other (because the left most position of each NP is pronounced). Hence *and* is absent.

We can keep our rule for variable binding intact, as long as we define the maximal projection of a head μ as the maximal projection that has μ as one of its heads.

(20) **The Syntax of Variable Binding**
When a head, μ, has maximal projections μP_1 and μP_2, such that μP_1 is sister of D_1 and μP_2 is sister of D_2, if $[D_1\ \mu P_1]$ c-commands $[D_2\ \mu P_2]$, D_2 must be the_i where i is bound by $[D_1\ \mu P_1]$.

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[4] An alternative would be to revise the syntax somewhat as in (i), and replace (22) with (ii) so that pro_i μP can be interpreted by predicate modification. The rule for variable binding in (20) would need to be revised to fit the revised syntax.

(i) [the [pro_i μP]]
(ii) $[\![pro_i]\!]^g = \{x: x \leq g(i)\}$

4. Further Predictions

4.1. The same determiner must be spelled out on every head of the complement

(24) a. *A woman is smiling and every man is frowning who came in together.
b. A woman is smiling and a man is frowning who came in together.

(25) a. *Every woman is smiling and some man is frowning who came in together.
b. Some woman is smiling and some man is frowning who came in together.

(26) a. *Most woman are smiling and every man is frowning who came in together.
b. ? Most woman are smiling and most men are frowning who came in together.

(27) a. *Every woman is smiling and few men are frowning who came in together.
b. Few woman are smiling and few men are frowning who came in together.

(28) a. *No woman is smiling and every man is frowning who came in together.
b. no woman is smiling and no man is frowning who came in together.

4.2. Can't conjoin identical NP meanings

(29) a. *Every woman is smiling and every woman is frowning who came in together.
b. *Every woman and every woman who came in together like each other.
c. *Every woman and woman who came in together like each other.

This is not explained yet. (An explanation will be provided in section 10 below). But, given this observation, we predict that we should find nothing like ATB QR (see Boskovic and Franks (2000)).

(30) Some boy hugged every girl and kissed every girl
Cannot mean:
for every girl there is a boy who kissed her and hugged her.

Also cannot mean
For every pair of two girls there is a boy who kissed one of the two and hugged the other.

However:

(31) Some philosopher or other praised every dialogue by Plato and trashed every book by Aristotle.

should be able to mean:

For every pair made up of a diaglogue by Plato and a book by Aristotle, there is some philosopher that has praised the dialogue and trashed the book.

equivalent to: For every dialogue by Plato and every book by Aristotle, there is some philosopher that has praised the dialogue and trashed the book.

4.3. Extraposition Scope Generalization (Williams, Fox and Nissenbaum)

Plain Extraposition:

(32) a. I read a book that John had recommended before you did.
b. I read a book before you did that John had recommended.

SAE

(33) a. I read a book and saw a documentary that follow the lives of the same characters before you did.
b. I read a book and saw a documentary before you did that follow the lives of the same characters.

Plain Extraposition:

(34) a. You can do nothing without being expelled that is prohibited.
b. #You can do nothing without being expelled that is required.

SAE:

(35) a. I can read no book and see no movie that follow the life of the same character and still feel that I am on top of things.
b. I can read no book and see no movie and still feel that I am on top of things that follow the life of the same character.

5. A problem for semantically vacuous μ

Our account of Hydra and extraposition with split antecedents relied on the assumption that determiner words (*every*, *some*, etc.) are not lexical items that carry quantification meaning directly. Instead they are the spell-out of a different item μ within the complement of D (with nature of spell-out determined – via agreement – by the identity of D).

(36) a. Every linguist and philosopher in this university can prove Gödel's theorem.
$\forall x[(Lx \,\&\, Px) \rightarrow CanPr(x)]$
$\forall x[Lx \rightarrow CanPr(x)] \,\&\, \forall x[Px \rightarrow CanPr(x)]$
b. Every linguist and every philosopher in this university can prove Gödel's theorem.
$*\forall x[(Lx \,\&\, Px) \rightarrow CanPr(x)]$
$\forall x[Lx \rightarrow CanPr(x)] \,\&\, \forall x[Px \rightarrow CanPr(x)]$

Conclusion: If μ is semantically vacuous, we would need to explain why μPs can be conjoined by and_{Link} but not by simple intersective conjunction.

This probably teaches us that μ is not semantically vacuous.

Champollion (2015)), Winter (2001): *and*$_{Link}$ is not a lexical item. To get the *and*$_{Link}$ meaning, we must embed an ordinary intersective *and* within some covert structure.

Goal: to find a meaning for μ such that

$$[\![\text{and}]\!]([\![\boldsymbol{\mu}]\!](P))([\![\boldsymbol{\mu}]\!](Q)) \approx [\![\text{and}_{\text{Link}}]\!](P)(Q)$$

where *and* is the basic lexical item needed for simple cases of coordiantion.

6. Variation on Champollion (2015) and Winter (2001)

(37)John left.
LF
[[ι [μ John]] left]

(38)John and Mary met
LF
[[ι [[μ John] and [μ Mary]]] [met]]

(39) a. $[\![\text{Mary}]\!] = \{m\}$; $[\![\text{John}]\!] = \{j\}$
b. $[\![\mu]\!](P_{et}) = \{x: \exists y \in P[x \geq y]\}$
c. $[\![\iota]\!](P_{et})$ = the unique x s.t. $x \in MIN(P)$

(40) $MIN(P) = \{x \in P: \neg\exists y \in P[y < x]\}$

(41) Every boy and (every) girl who like each other met
LF
[[∀ [[μ boy] and [μ girl]] RC] [met]]

(42)$[\![\forall]\!](P_{et}) = \lambda Q_{et}[MIN(P) \subseteq Q]$

Questions:

a. Why MIN? Many questions arise here. But the most pressing perhaps is to resolve an obvious conflict between the semantics I gave for ι and standard approaches to the semantics of the definite article?
b. What is the semantics of number within DP? E.g., what is the difference between *some boy and (some) girl* and *some boys and (some) girls*?
c. What explains pair formation by conjunction of non-disjoint NPs (Champollion, Chapter 4)

(43) Every singer and dancer (who like each other) had dinner together.

d. How to account for **every boy and boy*, **every boy and tall boy*?

e. Aren't we making crazy predictions for sentences such as (44)?

(44)a. *Every man who are compatible married to each other.
b. *Every compatible man married each other.
∀X[X is a minimal collection of compatible individuals one of which is a man → X married each other].

7. The Semantics of the definite article (von Fintel, Fox and Iatridou)

(45) a. The amount of money necessary for opening an account in this bank
The *maximal* amount necessary…
a. The amount of money sufficient for opening an account
The *minimal* amount sufficient…

(46) Test with six easy questions $q_1,\ldots q_6$ which you have to answer correctly to pass. (You fail one, you get an F). Additional questions determine your specific passing grade.

a. The questions such that anyone who passes the test answers each of them correctly
The *maximal* set of questions such that…
b. The questions such that anyone who answers each of them correctly passes the test
The *minimal* set of questions such that…

(47) $[\![\iota]\!]^w(P_{<s,et>})$ = the maximally informative individual that satisfies P, i.e.
the unique x s.t. $P(w)(x)=1$ &
$\forall y[P(w)(y)=1 \rightarrow \{w: P(w)(x)\} \subseteq \{w: P(w)(x)\}]$

8. Why MIN in the semantics of ι

(48) $[\![\text{John}]\!]^w = \lambda x.\ x$ = the person called *John* in w (*likewise for Mary*)

(49) $[\![\iota\ [\mu\ \text{John}]]\!]^w$
= the maximally informative individual that has a part called *John*
= the unique x s.t. x has a part called *John* in w &
$\forall y$[y has a part called John in w →
{w: x has a part called John in w}⊆
{w: y has a part called John in w}
= the minimal individual that has a part called *John* in w.

(50) $[\![\iota\ [\mu\ \text{John}]\ \text{and}\ [\mu\ \text{Mary}]]\!]^w$
= the maximally informative individual that has a part called *John* and a part called Mary
= the unique x s.t. x has two parts called *John* and *Mary* in w resp &
$\forall y$[y has has two parts called *John* and *Mary* in w resp →
{w: x has two parts called *John* and *Mary* in w resp }⊆
{w: y has two parts called *John* and *Mary* in w resp }
= the minimal individual that has two parts called *John* and *Mary* in w resp.

9. Plurality in the NP

(51) **Structure of DP**
[D [ϕ [[μ NP]]]

(52) $[\![\text{Pl}]\!](P_{s,et}) = \lambda w.\lambda x.\ x \in \text{Closure}(\text{Max-inf}(P)(w), \oplus)$

Max-inf(P)(w) = {x: P(w)(x)=1 & $\neg\exists$y[P(w)(y)=1 & {y:P(w)(y)}$\subset${x:P(w)(x)]}[5]

(53) $[\![Pl]\!](\lambda w.\ [\![\mu\ boy]\!]^w) = \lambda w.\lambda x.\ x \in Closure(MIN([\![\mu\ boy]\!]^w), \oplus)$

(54) the boys
LF
ι [Pl [[μ NP]]
$[\![\ \iota$ [Pl [[μ NP]] $]\!]^w$ = the sum of all boys in w

10. Quantification over individuals only if they are possibly maximally informative

(55)**Statements from before**
a. $[\![\forall]\!](P_{et}) = \lambda Q_{et}[MIN(P) \subseteq Q]$
b. $[\![\exists]\!](P_{et}) = \lambda Q_{et}[[MIN(P) \cap Q] \neq \varnothing]]$

Wrong For Plural Quantification

(56) Some boys met each other.

Won't help to quantify over maximally informative individuals: (56) would be true only if all boys met each other.

(57) **Alternative Statements**
a. $[\![\forall]\!]^w(P_{s,et}) = \lambda Q_{et}[P\text{-}Max\text{-}inf(P)(w) \subseteq Q]$
b. $[\![\exists]\!]^w(P_{s,et}) = \lambda Q_{et}[[P\text{-}Max\text{-}inf\ (P)(w) \cap Q] \neq \varnothing]]$

P-Max-inf(P)(w) = {x: P(w)(x)=1 & $\exists w[\![\iota]\!]^w(P_{<s,et>}) = x$}[6]

This, I think, resolves the problem of non-empty intersection pointed out by Champollion, while at the same time accounting for the impossibility of conjoining two [μ NP]s where one of the NPs entails the other.

(58) a. Every singer and dancer (who like each other) had dinner together.
b. *Every boy and boy…
c. *Every boy and tall boy…

11. *Compatible <u>boy</u>*

Hopefully a presupposition failure (given the Strong-Kleene/Supervaluation logic of presupposition projection)

12. Resulting view of number

-Pl (possibly Sg) interpretable in NP (type <set, set>)
-Sg/Pl interpretable above DP (type <e,e>), must be there to check off uninterpretable features on T (Sauerland).

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[5] See Beck (2010, 2014) for another use of Max-inf.
[6] We can move to P-Max-inf in (52) as well.