Plurality beyond nominals

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🗎: https://patrl.github.io/assets/LAGB2016Plurality.pdf

Introduction

Overview

Our question: what are the limits of semantic plurality? Is it contrained by morphosyntactic plurality, and if so, how?

Two empirical domains of inquiry:

- Group nouns and agreement in British English.
- Semantically plural interrogatives.

Overview

- Building on de Vries (2015), we show that there is a tight connection between semantic plurality and plural morphosyntax, on the basis of the variable availability of distributive and cumulative readings with *group nouns*, such as *team*.
- We show that the framework developed by Winter (2001) and de Vries (2015), according to which plurals are set-denoting expressions, naturally predicts the availability of distributive and cumulative readings with embedded questions, which are also, according to a Hamblin/Karttunen semantics, set-denoting.
- Finally, we propose a negative licensing condition on $*$ and $**$-operators (discussed in subsequent sections), in order to capture the *constrainedness* and *domain-generality* of semantic plurality.

Plurality

Pluralities as sets

Singular NPs range over *atomic individuals*:

(1) $[\![\text{poet}]\!] = \{\text{Rilke, Yeats, Elliot}\}$

Assumption here: Plural NPs range over *sets of individuals* (Schwarzschild 1996, Winter 2001, Champollion 2015, de Vries 2015, etc.):

(2) $$[\![\text{poets}]\!] = \left\{ \begin{array}{c} \{\text{Rilke}\}, \{\text{Yeats}\}, \{\text{Elliot}\} \\ \{\text{Rilke, Yeats}\}, \{\text{Rilke, Elliot}\}, \{\text{Yeats, Elliot}\} \\ \{\text{Rilke, Yeats, Elliot}\} \end{array} \right\}$$

Pluralities as sets cont.

This is an alternative to a popular approach in the literature in which plural NPs range over *i-sums* (see, e.g., Link 1983, Landman 1996).

$$(3) \quad [\![\text{poets}]\!] = \left\{ \begin{array}{c} \text{Rilke, Yeats, Elliot} \\ \text{Rilke} \oplus \text{Yeats, Rilke} \oplus \text{Elliot, Yeats} \oplus \text{Elliot} \\ \text{Rilke} \oplus \text{Yeats} \oplus \text{Elliot} \end{array} \right\}$$

To a large extent the two approaches are isomorphic. As we'll see in subsequent sections however, treating pluralities as sets allows us to give a unified account of plurality effects with questions.

Pluralization

Following, e.g., Winter (2001), de Vries (2015), etc., we take the plural affix PL to denote the $*$-operator. $*$ is defined as taking a set, and returning its powerset (minus the empty set).

(4) **Predicate pluralization** (de Vries's definition)
$*P_{\sigma t} := \wp(P) - \emptyset$ for any type σ

Applied to our denotation for singular *poet*, the $*$-operator returns the desired denotation for plural *poets*.

Plural DPs

Singular DPs denote/quantify over entities, whereas plural DPs denote/quantify over sets of entities.

$[\![\text{Rilke, Yeats and Elliot}]\!] = \{\text{Rilke, Yeats, Elliot}\}$

We assume here that DP coordination is interpreted as *set-union*, to account for co-ordinated plural DPs (see Winter 2001, Champollion 2015 for an account in terms of boolean coordination):

$[\![\text{the boys}]\!] = \{\text{Abed, Troy, Jeff}\}$

$[\![\text{the girls}]\!] = \{\text{Annie, Shirley, Britta}\}$

$[\![\text{the girls and the boys}]\!] = [\![\text{the boys}]\!] \bigcup [\![\text{the girls}]\!]$

$= \{\text{Abed, Troy, Jeff, Annie, Shirley, Britta}\}$

Plural DPs cont.

To deal with coordinated singular DPs, the coordinands are first type-lifted into singleton sets via Partee's (1986) IDENT.

$\textsc{ident}(\alpha) := \{\alpha\}$

$\textsc{ident}([\![\text{Rilke}]\!]) = \{\text{Rilke}\}$

$\textsc{ident}([\![\text{Yeats}]\!]) = \{\text{Yeats}\}$

$\textsc{ident}([\![\text{Rilke}]\!])$ and $\textsc{ident}([\![\text{Yeats}]\!]) = \{\text{Rilke}\} \bigcup \{\text{Yeats}\}$

$= \{\text{Rilke}, \text{Yeats}\}$

Plural DPs cont.

We can define a generalized definite article THE which:

- When it combines with a singular NP_{SG} of type D_{et} returns the unique individual x s.t. $x \in [\![NP_{SG}]\!]$, and is undefined otherwise.
- When it combines with a plural NP_{PL} of type D_{et} returns the unique maximal subset X s.t. $X \in [\![NP_{PL}]\!]$ and is undefined otherwise.

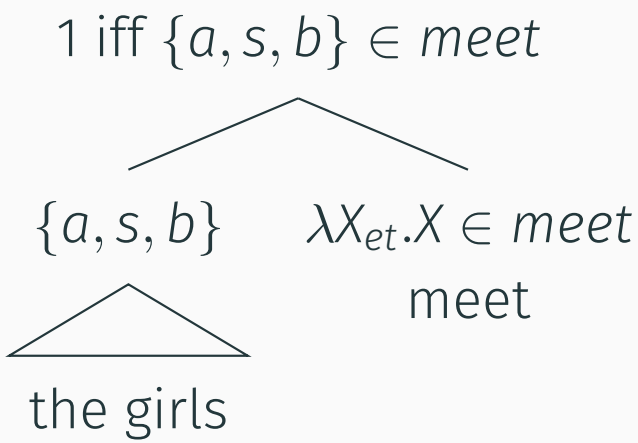
(5) **Generalized** THE (de Vries's definition)
$\text{THE}_{\sigma t,\sigma}(P_{\sigma t}) := \text{MAX}(P)$ for any type σ

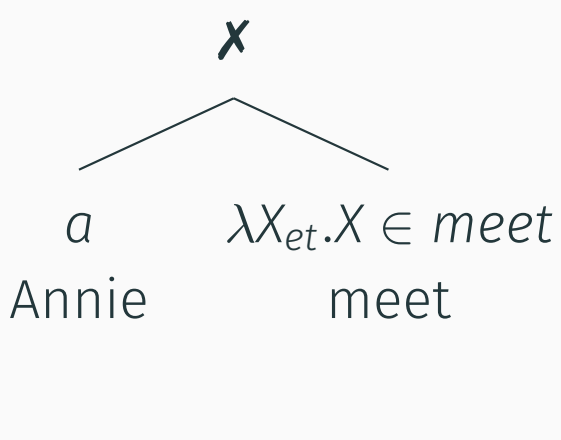
Collective predicates

Note that in the framework assumed here, there is a type difference between singular and plural DPs: Singular DPs are of type *e*, and plural DPs are of type *et*.

This provides an immediate account of the restrictions on *collective predicates*: they require set-denoting arguments.

$[\![\text{meet}]\!] = \lambda X_{et}.X \in \mathit{meet}$





Distributive predicates

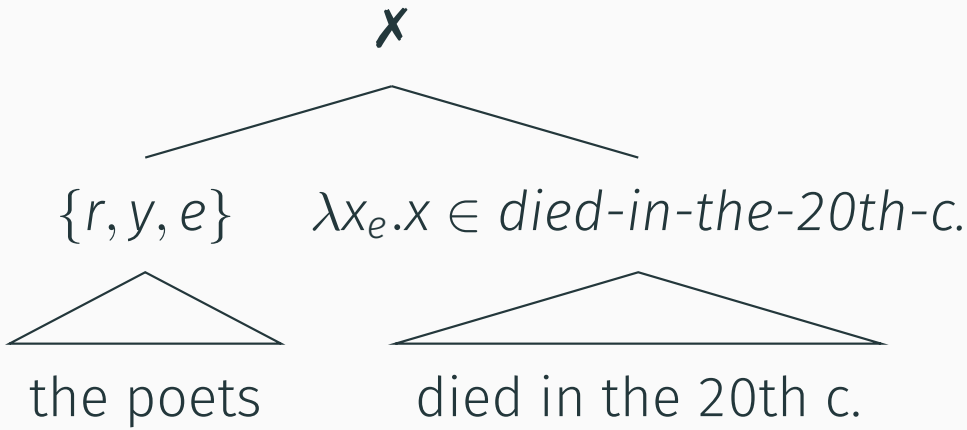
Distributive predicates range over atomic individuals, and give rise to distributive inferences with plural arguments.

For a given distributive predicate P_{DIST}, if a plurality X is s.t. $X \in P_{\text{DIST}}$, then $\forall x[x \in X \rightarrow x \in P_{\text{DIST}}]$

For example, *died in the 20th century* is a distributive predicate. Therefore, if it's true that the poets (Rilke, Yeats, and Elliot) died in the 20th century, then Rilke died in the 20th century, Yeats died in the 20th century, and Elliot died in the 20th century.

Distributive predicates cont.

Distributive predicates are of type *et*, and therefore give rise to a type-mismatch with a plural argument in our framework.

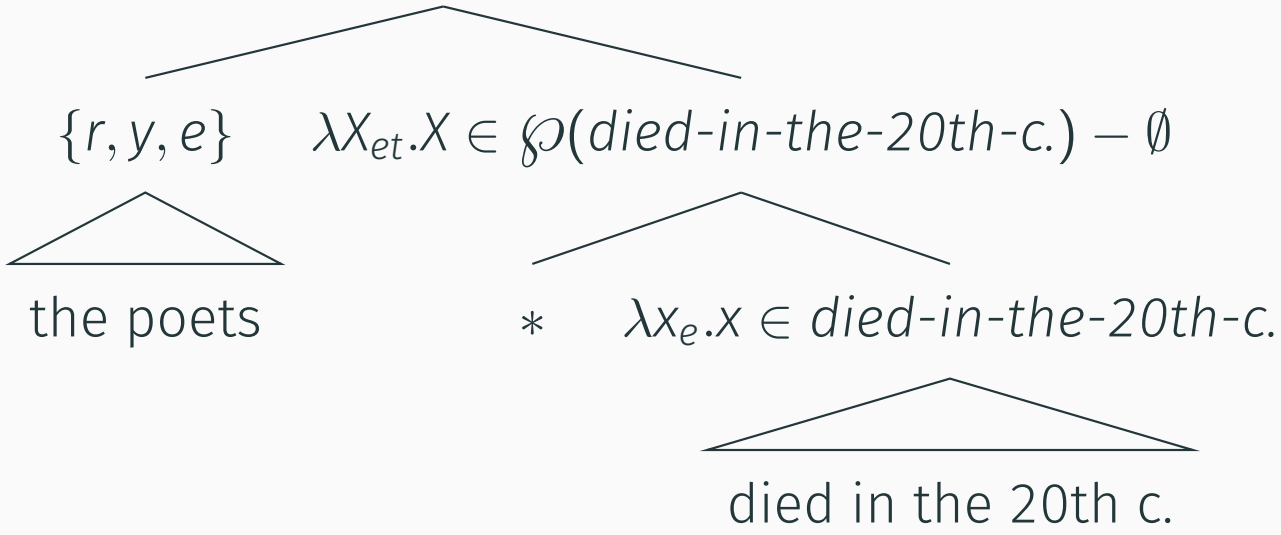


We resolve this by type-lifting the VP using the $*-$operator; the same operator that we gave as the interpretation of the plural affix PL!

Distributive predicates cont.

Recall: $*P := \wp(P) - \emptyset$

1 iff $\{r, y, e\} \in \wp(\textit{died-in-the-20th-c.}) - \emptyset$



This correctly predicts *distributive inferences* with distributive predicates.

Lexical distributivity

There is an alternative theory of distributive inferences, due to Scha (1981).

The idea in brief: there is no $*$-operator at LF; distributive predicates range over individuals *and* sets. Distributive inferences arise due to our world knowledge concerning what it means for a distributive predicate P_{DIST} to be true of a plurality X.

Both approaches seem viable; how due we distinguish between the two?

Winter's (2001) argument for phrasal distributivity

Scha's lexical theory of distributivity does not predict scopal interaction with other operators, whereas the $*$-operator potentially does.

Winter (2001) shows that the $*$-operator is necessary to capture certain readings.

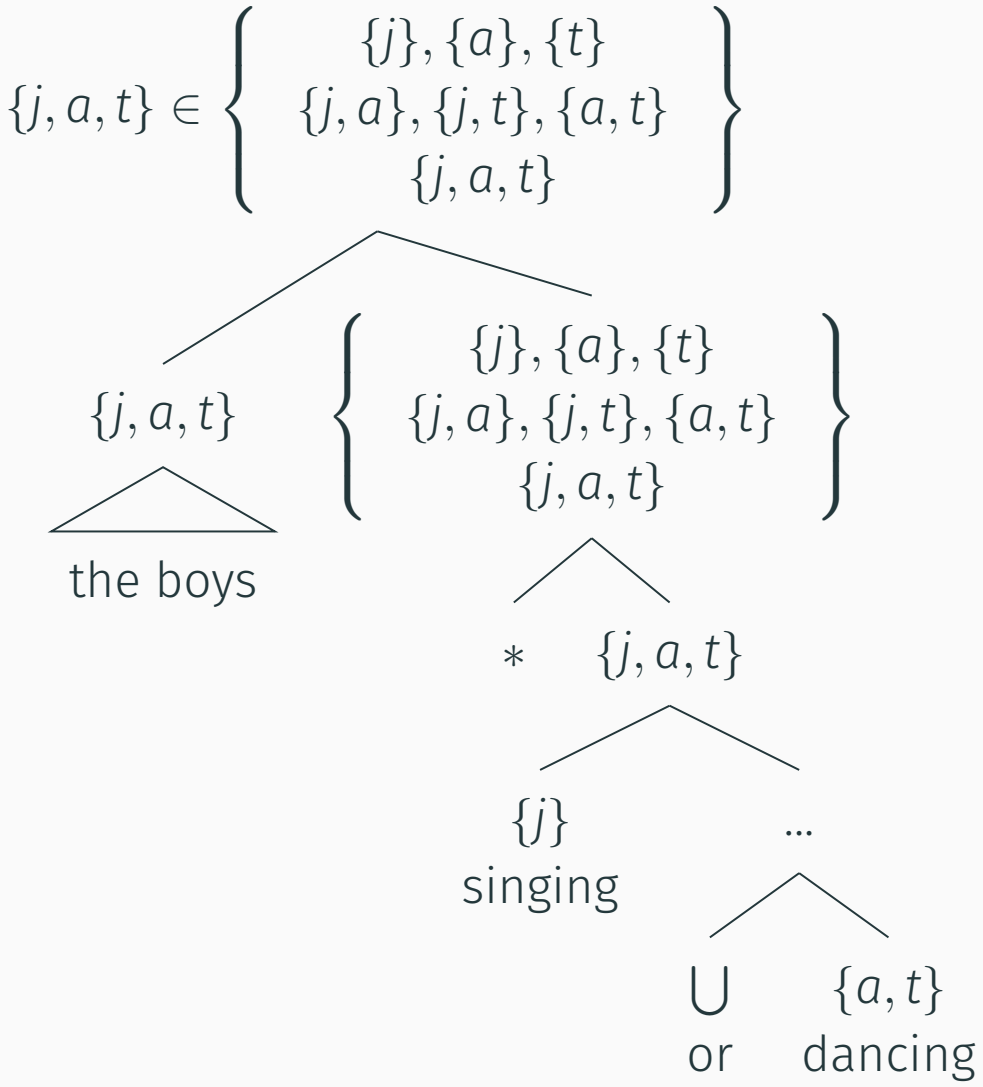
(6) The boys are singing or dancing.

Lexical distributivity predicts that (6) is true iff *all* of the boys are dancing, or *all* of the boys are singing.

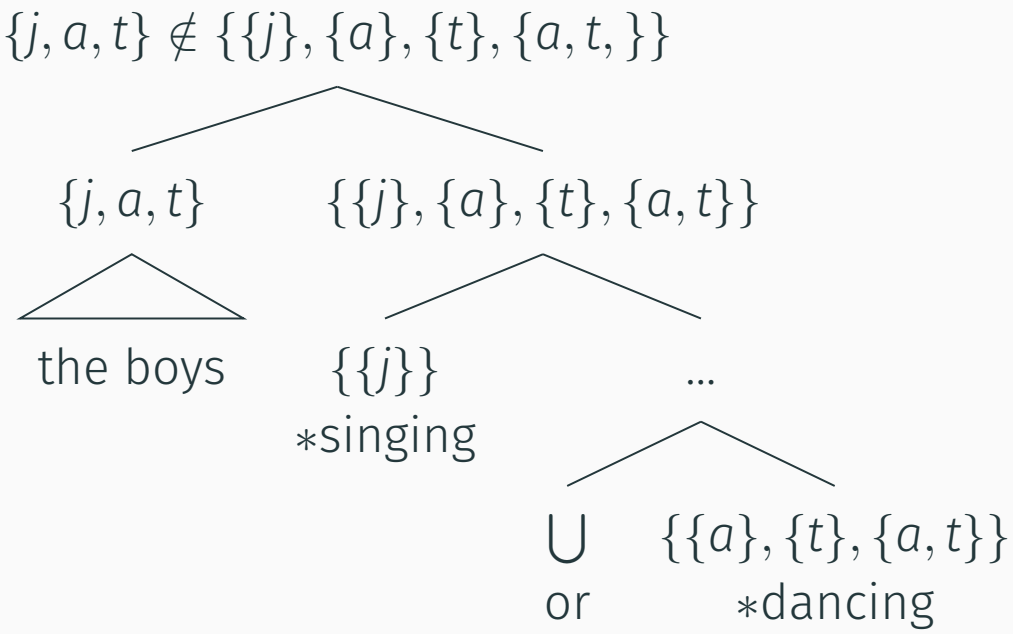
Intuitively, (6) is true in a scenario where, e.g. Jeff is singing, and Abed and Troy are dancing.

The second reading can only be captured if we allow the $*$-operator to take scope *above* disjunction.

Winter's (2001) argument for the $*$-operator cont.



Winter's (2001) argument for the $*$-operator cont.



Lexical vs. phrasal distributivity

de Vries (2015) gives a compelling argument that:

- Both lexical distributivity (Scha 1981) and phrasal distributivity (the $*$-operator) must be available.
- The availability of phrasal distributivity is dependent on plural morphology.

The argument is is based on the availability of distributive inferences with group nouns, such as *team*, *committee*, etc.

Lexical vs. phrasal distributivity

In British English, unlike in American English, group nouns can trigger plural agreement on the predicate.

(7) a. The committee **is** convening at 9am.

b. %The committee **are** convening at 9am.

Group nouns are compatible with collective predicates (such as *convening*, above). They are also compatible with distributive predicates and give rise to distributive inferences.

(8) The committee is/%are tired.

Lexical vs. phrasal distributivity

Now consider the following:

$[\![\text{the team}]\!] = \{\text{Jeff}, \text{Annie}, \text{Shirley}, \text{Troy}\}$

(9) a. The team **is** hugging or kissing.

b. The team **are** hugging or kissing.

Scenario 1: Jeff and Annie are hugging, and Shirley and Troy are hugging. (9a) = true; (9b) = true

Scenario 2: Jeff and Annie are kissing, and Shirley and Troy are hugging. (9a) = false; (9b) = true

Lexical vs. phrasal distributivity

The sentence is only predicted to be true in scenario 2 (the mixed hugging/kissing scenario) if a $*$-operator takes scope higher than disjunction, as illustrated before.

Since the sentence is only judged true in the mixed scenario with plural agreement on the VP, the inevitable conclusion is that the presence of the $*-$operator is dependent on a morphosyntactically plural VP.

Lexical distributivity is independently necessary to account for the availability of distributive inferences with singular agreement elsewhere, such as *the committee is tired*.

Lexical vs. phrasal cumulativity

New observation here: a similar argument can be made for the availability of lexical vs. phrasal *cumulativity*.

Cmulative readings arise with a plural subject and a plural object:

(10) The boys admired the girls.

The classical observation is that (10) has surprisingly weak truth-conditions. It is true just so long as, for each boy, there is some girl he admired, and for each girl, there is some boy who admired her.

The predicted (distributive) truth-conditions are much stronger, given the machinery we have introduced so far.

The $**$-operator

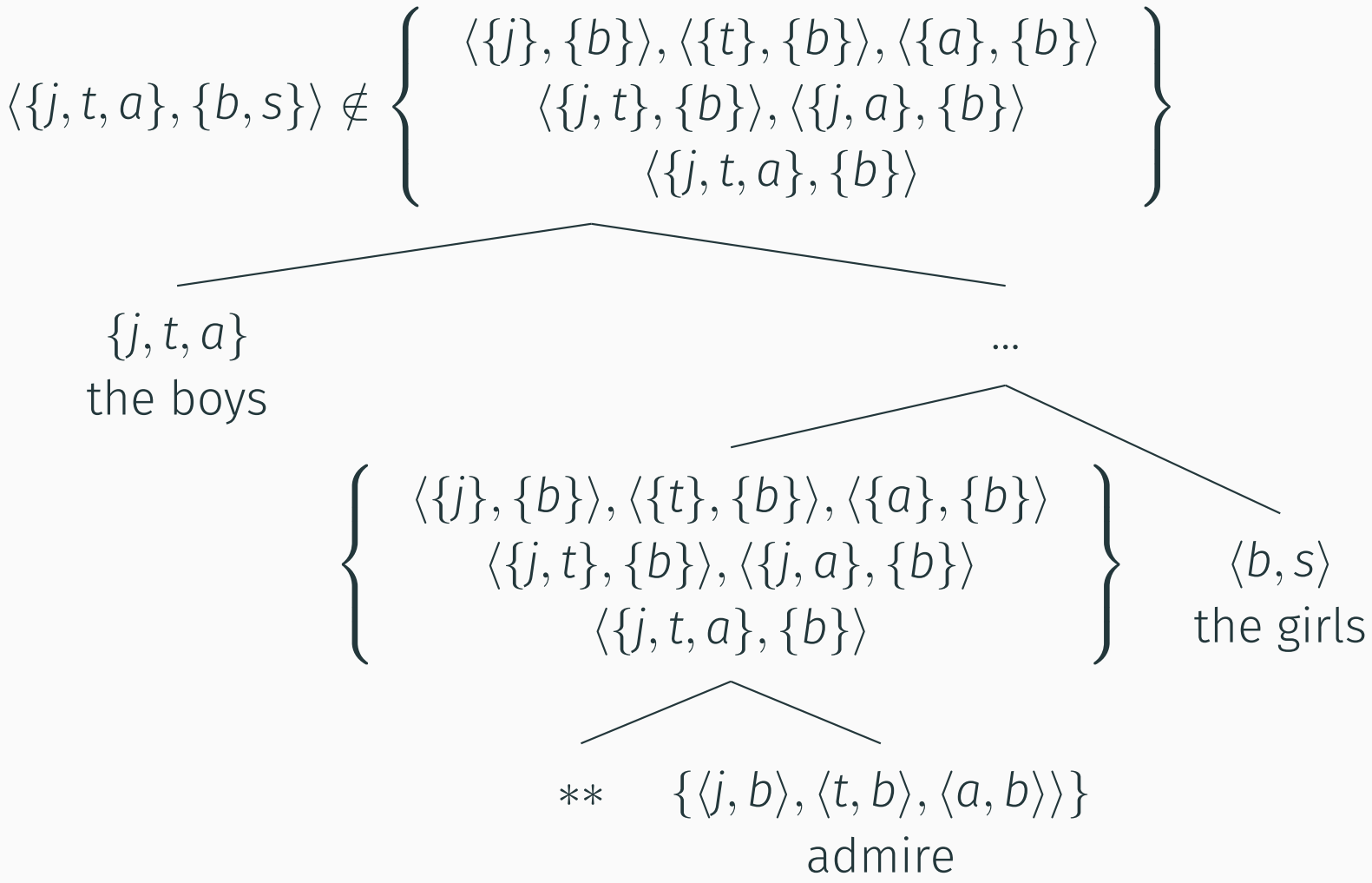
The standard theory of the cumulative reading involves a $**$-operator, which pluralizes a relation.

$$**R_{\tau,\tau t} :=$$
$$\{\langle X_{\tau t}, Y_{\tau t}\rangle : \forall x_\tau \in X, \exists y_\tau \in Y[\langle x, y\rangle \in R] \wedge \forall y_\tau \in Y, \exists x_\tau \in X[\langle x, y\rangle \in R\rangle]\}$$

(11) The boys admire the girls.

If there is some girl who *isn't* admired, the def. of $**$ predicts the sentence to be false.

The $**$-operator cont.



Disjunction argument for phrasal cumulativity

(12) The boys are hugging or kissing the girls.

Consider the following model:

$[\![\text{the boys}]\!] = \{j, a, t\}$, $[\![\text{the girls}]\!] = \{b, s\}$

(12) is true if *j is hugging b*, *a is hugging b*, and *t is hugging s*.

We can only capture this reading if we allow $**$ to take scope over disjunction. See Beck & Sauerland 2000 for additional arguments for phrasal cumulativity.

Cumulative readings with group nouns

(13) a. The winning team are kissing or hugging the losing team.

b. The winning team is kissing or hugging the losing team.

Consider the following model:

$[\![\text{the winning team}]\!] = \{t, s, b\}$, $[\![\text{the losing team}]\!] = \{j, a\}$

t and s are hugging j, whereas b is kissing a.

$[\![(13a)]\!] = \text{true}$

$[\![(13b)]\!] = \text{false}$

Conclusion: phrasal cumulativity is only possible with plural agreement.

Questions

Hamblin/Karttunen

A standard theory of questions says that constituent questions denote *sets of propositions* (Hamblin 1973, Karttunen 1977, Heim 1994).

$$[\![\text{which boy left?}]\!] = \begin{array}{l}\{p \in D_{st} | \exists x[x \in \text{boy}_w \\ \wedge\, p = \{w' \in D_s : x \in \text{left}_w\}]\}\end{array}$$

$$= \left\{ \begin{array}{c} \{w' \in D_s : \text{ Jeff left in } w'\} \\ \{w' \in D_s : \text{ Abed left in } w'\} \\ \{w' \in D_s : \text{Troy left in } w'\} \\ \ldots \end{array} \right\}$$

Pluralities of questions

Following recent work by Fox (2012), Nicolae (2013), and Kotek (2014), we assume that *multiple constituent questions* denote *pluralities of questions*.

$$[\![\text{Which boy admires which girl?}]\!] = \begin{array}{l} \{Q \in D_{st,t} : \exists x[x \in boy_w \\ \wedge\, Q = \{p \in D_{st} : \exists y[y \in girl_w \\ \wedge\, p = \{w' \in D_s : x \text{ admires }_{w'} y\}]\}]\} \end{array}$$

Pluralities of questions cont.

$$= \left\{ \begin{array}{r} [\![\text{which girl does Jeff admire?}]\!] = \left\{ \begin{array}{c} \{w' : \text{jeff admires Britta in } w'\} \\ \{w' : \text{Jeff admires Annie in } w'\} \\ \ldots \end{array} \right\} \\ [\![\text{which girl does Abed admire?}]\!] = \left\{ \begin{array}{c} \{w' : \text{Abed admires Britta in } w'\} \\ \{w' : \text{Abed admires Annie in } w'\} \\ \ldots \end{array} \right\} \\ [\![\text{which girl does Troy admire?}]\!] = \left\{ \begin{array}{c} \{w' : \text{Troy admires Britta in } w'\} \\ \{w' : \text{Troy admires Annie in } w'\} \\ \ldots \end{array} \right\} \end{array} \right\}$$

A structured representation is independently necessary in order to capture the presuppositions of multiple questions (under the pair-list reading): *pointwise uniqueness* and *domain exhaustivity* (Dayal 1996).

A correlate of collective predicates in the interrogative domain?

Much like Winter's (2001) theory of plurality, according to fairly standard theory of question semantics *pluralities of questions* are higher order objects of type $(st, t), t$.

Rattling-off predicates (Schwarz 1994) don't embed singular *which*-questions, but do embed *multiple* singular *which*-questions:

(14) a. Jeff rattled off which boy likes which girl.

b. *Jeff rattled off which girl Abed likes.

(15) a. Abed listed which poet died in which year.

b. *Abed listed which poet died in 1926.

A correlate of collective predicates cont.

An obvious analysis would be that *rattling-off* predicates select an argument of type $(st, t), t$, as opposed to st, t. This won't quite work, since plural *which*-questions are also possible embedded under *rattling-off* predicates:

(16) a. Jeff rattled off which girls Abed likes.

b. Abed listed which poets died in 1926.

Pluralizing questions

Building on Lahiri 2002 and Beck & Sharvit 2002, we account for this by proposing that the plural morphology on the *wh*-restrictor licenses pluralization of the question, resulting in a higher-order set of subquestions of type *st*, via the $*$-operator:

$$[\![\text{which girls does Abed like?}]\!] = \left\{ \begin{array}{c} \{w' : \text{Abed likes } \{\text{Britta}\} \text{ in } w'\} \\ \{w' : \text{Abed likes } \{\text{Annie}\} \text{ in } w'\} \\ \{w' : \text{Abed likes } \{\text{Annie, Britta}\} \text{ in } w'\} \end{array} \right\}$$

$$*[\![\text{which girls does Abed like?}]\!] = \wp([\![\text{which girls does Abed like?}]\!]) - \emptyset$$

$$= \left\{ \begin{array}{c} \text{does Abed like Brita?} \\ \text{does Abed like Annie?} \\ \text{does Abed like Annie and Britta?} \\ \ldots \end{array} \right\}$$

Cumulative readings of questions

(17) The four detectives found out which gang controls which estate.

Observe that no single detective must have found out the answer to the embedded question - it is enough just so long as each detective found out some partial answer to the question, just so long as taken together, the partial answers give a complete answer to the question. In other words, the truth conditions are cumulative:

$$
\begin{aligned}
[\![(17)]\!] = 1 \text{ iff } \quad & \forall x[x \in [\![\text{the four detectives}]\!] \\
& \rightarrow \exists Q[Q \in [\![\text{which gang controls which estate}]\!] \\
& \wedge x \text{ found out } Q]] \\
& \wedge \forall Q[Q \in [\![\text{which gang controls which estate}]\!] \\
& \rightarrow \exists x[x \in [\![\text{the four detectives}]\!] \wedge x \text{ found out } Q]]
\end{aligned}
$$

Cumulative readings of questions cont.

This is exactly the reading we predict if we apply the $**$-operator to the relation between individuals and questions.

$$\langle [\![\text{the four detectives}]\!], [\![\text{which gang controls which estate}]\!] \rangle \in **[\![\text{found out}]\!]$$

We can additionally show that phrasal cumulativity must be possible here, given examples like the following:

(17) The four detectives have found out or are investigating which gang controls which estate.

Absence of distributivity effects with questions

Given the existence of (a) predicates which select for pluralities of questions, and (b) cumulative readings with questions, we might expect semantically plural questions to give rise to distributive readings.

(18) Which girl likes which boy depends on at least two factors.

Note that this does *not* mean: which boy Annie likes depends on at least two factors,
which boy Britta likes depends on at least two factors,
etc.

This is however the reading we would expect, if we were free to introduce the $*-$operator.

N.b. that the interrogative triggers morphosyntactically singular agreement on the predicate.

Consequences

We've seen some evidence that seems *prima facie* difficult to reconcile:

- The evidence from group nouns, and agreement in British English shows a tight connection between plural morphosyntax and semantic plurality, i.e. as diagnosed by distributivity and cumulativity.
- We saw evidence for the existence of semantically plural questions:
    - Interrogative-collective predicates (*rattling-off*) etc.
    - Cumulative readings with questions.
- On the other hand distributive readings, one of the hallmarks of semantic plurality, were unavailable.

The set-theoretic semantic machinery developed by Winter (2001) a.o. is incredibly powerful.

- Advantage: Semantic plurality can be captured outside of the nominal domain via type-flexible definitions of the $*-$ and $**-$operators.
- Disadvantage: Free insertion of $*$ and $**$ massively overgenerates, predicting, e.g. the availability of phrasal cumulativity with group nouns and singular agreement, and distributive readings for interrogatives.

On the other hand, we don't want to constrain insertion of $*$ and $**$ *too* much, since, e.g., we want to allow pluralization of questions with a plural *wh*-restrictor, in order to account for the selectional restrictions of *rattling-off* predicates.

To conclude, we propose the following *negative* licensing condition on insertion of $*$ and $**$.

(19) **Condition on phrasal plurality ($*$/$**$)**
The $*$ and $**$-operators may freely attach to any extended projection *unless* it is morphosyntactically singular.

This accounts for the generalization that morphosyntactically singular agreement on the VP *always* blocks plurality effects - this is what is responsible for the absence of phrasal distributivity/cumulativity with group nouns and singular agreement, and the absence of distributivity with an interrogative subject.

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