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Scope-related cumulativity asymmetries and cumulative composition

In a nutshell: We propose a novel account of asymmetries concerning cumulative readings of universal quantifiers like *every*, and related expressions like German *sowohl A als auch B* 'A as well as B'. Our system avoids some of the problems of existing theories because unlike them it does not rely on syntactically derived cumulative predicates, but is surface compositional: The basic idea is to include pluralities of all semantic types in the ontology and build cumulativity into a composition rule, so that any larger expression containing a plurality-denoting expression will also denote a plurality.

Background: Singular universal quantifiers like English *every* allow for cumulative readings wrt. higher, but not wrt. lower semantically plural arguments ([1],[2], but cf. also [5],[4],[7]): (1-b) can be true in the scenario in (1-c), but (1-a) is not.

(1)a. *Every copy editor found the three mistakes.* adapted from [4]

b. *The three copy editors found every mistake.* adapted from [4]

c. There were three mistakes in the manuscript. Anna found (only) mistake 1, Sarah found (only) mistake 2 and Mary found (only) mistake 3.

[1] proposes that *every NP* (i) has the same denotation as *the* NP_{pl}, (ii) must minimally c-command a distributivity operator * or cumulation operator ** and (iii), when moved, involves binding into a definite description denoting atomic boys ('trace conversion', [3]). In addition, plurals under surface c-command by an *every* NP must be in the scope of */**. This derives the contrast between (1-a) and (1-b): The plural object in (1-a) cannot move across *every NP* and thus the input for 'cumulative' ** cannot be formed. It also correctly predicts that sentences like (2-a), discussed by [5], have a reading in which the higher two DPs cumulate, but DP3 is scopally dependent on DP2: (2-a) can have the LF in (2-c), which is true in scenario (2-b).

(2)a. [$_{DP1}$ *The two girls*] *taught* [$_{DP2}$ *every boy*] [$_{DP3}$ *two new tricks*]

b. $[\![\text{taught}]\!] = \{\langle g1, b1, t1\rangle, \langle g1, b1, t2\rangle, \langle g1, b2, t3\rangle, \langle g2, b2, t2\rangle\}$

c. [DP1 [DP2 [** [2 [1 [DP3 [3 [t_1 ****taught* [*the boy* t_2] t_3]]]]]]]]

Observations: We draw attention to two constructions that are semantically analogous to (2-a), but to which existing analyses do not generalize. **Point 1:** (3-a) is true in scenario (3-b). Intuitively, we have a cumulative relation between the two spies and the properties in (3-c). [6] shows that these truth conditions cannot generally result from cumulating syntactically derived relations as in (2-c): Essentially, we can only create a relation either between the subject and the two conjuncts (A,B) or the subject and *die zwei Bücher* – neither yields the correct meaning.

(3)a. *Die zwei Spione haben die Eva* [$_A$*rauchen*] *und* [$_B$*die zwei Bücher stehlen*] *gesehen.*

The two spies have the Eva smoke and the two books steal seen

'The two spies saw Eva smoke and steal the two books.' (German)

b. Spy 1 saw Eva smoke and steal book 1, and spy 2 saw Eva steal book 2.

c. $[\![\textit{smoke}]\!]$, $[\![\textit{steal book 1}]\!]$, $[\![\textit{steal book 2}]\!]$

(3) is similar to examples like (2-a) in that the part structure of the denotation of a scopally dependent plural expression must remain 'accessible' for semantic composition at higher nodes. Roughly, in (2), something corresponding to the individual tricks must be accessible because we don't want to require that for every boy there was a girl who taught him two tricks. In (3), something corresponding to individual books must be accessible because we don't want to require that there was a spy who saw Eva steal two books. **Point 2:**

Examples like (2-a) can be constructed with the German conjunction *sowohl ... als auch* 'as well as', which shows scope-related cumulativity asymmetries analogous to *every* in some dialects. In [1], trace conversion ensures that *every* quantifies over atoms and thus does not cumulate with a lower DP. Extending this to conjunction would be stipulative – as it is unclear which predicate to reconstruct – and empirically inadequate since *sowohl ... als auch* allows for non-atomic conjuncts.

(4) *Die zwei Mädchen haben sowohl dem Kai als auch dem Max zwei Tricks gezeigt.*
The two girls have PRT the Kai PRT PRT the Max two tricks shown
'The two girls taught Kai as well as Max two tricks.'

Proposal: We build on the analysis proposed by [6] for cases like (3-a): The ontology contains pluralities of any type and expressions of type a denote sets of pluralities formed from atomic objects from D_a (where the set of pluralities is isomorphic with $\wp(D_a) \setminus \{\emptyset\}$). The part structure of plurality-denoting expressions 'projects' to larger expressions containing them: This is the result of introducing a new composition rule with an operation $\bullet$ that has cumulation built in (5).

(5) a. Let P and x be pluralities of type $\langle a,b\rangle$ and a respectively. A relation $R \subseteq D_{\langle a,b\rangle} \times D_a$ covers (P,x) iff $\bigoplus(\{Q \mid \exists y : (Q,y) \in R\}) = P$ and $\bigoplus(\{y \mid \exists Q : (Q,y) \in R\}) = x$.
b. For any set $\mathbf{P}$ of pluralities of type $\langle a,b\rangle$ and any set $\mathbf{x}$ of pluralities of type a: $\mathbf{P} \bullet \mathbf{x} = \{\bigoplus(\{Q(y) \mid (Q,y) \in R\}) \mid \exists P \in \mathbf{P}, x \in \mathbf{x} : R \text{ covers } (P,x)\}$

(6-b) illustrates this for the simple sentence in (6-a). In this system, sentence meanings are sets of pluralities of propositions; a set is true if it contains at least one plurality all atomic parts of which are true. E.g. (6-a) is true if Eve saw Rob and Sue saw Bob.

(6) a. $[_{TP}$ $[_{DP1}$ *Eve and Sue*$]$ $[_{VP}$ $[_{V}$ *saw*$]$ $[_{DP2}$ *Rob and Bob*$]]]$
b. $[\![DP2]\!] = \{b \oplus r\}$ $\quad [\![\mathrm{V}]\!] = \{\lambda x.\lambda y.y \text{ saw } x\}$
$[\![\mathrm{VP}]\!] = [\![\mathrm{V}]\!] \bullet [\![\mathrm{DP2}]\!] = \{\lambda y.y \text{ saw } b \oplus \lambda y.y \text{ saw } r\}$
$[\![\mathrm{TP}]\!] = [\![\mathrm{VP}]\!] \bullet [\![\mathrm{DP1}]\!] = \{e \text{ saw } b \oplus s \text{ saw } r,\ s \text{ saw } b \oplus e \text{ saw } r, \ldots\}$

We propose that *and* or *every* denote operations on plural sets and thus 'block' the cumulation rule, combining with their argument by regular functional application, (8).

(7) $\mathscr{D}(P,x) = \bigoplus\{P'(x') \mid P' \leq_{AT} P, x' \leq_{AT} x\}$ for P a plurality of type $\langle a,b\rangle$ and x a plurality of type a (where $A \leq_{AT} B$ stands for 'A is an atomic part of B')

(8) a. $[_{TP}$ $[$*The two girls*$]$ $[_{VP1}$ $[$*every boy*$]$ $[_{VP2}$ *taught* $[$*two tricks*$]]]]$
b. $[\![\textit{two tricks}]\!] = \{x \oplus y \mid [\![\textit{trick}]\!](x) \& [\![\textit{trick}]\!](y) \& x \neq y\}$
c. $[\![\mathrm{VP2}]\!] = [\![\lambda x.\lambda y.\lambda z.z \text{ taught } x \text{ to } y]\!] \bullet [\![\textit{two tricks}]\!]$
$= \{[\![\textit{taught}]\!](x) \oplus [\![\textit{taught}]\!](y) \mid [\![\textit{trick}]\!](x) \& [\![\textit{trick}]\!](y) \& x \neq y\}$
d. $[\![\mathrm{VP1}]\!] = \{\bigoplus\{\mathscr{D}(f(z),z) \mid z \text{ is a boy}\} \mid f \text{ is a function from } \{z : z \text{ is a boy}\} \text{ to } [\![\mathrm{VP2}]\!]\}$
e. $[\![\mathrm{TP}]\!] = [\![\mathrm{VP1}]\!] \bullet \{g1 \oplus g2\}$

This derives the correct truth-conditions. If there are only two boys $b1$ and $b2$, $[\![\mathrm{TP}]\!]$ can contain pluralities of propositions like $[\![\textit{taught}]\!](t1)(b1)(g1) \oplus [\![\textit{taught}]\!](t2)(b1)(g1) \oplus [\![\textit{taught}]\!](t3)(b2)(g1) \oplus [\![\textit{taught}]\!](t2)(b2)(g2)$, but not pluralities like $[\![\textit{taught}]\!](t1)(b1)(g1) \oplus [\![\textit{taught}]\!](t3)(b2)(g1) \oplus [\![\textit{taught}]\!](t2)(b2)(g2)$ which don't require that every boy was taught two tricks, or pluralities that don't cover all of the girls and all of the boys. It also derives the asymmetry in (1), because the 'distributive' effect of *every NP* (visible in (8-d)) only concerns elements in its scope. As our analysis is surface compositional and doesn't involve cumulation of predicates derived by movement or trace conversion, it immediately generalizes to the conjunction examples discussed above. Finally, as our proposal doesn't rely on event semantics, unlike the proposal in [5], the asymmetries in

(1) and (2) are predicted to be independent of the availability of an event argument.

References

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