

semantics for MNs, we get (40b) as our lower set for (40a), but the upper set would contain all propositional pluralities in which two or more students are each related to two or more books. We then predict (40a) to be false if there is a third student who read ten books, which does not seem correct. Intuitively, the problem is that the maximality condition of *exactly two books* should not ‘project’ unchanged through the distributivity operator.

- (40) a. *Exactly two students (each) read exactly two books.*
 b. $\llbracket \text{two students each read two books} \rrbracket = [\mathbf{R}(\mathbf{b1})(\mathbf{a}) + \mathbf{R}(\mathbf{b2})(\mathbf{a}) + \mathbf{R}(\mathbf{b3})(\mathbf{b}) + \mathbf{R}(\mathbf{b4})(\mathbf{b}), \mathbf{R}(\mathbf{b1})(\mathbf{a}) + \mathbf{R}(\mathbf{b2})(\mathbf{a}) + \mathbf{R}(\mathbf{b2})(\mathbf{b}) + \mathbf{R}(\mathbf{b3})(\mathbf{b}), \dots]$

One might take this to show that distributive sentences do not involve plural sets. But this is not an option in light of the more complex examples discussed by Schein (1993), where the higher MN additionally cumulates with another plural that also outscopes *each*. Schein shows that the truth conditions of such sentences are sensitive to the part structure introduced by the MN embedded under *each*. The problem posed by (40) must therefore be solved within a theory of cumulativity. While the mixed cumulative/distributive configurations discussed by Schein do not pose a general problem for our theory (see Haslinger and Schmitt, 2019), we do have a problem with those of his examples that involve two MNs on different ‘sides’ of a distributive operator. This suggests that there should be a more complex interaction between distributivity and the two-dimensional semantics, the details of which must be left to future work.¹⁵

Another issue for further research is the relation between the non-maximal reading of MNs and the special interpretation of plural definites, and plural universals like *all*, in cumulative sentences. Schmitt (2015) and Buccola and Spector (2016) show that it is sometimes sufficient if the cumulative predicate is true of a part of the plurality the DP introduces – e.g., (41) can be true even if some activists did not call any voters. This reading and the non-maximal reading of MNs seem to have a similar distribution (Schmitt, 2015), which suggests they are related.

- (41) *The 50 activists called exactly 10 voters.*

Finally, our analysis of the modifiers was tailored for cumulative readings of MNs, but they are in fact cross-categorical and not restricted to numerals (Krifka, 1999). Our notion of ‘upper’ and ‘lower sets’ should thus follow from a general two-dimensional semantics for the modifiers. It is unclear how this could be done, especially in the case of scales that are not entailment-based.

References

- Abrusán, M. (2011). Presuppositional and negative islands: a semantic account. *Natural Language Semantics* 19, 257–321.
 Barwise, J. and R. Cooper (1981). Generalized quantifiers and natural language. *Linguistics and Philosophy* 4, 159–219.
 Beck, S. and U. Sauerland (2000). Cumulation is needed: a reply to Winter (2000). *Natural Language Semantics* 8(4), 349–371.

¹⁵Schein’s (1993) analysis of MNs does not face this criticism, as it is not two-dimensional. So does it account for cumulative sentences without encoding the maximality conditions in a plural-quantifier meaning for the MN – an idea we argued against in Section 1? To the extent we understand his proposal, it seems to avoid the problem discussed in Section 1 due to a syntactic LF for cumulative sentences where none of the MNs is in the scope of the others. It is, however, unclear to us 1) how maximality conditions are then computed compositionally and 2) how to encode the ‘surprise’ condition from Section 5, which is sensitive to plurals in the scope of the MN.

- Brasoveanu, A. (2013). Modified numerals as post-suppositions. *Journal of Semantics* 30, 155–209.
- Buccola, B. and B. Spector (2016). Modified numerals and maximality. *Linguistics and Philosophy* 39, 151–199.
- Champollion, L. (2010). Cumulative readings of *every* do not provide evidence for events and thematic roles. In M. Aloni, H. Bastiaanse, T. de Jager, and K. Schulz (Eds.), *Logic, Language and Meaning*, Heidelberg, pp. 213–222. Springer.
- Greenberg, Y. (2016). A novel problem for the likelihood-based semantics of *even*. *Semantics and Pragmatics* 9(2), 1–28.
- Haslinger, N. and V. Schmitt (2018). Scope-related cumulativity asymmetries and cumulative composition. In S. Maspong, B. Stefánsdóttir, K. Blake, and F. Davis (Eds.), *Proceedings of SALT 28*.
- Haslinger, N. and V. Schmitt (2019). Asymmetrically distributive items and plural projection. Ms., University of Vienna.
- Kratzer, A. (2003). The event argument and the semantics of verbs. Ms., University of Massachusetts at Amherst.
- Kratzer, A. and J. Shimoyama (2002). Indeterminate pronouns: The view from Japanese. In Y. Otsu (Ed.), *The Proceedings of the Third Tokyo Conference on Psycholinguistics*, Tokyo, pp. 1–25. Hituzi Syobo.
- Krifka, M. (1999). At least some determiners aren't determiners. In K. Turner (Ed.), *The semantics/pragmatics interface from different points of view*, pp. 257–291. Elsevier.
- Landman, F. (2000). *Events and Plurality*. Dordrecht: Kluwer Academic Publishers.
- Panizza, D. and Y. Sudo (2019). Minimal sufficiency with covert *even*. To appear in *Proceedings of GLOW 42*.
- Scha, R. (1981). Distributive, collective and cumulative quantification. In J. Groenendijk, T. Janssen, and M. Stokhof (Eds.), *Formal Methods in the Study of Language*, Volume 2, pp. 483–512. Amsterdam: Mathematisch Centrum.
- Schein, B. (1993). *Plurals and Events*. MIT Press.
- Schmitt, V. (2015). Asymmetries in plural predication. Talk at Sinn und Bedeutung 20, Tübingen.
- Schmitt, V. (2019). Pluralities across categories and plural projection. *Semantics and Pragmatics* 12(17), 1–49.
- Sher, G. (1990). Ways of Branching Quantifiers. *Linguistics and Philosophy* 13(4), 393–422.
- Sternefeld, W. (1998). Reciprocity and cumulative predication. *Natural Language Semantics* 6(3), 303–337.
- van Benthem, J. (1986). *Essays in Logical Semantics*. Kluwer Academic Publishers.