Homogeneity and Underspecification with non-distributive predicates
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Overview.   We propose an account of Homogeneity which locates the source of Homogeneity in the pluralization operator * (building on but departing from Schwarzschild 1994). We argue that this view has the advantage of being able to account for a correlation we put forward between the behavior of predicates with respect to Homogeneity and their behavior with respect to Underspecification.

Homogeneity properties of predicates.   Homogeneity is manifested in the fact that (1a) and (1b) are both not true if some but not all of the kids laughed (ignoring Non-maximality, see e.g., Križ 2015). Križ (2015) observed the existence of Homogeneity with non-distributive predication: Both (1c) and (1d) are not true if half of the kids lifted the piano together (and no one else did). However, previous accounts of Homogeneity with non-distributive predication (Križ 2015; Križ & Spector 2017) require a stipulation in order to explain why 'non-homogeneous' plural predication is possible: On collective construals, (2a) is true if the plurality consisting of all bottles is light, and otherwise (2b) is true, regardless of whether any individual bottles are light.
(1)   'Homogeneous' predication:
    a.   The kids laughed.   b.   The kids didn't laugh.
    c.   The kids lifted the piano.   d.   The kids didn't lift the piano.
(2)   'Non-homogeneous' predication:
    a.   The bottles are light.   b.   The bottles aren't light.
    c.   The bottles are heavy.   d.   The bottles aren't heavy.

Correlation with Underspecification properties.   We point out a correlation which isn't captured by previous accounts between Homogeneity properties of predicates and their Underspecification properties, i.e., whether they give rise to readings which are underspecified with respect to distributivity and collectivity (henceforth: US-predicates) or to specified (distributive or collective) ones (henceforth: S-predicates). We claim that US-predicates are 'homogeneous' and S-predicates are 'non-homogeneous': Systematically, non-distributive predicates which only give rise to homogeneous interpretations (e.g., *lift the piano*, *perform Hamlet*, *gather*) yield underspecified meanings, and predicates which can give rise to non-homogeneous interpretations (e.g., *be light*, *be heavy*, *be numerous*, *be few in number*, *cost 6 dollars*) yield specified meanings. To establish this correlation, we point out that tests for specification vs. underspecification lead to different results when applied to 'homogeneous' and 'non-homogeneous' (non-distributive) predicates compatible with distributive and collective situations: (a) *Negation*: while (2d) has a distributive meaning compatible with all the bottles together being heavy, (1d) does not have a reading compatible with all the kids together lifting the piano (see Schwarzschild 1994, ex. (72) for a similar claim); (b) *Universal quantification*: While it's possible to quantify universally over the homogeneous predication in *the kids lifted the piano* for describing both distributive and collective scenarios, (3a), it is impossible to do the same with the non-homogeneous predication in *the bottles cost 6 dollars*, (3b); (c) *Objections*: only 'non-homogeneous' plural predication can be objected to based on a collective understanding knowing that it holds distributively (compare (4) to (5)).
(3)   a.   [Context: Last week each of the kids at my kid's school lifted the piano alone, yesterday they did it together.]
       On both occasions the kids lifted the piano.
    b.   [Context: Last week at the store there were 3 toys which cost 6 dollars each. Yesterday

they were sold together for 6 dollars.]

?? On both occasions the toys cost 6 dollars.

(4)   [Context: B thinks that each of the bottles is light but taken together they are heavy.]

A: The bottles are light enough to carry.

B: What? That's not true! (Oh, you mean individually.)

(5)   [Context: B thinks that the kids lifted the piano individually, but not together.]

A: The kids lifted the piano.

B: #What? That's not true! (Oh, you mean individually.)

The correlation between Underspecification and Homogeneity calls for a principled explanation. We will first present a view of Pluralization which leaves room for both specified and underspecified meanings, and then propose a way to tie Homogeneity to Pluralization in order to account for the correlation.

* **and covers.**   We follow Schwarzschild (1991); Heim (1994) who propose to account for the availability of both specified and underspecified meanings by assuming that the pluralization operator is Link's (1983) * operator which is relativized to contextually-supplied covers:

(6)   a. $[\![^{\star Cov}]\!]^c(P)(x) = 1$ *iff* $\exists P' \subseteq P \cap Cov_x^c[\bigsqcup P' = x]$

b. P covers x *iff* $\exists P' \subseteq P[\bigsqcup P' = x]$ (Cov_x^c is a contextually supplied cover of x)

* yields an underspecified meaning when Cov_x^c is a TOTAL cover of x (i.e., it contains all parts of x). It yields specified meanings when the cover is MINIMAL (i.e., has no proper subset which covers x): a distributive one when it's MINIMAL-ATOMIC (i.e., contains all atomic parts of x) and a collective one when it's MINIMAL-SINGLETON (i.e., it contains x). In order to capture the differences between US-predicates and S-predicates pointed out above we put forward the following tentative generalization, according to which different predicates associate with different cover-types (we leave open the important issue of the source of such associations):

(7)   **Association between predicates and cover-types**:

a.   TOTAL cover (US-predicates): *lift the piano*, *perform Hamlet*, *gather*.

b.   MINIMAL cover (S-predicates): *cost 6 dollars*, *be heavy*, *be light*, *be numerous*.

We further assume (following Schwarzschild 1994; Kratzer 2007) that there are no *-less LFs when predicating over pluralities (otherwise purely collective readings would freely sneak in).

A trivalent * **operator.**   We further follow Schwarzschild (1994) in assuming that a trivalent semantics for * is responsible for Homogeneity. Schwarzschild's own proposal however does not account for Homogeneity with non-distributive predicates. We hence propose an alternative way to make * trivalent, which is closer in spirit to Gajewski (2005). * as defined in (6) can be paraphrased as a weak distributivity operator which 'distributes participation': *the kids* $^{\star Cov}$ *[lifted the piano]* (assuming a TOTAL cover) is true *iff* **every** kid is part of a plurality of kids that lifted the piano. To get an 'all-or-nothing' meaning we'd like to make this sentence false *iff* **no** kid is part of a plurality of kids that lifted the piano. In order to achieve this we define the following falsity conditions for * (note the replacement of '=' in (6) with '⊑'):

(8) $[\![^{\star Cov}]\!]^c(P)(x) = 0$ *iff* $\neg\exists P' \subseteq P \cap Cov_x^c[\bigsqcup P' \sqsubseteq x]$

Importantly, given this trivalent semantics for * (1d) entails that no plurality of kids lifted the piano (assuming that adding negation doesn't change the cover associated with the predicate, i.e., it is TOTAL). The truth conditions of (2b)/(2d) are however different. Since the cover associated with *light* and with *heavy* is MINIMAL, they have two meanings: if the cover is ATOMIC we get distributive meanings according to which no atomic bottle is light/heavy (regardless of whether non-atomic

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pluralities of bottles are); and if instead the cover is a SINGLETON cover we get collective meanings according to which the plurality containing all bottles isn't light/heavy (regardless of whether other pluralities are). The Homogeneity properties of predicates hence follow from the analysis of their Underspecification properties (association with cover-types) together with our trivalent semantics for *.

Extensions. Our theory can seamlessly explain why *the girls danced with the boys* is true in a cumulative scenario but false only if no girl danced with any boy, by adopting standard assumptions about *-ing two-place predicates and assuming a TOTAL cover. Furthermore, if we replace '$\bigsqcup P' \sqsubseteq x$' in (8) with '$\bigsqcup P' \circ x$' (where $x \circ y$ iff x and y overlap, i.e., have parts in common), we can explain what Criž calls Upward Homogeneity, i.e., why *the kids didn't perform Hamlet* is not judged true if the kids were part of a bigger plurality which performed Hamlet.

Homogeneity and trivalence. Contra Križ, we have argued that a proper analysis of Homogeneity with non-sidtrivutive predicates should tie Homogeneity to the Pluralization operator. While our implementation above relies on a view of Homogeneity as a trivalent phenomenon, similar results can be achieved within other frameworks in which Homogeneity is tied to pluralization, e.g., Bar-Lev (2018, 2020).

References

Bar-Lev, Moshe E. 2018. *Free choice, homogeneity, and innocent inclusion*: Hebrew University of Jerusalem dissertation.

Bar-Lev, Moshe E. 2020. An implicature account of homogeneity and non-maximality. *Linguistics and Philosophy* doi:10.1007/s10988-020-09308-5.

Gajewski, Jon Robert. 2005. *Neg-raising: Polarity and presupposition*: Massachusetts Institute of Technology dissertation.

Heim, Irene. 1994. Plurals. Lecture notes.

Kratzer, Angelika. 2007. On the plurality of verbs. *Event structures in linguistic form and interpretation* 269–300.

Križ, Manuel. 2015. *Aspects of homogeneity in the semantics of natural language*: University of Vienna dissertation.

Križ, Manuel & Benjamin Spector. 2017. Interpreting plural predication: Homogeneity and non-maximality. Ms., Institut Jean Nicod.

Link, Godehard. 1983. The logical analysis of plurals and mass terms: A lattice theoretical approach. In Rainer Bäuerle, Christoph Schwarze & Arnim von Stechow (eds.), *Meaning, use, and interpretation of language*, 127–144. Walter de Gruyter.

Schwarzschild, Roger. 1994. Plurals, presuppositions and the sources of distributivity. *Natural Language Semantics* 2(3). 201–248.

Schwarzschild, Roger Selig. 1991. *On the meaning of definite plural noun phrases*: University of Massachusetts at Amherst dissertation.