Mixed-Polarity Pluralities

Patrick D. Elliott ~ Heinrich-Heine University Düsseldorf

LAGB Annual Meeting, 2024.08.29

- https://patrickdelliott.com/pdf/lagb2024.pdf

Introduction

Roadmap

- Background on van Benthem's problem, focusing on modified numerals such as *exactly two*.
- Constructing a logic for plural expressions based on a distinction between positive/negative individuals, building on Akiba's *shadow theory* and Bledin's *menu semantics* (Akiba 2009, Bledin 2024).
- A concrete analysis of modified numerals (and determiners more generally) in terms of mixed-polarity pluralities.
    - Immediate payoff: a straightforward resolution to van Benthem's problem.
    - More general payoff: a bona fide alternative to generalized quantifier theory, allowing determiners to be treated as intersective modifiers.

Consider a completely standard semantics for the modified numeral *exactly two* in terms of generalized quantifier theory (Barwise & Cooper 1981).

(1) [exactly two NP] VP $\Longleftrightarrow$ $\mathbf{Card}([\![\text{NP}]\!] \cap [\![\text{VP}]\!]) = 2$
The cardinality of the NP-elements that are also VP-elements is ex. 2

Sentences involving nested modified numerals are systematically ambiguous between two different readings:

- The doubly-distributive reading.
- The cumulative reading.

How to derive the second, more puzzling reading will be the focus of this talk.

Consider the following sentence:

(2) Exactly two boys ate exactly two pizza slices.

This may be true, e.g., in a scenario where boy *a* ate s_1, s_2, and boy *b* ate s_3, s_4; four slices were eaten in total.

This is unsurprising from the perspective of a standard GQ-semantics for modified numerals, assuming that *exactly two pizza slices* is interpreted in the scope of *exactly two boys*.

(3) $\textbf{Card}(\{\, b \mid b \text{ a boy and } \textbf{Card}(\{\, s \mid s \text{ a slice eaten by } b \,\}) = 2 \,\}) = 2$
The cardinality of [boys who each ate exactly two pizza slices] is exactly two

Sentences involving modified numerals also have a much more puzzling reading, called the cumulative reading.

(4) Exactly two boys ate exactly two pizza slices.

This may be true, e.g., in the following scenario: *boy a ate* s_1*, and boy b ate* s_2*, and no other eating took place, so exactly two boys ate pizza slices, and exactly two slices were eaten by boys overall*.

Intuitively, this is related to cumulative readings of sentences with expressions denoting pluralities, which are independently attested:

(5) [Jimmy and Chuck] ate [the first and second slice].

The cumulative reading cont.

It's natural to try to account for the cumulative reading by analyzing *exactly two NP* as an existential quantifier over pluralities, e.g.,

(6) $[\![\text{exactly two NP}]\!]$

$= \lambda P \,.\, \exists X, \forall x \leq_{At} X, x \in [\![\text{NP}]\!], \mathbf{Card}(X) = 2, P(X)$

there's an NP-plurality X, with exactly two atomic elements, that is true of P.

This analysis however fails to accurately capture the truth-conditions of even simple sentences with modified numerals, since it renders the upper-bound associated with *exactly two* inert (Van Benthem 1986):

(7) Exactly two boys swam.

This is predicted to be true, if a, b and c swam, since there is a boy-plurality, $a \oplus b$, whose cardinality is two, which is true of *swam*.

It has long been recognized that cumulative readings of modified numerals are an extremely hard nut to crack in the semantics of noun phrases, e.g., (Landman 2000, Brasoveanu 2013).

Various different accounts have been proposed to resolve van Benthem's problem, typically involving non-standard compositional regimes which allow the maximality condition associated with modified numerals to be evaluated globally, e.g.,:

- Post-suppositions in the context of dynamic semantics (Brasoveanu 2013, Charlow 2016).
- Two dimensional semantics and plural projection (Haslinger & Schmitt 2020).

The main goal of today's talk is to introduce a new approach to van Benthem's puzzle in terms of mixed-polarity pluralities.

In some respects, my approach is conceptually simpler than existing approach, but it does require a modest ontological leap of faith - I will make use of the notion of a negative individual, building on (Akiba 2009, Bledin 2021, 2024).

In order to account for van Benthem's problem as a completely orthodox cumulative reading, I'll argue that negative individuals play a privileged role in the semantics of plurality.

A new approach to van Benthm’s puzzle cont.

Concretely, I’ll suggest that pluralities of individuals encode both positive and negative information.

As we’ll see, this provides a novel way of encoding maximality in the semantics of plurality itself.

Once this is in place, van Benthem’s problem will dissolve - cumulative readings of modified numerals will fall out from independently motivated mechanisms for cumulative readings.

Negative individuals

Start with a domain of ordinary individuals, D:

(8) $D := \{ a, b, c, \ldots \}$

A domain of polarized individuals can be constructed by introducing a unique, negative counterpart x^- for each $x \in D$, as well as a positive counterpart x^+, standing in for x itself (Akiba 2009, Bledin 2024).

(9) $\{ a^+, a^-, b^+, b^-, c^+, c^-, \ldots \}$

Ordinary individuals in *D* stand in a *one-to-one* relationship with both (i) their positive counterparts, and (ii) their negative counterparts.

This means that, given e.g., a negative counterpart, we can always retrieve the ordinary individual that it is a counterpart of.

This is reflected transparently in the +/− notation, i.e.:

- Nadja^- is the negative counterpart of Nadja
- Nadja^+ is the positive counterpart of Nadja

Negative individuals can be thought of as a formal device for encoding an individual's non-participation.

In other words, if Jimmy happens to be swimming, then Jimmy^{-} is not swimming, and if Jimmy is not swimming, then Jimmy^{-} is swimming.

If you're bothered by these murky ontological waters, it's possible to model positive/negative individuals as Montague-lifted individuals.

- $x^+ := \lambda k_{et} \,.\, k(x)$
- $x^- := \lambda k_{et} \,.\, \neg k(x)$

For the purposes of this talk, I'll assume that negative individuals exist as bona fide entities.

(Bledin 2024) argues that expressions involving negation such as "not Jimmy" directly denote negative individuals; instead, I'll suggest negative individuals infiltrate the grammar indirectly, via the semantics of plurality.

Since Link (1983), it is standard in the literature on plurality to close the domain of individuals under the sum-formation operator $\oplus$.

I assume that the domain of polarized individuals $D^{\pm}$ is closed under sum-formation, with an important proviso - incoherent pluralities are removed (Akiba 2009):

- For any $x \in D$, no plurality $X \in D^{\pm}$ may contain both x^{+} and x^{-} as atomic parts .

As a result, $D^{\pm}$ contains many different kinds of pluralities of polarized individuals, given e.g., $a, b \in D$:

- Wholly-positive pluralities, e.g., $a^{+} \oplus b^{+}$.
- Wholly-negative pluralities, e.g., $a^{-} \oplus b^{-}$.
- Mixed-polarity pluralities, e.g., $a^{+} \oplus b^{-}$ and $a^{-} \oplus b^{+}$

As mentioned, incoherent pluralities such as $a^{+} \oplus a^{-}$ and $b^{+} \oplus b^{-}$ are filtered out.

Assuming that $D^{\pm}$ is closed under $\oplus$ produces a domain with significantly more structure than a classical, Link-style lattice.

Note especially that there are multiple maximal pluralities with respect to $\leq$ - in a setting with only ordinary individuals, there is only a single maximal plurality $a \oplus b \oplus c$.

$$\left\{ \begin{array}{c} a^+ \oplus b^+ \oplus c^+, \\ a^+ \oplus b^+ \oplus c^-, a^+ \oplus b^- \oplus c^+, a^- \oplus b^+ \oplus c^+, \\ a^- \oplus b^- \oplus c^+, a^- \oplus b^+ \oplus c^-, a^+ \oplus b^- \oplus c^-, \\ a^- \oplus b^- \oplus c^- \\ a^+ \oplus b^+, a^+ \oplus c^+, b^+ \oplus c^+, \\ a^+ \oplus b^-, a^+ \oplus c^-, b^+ \oplus a^-, b^+ \oplus c^-, c^+ \oplus a^-, c^+ \oplus b^- \\ a^+, b^+, c^+, a^-, b^-, c^- \end{array} \right\}$$

In practice, the semantics I'll propose for plural terms will only need to make reference to the maximal such pluralities.

Given a toy domain $D := \{a, b, c\}$, the maximal elements wrt. $\leq$ in $D^{\pm}$ are:

$$\text{(10)}\quad \mathrm{Max}(D^{\pm}) := \left\{ \begin{array}{c} a^{+} \oplus b^{+} \oplus c^{+}, \\ a^{+} \oplus b^{+} \oplus c^{-}, a^{+} \oplus b^{-} \oplus c^{+}, a^{-} \oplus b^{+} \oplus c^{+}, \\ a^{+} \oplus b^{-} \oplus c^{-}, a^{-} \oplus b^{+} \oplus c^{-}, a^{-} \oplus b^{-} \oplus c^{+}, \\ a^{-} \oplus b^{-} \oplus c^{-} \end{array} \right\}$$

It might be helpful to think of the elements of this set as *complete specifications* of whether a, b, c participated in some yet-to-be-named event, i.e., $a^{+} \oplus b^{+} \oplus c^{-}$ - "a, b and not c".

I assume that polarized individuals are implicated in the semantics of plurality.

(11) $[\![\text{boy}]\!] = \{\, x \in D \mid x \text{ is a boy} \,\}$

(12) $[\![\text{boys}]\!] =$
$\text{Max}\{\, X \in D^{\pm} \mid \forall x^{+} \leq_{At} X, x \in [\![\text{boy}]\!], \forall x^{-} \leq X, x \in [\![\text{boy}]\!] \,\}$

In other words, the extension of *boys* contains the maximal pluralities whose atomic elements are all positive/negative counterparts of ordinary boy individuals

If the extension of *boy* is $\{\, a, b, c \,\}$, then the extension of *boys* includes elements such as $a^{+} \oplus b^{+} \oplus c^{-}$, $a^{+} \oplus b^{-} \oplus c^{+}$, etc.

Composing mixed-polarity pluralities

How do (potentially) mixed-polarity pluralities interact with verbal predicates? This question becomes especially acute if verbal predicates are defined only for ordinary individuals.

As is standard in the literature on plurality, I assume a covert distributivity operator Δ, which universally quantifies over atomic parts (Link 1987).

$$(13) \quad \Delta(P) = \lambda X \in D^{\pm} . \forall x \in D \begin{bmatrix} x^{+} \leq_{At} X \rightarrow P(x) = 1 \\ \text{and } x^{-} \leq_{At} X \rightarrow P(x) = 0 \end{bmatrix}$$

In a nutshell, Δ takes an ordinary predicate P, a plurality X, and says that $\Delta(P)$ is true of all x's with a positive counterpart $x^{+} \leq_{At} X$, and false of all x's with a negative counterpart $x^{-} \leq_{At} X$ (I ignore homogeneity here).

Warming up

true iff a swims
and b swims
and c doesn't swim

$a^+ \oplus b^+ \oplus c^-$

$$\lambda X \in D^{\pm} \,.\, \forall x \in D \begin{bmatrix} x^+ \leq_{At} X \to x \text{ swims and} \\ x^- \leq_{At} X \to x \text{ doesn't swim} \end{bmatrix}$$

Δ swims

How do DPs come to denote pluralities? We still need to give a semantics for determiners.

In order to define determiners, I'll use the following conventions relative to a plurality $X \in D^{\pm}$ to pick out certain ordinary individuals:

(14) $X^{+} = \{ x \in D \mid x^{+} \leq_{At} X \}$ i.e., the set of individuals who have a positive counterpart in X

(15) $X^{-} = \{ x \in D \mid x^{-} \leq_{At} X \}$ i.e., the set of individuals who have a negative counterpart in X

For example:

- $(a^{+} \oplus b^{+} \oplus c^{-})^{+} = \{ a, b \}$
- $(a^{+} \oplus b^{+} \oplus c^{-})^{-} = \{ c \}$

With these ingredients, plural determiners can be defined as ordinary intersective modifiers(!).

(16) $[\![\text{some}]\!] = \{X \in D^{\pm} \mid X^{+} \neq \varnothing\}$

(17) $[\![\text{all}]\!] = \{X \in D^{\pm} \mid X^{-} = \varnothing\}$

(18) $[\![\text{no}]\!] = \{X \in D^{\pm} \mid X^{+} = \varnothing\}$

(19) $[\![\text{most}]\!] = \{X \in D^{\pm} \mid \mathbf{Card}(X^{+}) > \mathbf{Card}(X^{-})\}$

(20) $[\![\text{some}]\!] \cap [\![\text{boys}]\!] =$

$$\left\{\begin{array}{c} a^+ \oplus b^+ \oplus c^+, \\ a^+ \oplus b^+ \oplus c^-, a^+ \oplus b^- \oplus c^+, a^- \oplus b^+ \oplus c^+, \\ a^+ \oplus b^- \oplus c^-, a^- \oplus b^+ \oplus c^-, a^- \oplus b^- \oplus c^+ \end{array}\right\}$$

(21) $[\![\text{all}]\!] \cap [\![\text{boys}]\!] = \{\, a^+ \oplus b^+ \oplus c^+ \,\}$

N.b. determiners are definable as intersective modifiers due to the maximality inherent in the semantics of plurality; the maximal plurality of boys with no negative atomic parts is just the plurality consisting of all positive boys.

Existential raising

In the resulting semantics, [D boys] ends up denoting a *set* of maximal boy-pluralities.

I assume that all DPs involve a silent existential raising operator ∃, with a simple first order semantics, i.e., $\exists(P) := \lambda Q \,.\, \exists X \in P, Q(X) = 1$ (Partee 1986, Winter 2001).

true iff a, b and c swim, or a, b, and not c swim, ...

$\exists \quad \{a^+ \oplus b^+ \oplus c^+, a^+ \oplus b^+ \oplus c^-, \dots\}$

$\{X \in D^{\pm} \mid X^+ \neq \varnothing\}$ boys

some

$\lambda X \,.\, \forall x^+ \leq_{At} X, x$ swims,

$\forall x^- \leq_{At} X, x$ doesn't swim

Δ swim

- Placing constraints on X^+ and X^- allows all (and only) conservative determiners to be defined (my *Sinn und Bedeutung* talk in a couple of weeks).
- Pertinent to this talk, (modified) numerals can easily be defined as cardinality constraints on X^+.
    - N.b. due to maximality, unmodified numerals are assumed to have an 'at least' semantics.

(22) $[\![\text{two}]\!] = [\![\text{at least two}]\!] = \{X \mid \mathbf{Card}(X^+) \geq 2\}$

(23) $[\![\text{exactly two}]\!] = \{X \mid \mathbf{Card}(X^+) = 2\}$

Given the semantics I've outlined, *exactly two boys swam* says that *swim* holds of one of the following mixed-polarity pluralities with exactly two positive parts:

- $a^+ \oplus b^+ \oplus c^-$
- $a^+ \oplus b^- \oplus c^+$
- $a^- \oplus b^+ \oplus c^+$

Since pluralities are maximal, the plurality itself encodes the information that the remaining negative boy did not swim.

(24) $$\exists X \in \left\{ \begin{array}{c} a^+ \oplus b^+ \oplus c^-, \\ a^+ \oplus b^- \oplus c^+, \\ a^- \oplus b^+ \oplus c^+ \end{array} \right\}, \Delta(\llbracket \text{swim} \rrbracket)(X) = 1$$

true iff a, b and not c swam, a, c and not b swam, or b, c and not a swam.

Recall, van Benthem's puzzle involves *cumulative* readings of sentences with modified numerals.

(25) Exactly two boys ate exactly two slices of pizza.

On the cumulative reading, this sentence is true if *exactly two boys* ate pizza, and *exactly two slices of pizza* were eaten by boys.

I'll adopt a conservative approach to cumulative readings based on Beck & Sauerland (2000), who define an operator $.^{**}$ that applies to 2-place predicates.

Their operator is defined as follows (assuming ordinary i-sums):

(26) Beck and Sauerland's cumulativity operator:

$$R^{**} := \lambda X \,.\, \lambda Y \,.\, \forall y \leq_{At} Y, \exists x \leq_{At} X, R(y,x)$$
$$\forall x \leq_{At} X, \exists y \leq_{At} Y, R(y,x)$$

Beck and Sauerland's operator straightforwardly derives cumulative readings for simple sentences involving two plural arguments, such as *the two boys ate the two pizza slices*.

We need to tweak the semantics of the cumulativity operator to accommodate pluralities of polarized individuals.

The intuition is as follows: let's say that $a^+ \oplus b^+ \oplus c^-$ ate (in the cumulative sense) $s_1^+ \oplus s_2^+ \oplus s_3^-$. Truth in a scenario requires the following to be satisfied.

- For each of a, b, their should be one of s_1, s_2 that they ate.
- For each of s_1, s_2, their should be one of a, b that ate it.
- c can't have eaten any of s_1, s_2, s_3.
- s_3 can't have been eaten by any of a, b, c.

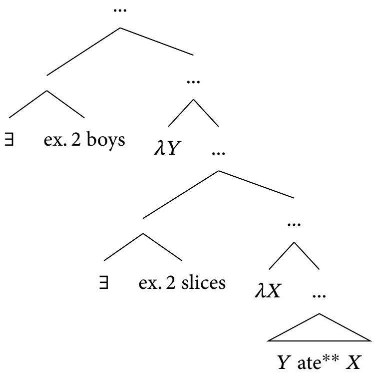
We build this intuition into a polarity-sensitive variant of Beck and Sauerland's .**.

(27) Polarity-sensitive cumulativity operator:

$$
\begin{aligned}
R^{**} := \lambda X \in D^{\pm}\,.\,\lambda Y \in D^{\pm}\,.\quad & \forall y^{+} \leq_{At} Y, \exists x^{+} \leq_{At} X, R(y,x) \\
& \forall x^{+} \leq_{At} X, \exists y^{+} \leq_{At} Y, R(y,x) \\
& \forall y^{-} \leq_{At} Y, \neg\exists x^{\pm} \leq_{At} X, R(y,x) \\
& \forall x^{-} \leq_{At} X, \neg\exists y^{\pm} \leq_{At} Y, R(y,x)
\end{aligned}
$$

Resolving van Benthem’s problem

The sentence I’ll focus on is “exactly two boys ate exactly two slices”.
The Logical Form for the cumulative reading is completely orthodox:



(Since existential quantifiers scopally commute the respective scope of the DPs is not important.)

Assuming boys $\{a, b, c\}$, and slices $\{s_1, s_2, s_3\}$:

- $[\![\text{ex. 2 boys}]\!] = \{a^+ \oplus b^+ \oplus c^-, a^+ \oplus b^- \oplus c^+, a^- \oplus b^+ \oplus c^+\}$
- $[\![\text{ex. 2 slices}]\!] = \{s_1^+ \oplus s_2^+ \oplus s_3^-, s_1^+ \oplus s_2^- \oplus s_3^+, s_1^- \oplus s_2^+ \oplus s_3^+\}$

The cumulative logical form requires that we be able to pick an element Y of $[\![\text{ex. 2 boys}]\!]$, and an element X of $[\![\text{ex. 2 slices}]\!]$, s.t., $\text{ate}^{**}(Y, X)$ is true.

Crucially, each plurality encodes an exhaustive specification of what's happening for every element in the extension of the simple noun.

For "exactly 2 boys ate exactly two slices" to be true, one of the following must be true:

- a, b cumulatively ate s_1, s_2, c didn't do any eating of slices, and s_3 wasn't eaten by a boy.
- a, c cumulatively ate s_1, s_2, b didn't do any eating of slices, and s_3 wasn't eaten by a boy.
- b, c cumulatively ate s_1, s_2, a didn't do any eating of slices, and s_3 wasn't eaten by a boy.
- a, b cumulatively ate s_1, s_3, c didn't do any eating of slices, and s_2 wasn't eaten by a boy.
- a, b cumulatively ate s_2, s_3, c didn't do any eating of slices, and s_1 wasn't eaten by a boy.
- …and so on.

In other words, exactly two boys in total ate pizza slices, and exactly two slices in total were eaten by boys. This is exactly the cumulative reading of the sentence!

Bonus: cumulative readings with zero

A semantics with *negative counterparts* allows us to maintain a standard adjectival semantics for the numeral *zero*, which is otherwise problematic in a standard Link-style ontology (Bylinina & Nouwen 2018).

$[\![\text{zero}]\!] = \{ X \mid \mathbf{Card}(X^{+}) = 0 \}$

Note: unlike other bare numerals, *zero* must inherently have an ‘exactly’ interpretation, otherwise its meaning becomes trivial (Bylinina & Nouwen 2018).

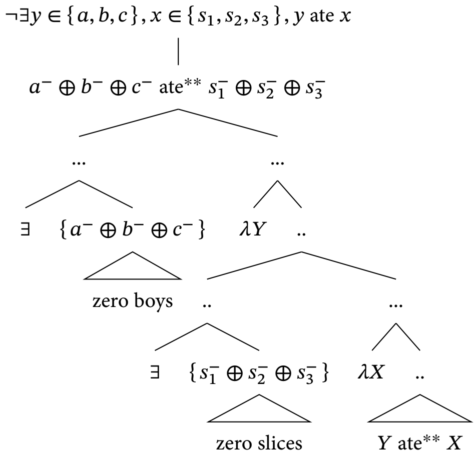
A virtue of the present account: it predicts cumulative readings of sentences with "zero", which remarkably seem to be attested.

(28) *I was expecting at least one philosopher to skip the hot dogs, but In fact…*
Zero philosophers ate zero hot dogs.

(29) *I guess the philosophers are all vegan. After determining who ate what, it turns out…*
Zero philosophers ate zero hot dogs.

- Doubly-distributive reading: every philosopher ate a hot dog.
- Cumulative reading: no philosopher ate a hot dog.

Since *zero boys* picks out a unique maximal plurality, deriving the cumulative reading is routine:



Conclusion

A well-known linguistic universal, formulated in GQ-theory:
$D(A, B) \iff D(A, A \cap B)$.

Consider again how determiners are defined in this system:

(30) $[\![\text{some}]\!] = \{X \in D^{\pm} \mid X^{+} \neq \varnothing\}$

(31) $[\![\text{all}]\!] = \{X \in D^{\pm} \mid X^{-} = \varnothing\}$

(32) $[\![\text{no}]\!] = \{X \in D^{\pm} \mid X^{+} = \varnothing\}$

(33) $[\![\text{most}]\!] = \{X \in D^{\pm} \mid \mathbf{Card}(X^{+}) > \mathbf{Card}(X^{-})\}$

In order to express a non-conservative meaning, a determiner $D(A, B)$ in GQ theory needs to place conditions on elements of B (the scope) that aren't also in A (the restrictor).

Since here determiners are intersective modifiers, it's impossible to place restrictions on anything outside of the restrictor set A.

- I've constructed a logic for plural expressions which encodes positive/negative information at the level of the *individual*, following (Akiba 2009, Bledin 2024).
- This additional structure in the semantics of plural NPs allows determiners to be defind as simple intersective modifiers.
- The maximality inherent in the semantics of plurality allows for a simple resolution to van Benthem's problem via completely orthodox mechanisms for achieving cumulative readings.
- Future horizons: determiners and semantic singularity, collective predication, and homogeneity.

Fin

Akiba, Ken. 2009. **A New Theory of Quantifiers and Term Connectives.** *Journal of Logic, Language and Information* 18(3). 403–431. https://doi.org/10.1007/s10849-009-9095-8. https://doi.org/10.1007/s10849-009-9095-8 (14 April, 2024).

Barwise, Jon & Robin Cooper. 1981. **Generalized quantifiers and natural language.** *Linguistics and Philosophy* 4(2). 159–219. https://doi.org/10.1007/BF00350139. https://doi.org/10.1007/BF00350139 (20 September, 2021).

Beck, Sigrid & Uli Sauerland. 2000. **Cumulation is needed: A reply to winter (2000).** *Natural Language Semantics* 8(4). 349–371. https://doi.org/10.1023/A:1011240827230. https://link.springer.com/article/10.1023/A:1011240827230.

Bledin, Justin. 2021. **Composing truthmakers.** https://www.youtube.com/watch?v=qijv-oEJr1s&t=2946s.

Bledin, Justin. 2024. **Composing menus.** Unpublished draft. Johns Hopkins University.

Brasoveanu, Adrian. 2013. **Modified Numerals as Post-Suppositions.** *Journal of Semantics* 30(2). 155–209. https://doi.org/10.1093/jos/ffs003. https://doi.org/10.1093/jos/ffs003 (13 February, 2022).

Bylinina, Lisa & Rick Nouwen. 2018. **On "zero" and semantic plurality.** *Glossa-an International Journal of Linguistics*: a journal of general linguistics 3(1). https://doi.org/10.5334/gjgl.441. http://www.glossa-journal.org//articles/10.5334/gjgl.441/.

Charlow, Simon. 2016. **Post-suppositions and semantic theory.** Rutgers University. https://ling.auf.net/lingbuzz/003243.

Haslinger, Nina & Viola Schmitt. 2020. **Cumulative readings of modified numerals: A plural projection approach.** *Proceedings of Sinn und Bedeutung*. 323–340 Pages. https://doi.org/10.18148/SUB/2020.V24I1.870. https://ojs.ub.uni-konstanz.de/sub/index.php/sub/article/view/870 (3 April, 2024).

Landman, Fred. 2000. ***Events and plurality: the Jerusalem lectures.*** (Studies in Linguistics and Philosophy 76). Dordrecht: Kluwer Academic. 381 pp.

- Link, Godehard. 1983. **The logical analysis of plurals and mass terms: A lattice-theoretic approach.** In P. Portner and B. H. Partee (ed.), *Formal semantics - the essential readings*, 127–147. Blackwell.
- Link, Godehard. 1987. **Generalized Quantifiers and Plurals.** In Peter Gärdenfors (ed.), *Generalized Quantifiers: Linguistic and Logical Approaches*, 151–180. Dordrecht: Springer Netherlands. `https://doi.org/10.1007/978-94-009-3381-1_6`. `https://doi.org/10.1007/978-94-009-3381-1_6` (19 April, 2024).
- Partee, Barbara. 1986. **Noun-phrase interpretation and type-shifting principles.** In J. Groenendijk, D. de Jongh & M. Stokhof (eds.), *Studies in discourse representation theory and the theory of generalized quantifiers*, 115–143. Dordrecht: Foris.

Van Benthem, Johan. 1986. ***Essays in Logical Semantics.*** Robin Cooper, Elisabet Engdahl & Richard Grandy (red.). Vol. 29 (Studies in Linguistics and Philosophy). Dordrecht: Springer Netherlands. `https://doi.org/10.1007/978-94-009-4540-1`. `http://link.springer.com/10.1007/978-94-009-4540-1` (10 May, 2021).

Winter, Yoad. 2001. ***Flexibility principles in boolean semantics - the interpretation of coordination, plurality, and scope in natural language.*** (Current Studies in Linguistics 37). Cambridge Massachussetts: The MIT Press. 297 pp.