A scalar analysis of polarity contrasts between exclusive modifiers*

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Abstract

The English exclusive *only* licenses weak NPIs like *any* and *ever*, but its lexical cousins *just*, *merely*, *exclusively*, and *solely* do not. This paper sketches an analysis in which *only*'s status as an NPI licensor follows from its capacity to order alternatives by entailment. NPIs are contradictory with *just* and *merely*, which order alternatives by rank, and *exclusively* and *solely*, which exclude unordered alternatives.

1 The puzzle

Exclusive modifiers, which in English include *only*, *just*, *merely*, *exclusively*, and *solely*, form a lexical class (Coppock and Beaver 2014), conveying that some proposition is true (the *prejacent*, (1-a)) and that alternatives to the prejacent are false (1-b). Famously, *only* licenses weak negative polarity items (NPIs) like *ever* and *any* in its nuclear scope. The other exclusives do not (2). This is surprising, since they all exclude alternatives.

(1) My cat Gertrude only/just/merely/exclusively/solely eats kibble.
  a. → Gertrude eats kibble
  b. → Gertrude does not eat alternatives to kibble

(2) a. Gertrude only ever eats kibble.
  b. # Gertrude just ever eats kibble.
  c. # Gertrude merely ever eats kibble.
  d. # Gertrude exclusively ever eats kibble.
  e. # Gertrude solely ever eats kibble.

To my knowledge, the contrast between *only* and *just* re NPIs was first noticed offhand by Wagner (2006). For experimental confirmation of the judgment, see Callahan-Kanik (2018). An analysis of (2) has so far eluded the literature.

2 Background

2.1 Exclusives

This paper assumes the scalar lexical entry schema of Beaver and Clark (2008) and Coppock and Beaver (2014) (CB), who argue that exclusives operate on a scale of alternatives $\geq_s$ consisting of propositional answers to the current Question under Discussion (CQ) (Roberts 1996/2012). Exclusives presuppose a lower-bounding MIN statement that some true answer to the CQ is at least as strong as the prejacent on the relevant scale, and assert an upper-bounding MAX statement that no true answer is stronger than the prejacent (3).

*I thank Chris Kennedy, Anastasia Giannakidou, Itamar Francez, and three anonymous AC reviewers for feedback and discussion.

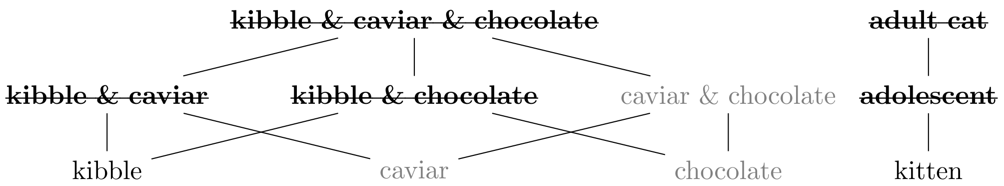
(3) a. $\textsc{min}_s(p) = \lambda w.\exists q_{\in \textsc{cq}_s}[q(w) \wedge q \geq_s p]$
b. $\textsc{max}_s(p) = \lambda w.\forall q_{\in \textsc{cq}_s}[q(w) \rightarrow p \geq_s q]$

Variation between exclusives is captured via variation in scale structure. Exclusives can have "complement exclusion" readings which exclude all other alternatives not entailed by the prejacent (4), and "rank-order" readings which only exclude alternatives ranked higher than the prejacent according to some contextual ordering (5).

(4) Gertrude only eats kibble. → Gertrude eats nothing **other** than kibble.

(5) Frederick is only a kitten. → Frederick is nothing **higher** than a kitten.

Complement exclusion readings rank the alternatives as a boolean lattice, closed under conjunction, so that recursively conjoined alternatives are included in addition to atomic ones: for example, *kibble&caviar* in addition to *kibble* and *caviar*. Logically stronger alternatives are ranked higher, so that the higher alternatives asymmetrically entail the lower ones. (4) is schematized in Figure 1a. Rank-order readings rank the alternatives as a qualitative ordering (Horn 2000) in which the higher alternatives can, but are not guaranteed to entail the lower ones. Since the alternatives do not necessarily stand in an entailment relation, they can be mutually exclusive. (5) is schematized in Figure 1b. The labels in Figure 1 are abbreviations for propositional alternatives; a ~~strikethrough~~ indicates exclusion.



(a) Entailment scale (b) Rank-order scale

Figure 1: Scales (adapted from CB ex. 27, 29.)

Complement exclusion sentences make exhaustive claims about all the alternatives on the scale. To see why, consider the scale in Figure 1a, which is ordered partially by entailment. $\textsc{max}$ only excludes the boldfaced alternatives that entail the prejacent. But these collectively entail the other non-boldfaced alternatives (in this example, *caviar*, *chocolate*, and *caviar&chocolate*). So we can conclude from $\textsc{min}$ and $\textsc{max}$ that the non-boldfaced alternatives are false too. For example, if Gertrude eats kibble, and Gertrude does not eat kibble and caviar, then Gertrude does not eat caviar. When the higher alternatives do not entail the lower ones, rank-order sentences do not make exhaustive claims about everything on the scale. In particular, they say nothing about alternatives ranked lower than the prejacent.

Excluding along an entailment scale is truth-conditionally equivalent to excluding on non-identity, as the classic analysis of *only* (Horn 1969, Rooth 1992) had it. The motivation for introducing entailment scales is to tie complement exclusion and rank-order readings to a unified entry for *only*, which excludes along a scale whose structure is underspecified. In CB's system, the scale is provided by the context, not the exclusive, but different exclusives are compatible with different scales. According to CB, *only* "prefers" entailment scales and *just* "prefers" rank-order scales, while *merely* specifically presupposes an "evaluative" rank-order scale whose alternatives are ranked according to what the speaker considers good or bad. By contrast, *exclusively* and *solely* only have complement exclusion readings (6), which CB take to indicate that they are restricted to entailment scales. Their motivation for using entailment scales with *exclusively* and *solely* is to achieve a unified scalar exclusive typology; non-scalar entries would capture the data just as well.

(6) Frederick is only/just/merely/#exclusively/#solely a kitten.

An exclusive's choice of scale indirectly correlates with whether the prejacent projects under negation (Klinedinst 2005). In negated complement exclusion sentences, it must; in negated rank-order sentences, it does not necessarily. (7) presupposes that an alternative at least as strong as the prejacent is true, and asserts that it is not the case that no stronger alternatives are true. It follows that at least one stronger alternative is true, and since these entail the prejacent, it survives negation. Gertrude still eats kibble in this example. (8) presupposes that an alternative ranked at least as high as the prejacent is true, and asserts that it is not the case that no higher alternatives are true. It follows that at least one higher alternative is true, but these do not entail the prejacent; in (8) they contradict the prejacent. So Frederick is no longer a kitten in this example.

(7) Gertrude doesn't only eat kibble (she eats chocolate). $\rightarrow$ Gertrude eats kibble.

(8) Frederick isn't only a kitten (he's an adult cat). $\nrightarrow$ Frederick is a kitten.

However, scale structure is not perfectly correlated with entailment or projection, because rank-order scales can still include atomic alternatives that entail other alternatives. It is ambiguous whether a scale like $\langle$*employee, senior employee, CEO*$\rangle$ has been ranked by entailment or seniority. Or consider Horn scales like $\langle$*some, many, most, all*$\rangle$ (Horn 1972). By definition the higher alternatives entail the lower ones, but since the atomic alternatives are not logically independent, it does not make sense to say that a Horn scale is organized as a boolean lattice.

Teasing apart entailment vs. rank is therefore not so straightforward. NPIs, which force complement exclusion readings in the scope of *only* (9), provide a good test. The absence of rank-order readings in (9-c) indicates that NPIs require scales ordered by entailment.

(9) *Context: card game* (example adapted from Klinedinst (2005) ex. 2)

a. I only/just/merely have a six. $\rightarrow$ Six is the **highest** card I have (rank-order)

b. Since the game started, I've only/just/merely had a six. $\rightarrow$ I have had no **higher** card than a six (rank-order)

c. Since the game started, I've only/#just/#merely ever had a six. $\rightarrow$ I have had no **other** card than a six (entailment)

This paper aims to derive (2) from scalar restrictions imposed by different exclusives.

2.2 NPIs

Let's assume with Chierchia (2013) that NPIs are existential quantifiers associated with maximally wide domains (10) that trigger obligatory exhaustification over domain alternatives (11). NPIs are grammatical when exhaustification does not contradict the prejacent (12). In (12-a), the output of *exh* is the proposition that there is no wider domain of time in which Gertrude doesn't eat kibble, which is entailed by the prejacent. In (12-b), the output of *exh* is the proposition that there is no narrower domain of time in which Gertrude eats kibble, which contradicts the prejacent.

(10) $[\![\text{ever}]\!] = \lambda e.\exists i_{\subset ever'}[\tau(e) = i]$

(11) $[\![exh]\!] = \lambda p \lambda w.p(w) \wedge \forall q_{\in \text{ALT}(p)}[{}^{a}q(w) \rightarrow {}^{a}p \geq_s {}^{a}q]$

(12) a. *exh*[Gertrude doesn't ever eat kibble.]

b. # *exh*[Gertrude ever eats kibble.]

Two features of the implementation will be useful. *Exh* is defined on partial propositions: ${}^{a}p$ in the exhaustification conjunct is shorthand for the at-issue component of p. This means *exh* ignores presuppositions. *Exh* is also scalar, sensitive to the same orderings exclusives are. This allows exhaustification over alternatives ordered by relations other than entailment. So if $\geq_s$ is a rank-order scale, *exh* will exclude alternatives ranked higher than the prejacent. That *exh* in (11) is defined identically to CB's MAX is intended to capture the intuition that *exh* is an abstract version of *only*[1].

Related implementations of the same idea (e.g. Krifka 1995) would work just as well here as long they accommodate rank-order scales.

3 Proposal

In treating scalar restrictions on exclusives as "soft preferences", CB's system as it stands is too permissive to explain (2), predicting that the presence of NPIs in the scope of exclusives other than *only* would force complement exclusion readings (as in (9-c)). Instead, they are completely out. Two modifications to CB's typology are necessary. First, we need to restrict *just* and *merely* to rank-order scales. Second, we need to model *exclusively* and *solely* as excluding everything other than the prejacent, as the classic analysis of *only* had it, without ranking or conjoining the alternatives. Only *only* can order alternatives by entailment[2]. *Just* and *merely* order alternatives by rank. *Exclusively* and *solely* operate on unordered alternatives. Setting aside whatever other factors distinguish *just* from *merely* and *exclusively* from *solely*, this analysis is implemented by the lexical entries in (13).

(13) a. $[\![\text{only}]\!] = \lambda p \lambda w : \text{MIN}_s(p)(w).\text{MAX}_s(p)(w)$
b. $[\![\text{just/merely}]\!] = \lambda p \lambda w : \text{RANK}(\geq_s) \wedge \text{MIN}_s(p)(w).\text{MAX}_s(p)(w)$
c. $[\![\text{exclusively/solely}]\!] = \lambda p \lambda w : p(w).\forall q_{\in \text{ALT}(p)}[p \neq q \rightarrow \neg q(w)]$

The NPI facts are captured as follows. Sentences with exclusives and NPIs include at least two dimensions of alternatives: the exclusive's focus alternatives (F-ALT) and the NPI's domain alternatives (D-ALT). The global alternative set ALT is represented as the union of F-ALT, D-ALT, and all the D-ALTs for each F-ALT (14).

(14) $\text{ALT}(p) = \text{F-ALT}(p) \cup \text{D-ALT}(p) \cup \{\text{D-ALT}(q) | q \in \text{F-ALT}(p)\}$

Scalar exclusives (*only*, *just*, and *merely*) only exclude higher-ranked F-ALTs, but impose the same ordering on the entire ALT set: either all alternatives are ordered by rank, or all are ordered by entailment. There are no "mixed" orderings. Revised definitions for MIN and MAX restricting exclusion to F-ALT are given in (15).

(15) a. $\text{MIN}_s(p) = \lambda w.\exists q_{\in \text{F-ALT}}[q(w) \wedge q \geq_s p]$
b. $\text{MAX}_s(p) = \lambda w.\forall q_{\in \text{F-ALT}}[q(w) \rightarrow p \geq_s q]$

[1] Panizza and Chierchia (2019) propose an exclusive semantics that also involves exhaustification over exclusive sentences, but in which *exh* only sees logically stronger alternatives, treating rank-order alternatives as disjunctions ranked by entailment. For example, they would represent the scale in Figure 1b as $\langle$*kitten* $\vee$ *adolescent* $\vee$ *adult cat*, *adolescent* $\vee$ *adult cat*, *adult cat*$\rangle$. This move to eliminate rank-order exclusives entirely would require an independent explanation of the NPI facts. This paper takes the opposite strategy, treating *exh* as scale-flexible.

[2] The key factor is not boolean structure per se, but whether the ordering is explicitly specified as entailment. These need to be distinguished primarily because *only* still licenses NPIs when excluding along a Horn scale (i).

(i) Only/#just/#merely $[\text{some}]_F$ cats ate any dinner, not all.

The input to *exh* in sentences with exclusives and NPIs is the MAX statement, where the alternative set for a MAX statement consists of equivalent MAX statements with narrower subdomains (16). *Exh* inherits the same ordering $\geq_s$ as MIN/MAX.

(16) $\text{ALT}(\text{MAX}_s(p)) = \{\text{MAX}_s(q) | q \in \text{D-ALT}(p)\}$

By modeling both dimensions of alternatives as a larger structured set, we can derive the NPI data. Restrictions on F-ALT structure affect D-ALT too, in ways that either avoid contradiction, or create it.

Let's start with *only* in (17). Since *only* ranks the alternatives by entailment, MAX reverses strength: if $q \rightarrow p$, then $\text{MAX}_s(p) \rightarrow \text{MAX}_s(q)$. Therefore *exh* is vacuous. Since there is no narrower domain in which the proposition that Gertrude eats at most kibble in that domain entails that Gertrude eats at most kibble in the widest domain, there are no stronger alternatives for *exh* to operate on, as desired. As a result, for each excluded F-ALT, all its respective D-ALTs are also declared false, but none of the prejacent's D-ALTs are. This is not a contradiction.

Ordered pairs like $\langle$*kibble, ever*$\rangle$ in (17) are abbreviations for alternative propositions; the notation is intended to highlight the two dimensions along which the alternatives vary. A ~~strikethrough~~ indicates exclusion.

(17) $[\![exh[\text{Gertrude only ever eats kibble}]]\!] = (\exists i_{\subset ever'}[\tau(eat(k)(g)) = i])(\lambda p \lambda w : \text{MIN}_s(p)(w).$ $\text{MAX}_s(p)(w) \wedge \forall q_{\in \text{ALT}(\text{MAX}_s(p))}[q(w) \rightarrow (\text{MAX}_s(p) \rightarrow q)]])$

a. $\text{F-ALT}(p) = \{\langle kibble,\ ever\rangle, \cancel{\langle kibble\ \&\ caviar,\ ever\rangle}, \cancel{\langle kibble\ \&\ chocolate,\ ever\rangle}, ...\}$

b. $\text{D-ALT}(p) = \{\langle kibble,\ ever\rangle, \langle kibble,\ sometimes\rangle, \langle kibble,\ often\rangle ...\}$

c. $\text{ALT}(p) = \{\langle kibble,\ ever\rangle, \cancel{\langle kibble\ \&\ caviar,\ ever\rangle}, \cancel{\langle kibble\ \&\ chocolate,\ ever\rangle}, \langle kibble,\ sometimes\rangle, \cancel{\langle kibble\ \&\ caviar,\ sometimes\rangle}, \cancel{\langle kibble\ \&\ chocolate,\ sometimes\rangle}, \langle kibble,\ often\rangle, \cancel{\langle kibble\ \&\ caviar,\ often\rangle}, \cancel{\langle kibble\ \&\ chocolate,\ often\rangle} ...\}$

d. $\text{ALT}(\text{MAX}_s(p)) = \{\text{MAX}_s(\langle kibble,\ ever\rangle), \text{MAX}_s(\langle kibble,\ sometimes\rangle), \text{MAX}_s(\langle kibble,\ often\rangle) ...\}$

Just and *merely* break the entailment relation between NPIs and their domain alternatives, forcing D-ALT onto a rank-order scale. Unlike (17), the ranking in (18) is not tied to logical strength and is not reversed by MAX: if $q \geq_s p$, then $\text{MAX}_s(q) \geq_s \text{MAX}_s(p)$, since $\text{MAX}_s(q)$ allows higher true alternatives than $\text{MAX}_s(p)$. So although the negation of each F-ALT entails the negation of its respective D-ALTs, rank is unaffected, and the narrower D-ALTs are still ranked higher. *Exh* is sensitive to rank: (11) defined it as scalar precisely to accommodate exhaustification over nonentailment scales. As a result, *exh* is not vacuous, excluding the higher-ranked, narrower MAX alternatives. (18) says that Gertrude eats nothing higher than kibble in the widest domain, but there is no alternative domain in which Gertrude eats nothing higher than kibble (i.e., that Gertrude *does* eat things ranked higher than kibble in narrower domains). This is a contradiction.

(18) $\#[\![exh[\text{Gertrude just ever eats kibble}]]\!] = (\exists i_{\subset ever'}[\tau(eat(k)(g)) = i])(\lambda p \lambda w : \text{MIN}_s(p)(w).$ $\text{MAX}_s(p)(w) \wedge \forall q_{\in \text{ALT}(\text{MAX}_s(p))}[q(w) \rightarrow \text{MAX}_s(p) \geq_s q])$

a. $\text{F-ALT}(p) = \{\langle kibble,\ ever\rangle, \cancel{\langle caviar,\ ever\rangle}, \cancel{\langle chocolate,\ ever\rangle}, ...\}$

b. $\text{D-ALT}(p) = \{\langle kibble,\ ever\rangle, \langle kibble,\ sometimes\rangle, \langle kibble,\ often\rangle ...\}$

c. $\text{ALT}(p) = \{\langle kibble,\ ever\rangle, \cancel{\langle caviar,\ ever\rangle}, \cancel{\langle chocolate,\ ever\rangle}, \langle kibble,\ sometimes\rangle, \langle caviar,\ sometimes\rangle, \langle chocolate,\ sometimes\rangle, \langle kibble,\ often\rangle, \langle caviar,\ often\rangle, \langle chocolate,\ often\rangle ...\}$

d. $\text{ALT}(\text{MAX}_s(p)) = \{\text{MAX}_s(\langle kibble,\ ever\rangle), \cancel{\text{MAX}_s(\langle kibble,\ sometimes\rangle)}, \cancel{\text{MAX}_s(\langle kibble,\ often\rangle)} ...\}$

Now consider *exclusively* and *solely*, which are not scalar. In the present system, the scalar/non-scalar distinction is implemented as exclusion of F-ALT vs. ALT. In sentences with one dimension of alternatives, ALT and F-ALT are the same, so that complement exclusion *only* vs. *exclusively/solely* sentences have equivalent truth-conditions. In sentences with NPIs, *exclusively/solely* exclude the prejacent's D-ALTs too. (19) says that Gertrude eats kibble in the widest domain, but not in any other domain. This is a contradiction[3]. *Exh* is vacuous here, so I've omitted it from the representation.

(19) $\#[\![\text{Gertrude solely ever eats kibble}]\!] = (\exists i_{\subset ever'}[\tau(eat(k)(g)) = i])(\lambda p \lambda w : p(w).\forall q_{\in \text{ALT}(p)}[p \neq q \rightarrow \neg q(w)])$

a. $\text{F-ALT}(p) = \{\langle kibble,\ ever\rangle, \cancel{\langle caviar,\ ever\rangle}, \cancel{\langle chocolate,\ ever\rangle}, \ldots\}$

b. $\text{D-ALT}(p) = \{\langle kibble,\ ever\rangle, \cancel{\langle kibble,\ sometimes\rangle}, \cancel{\langle kibble,\ often\rangle} \ldots\}$

c. $\text{ALT}(p) = \{\langle kibble,\ ever\rangle, \cancel{\langle caviar,\ ever\rangle}, \cancel{\langle chocolate,\ ever\rangle}, \cancel{\langle kibble,\ sometimes\rangle}, \cancel{\langle caviar,\ sometimes\rangle}, \cancel{\langle chocolate,\ sometimes\rangle}, \cancel{\langle kibble,\ often\rangle}, \cancel{\langle caviar,\ often\rangle}, \cancel{\langle chocolate,\ often\rangle} \ldots\}$

This is a somewhat surprising result. Previous analyses of *only* as an NPI licensor (von Fintel 1999, Chierchia 2013, Xiang 2017) have assigned it entries equivalent to (13-c), which the present analysis reserves for *exclusively* and *solely*. Once we understand F-ALT and D-ALT as different dimensions of the same set, an entry like (13-c) overexcludes. Modeling some but not all exclusives as scalar allows us to distinguish between those that operate on ordered alternatives (*only*, *just*, and *merely*) and unordered alternatives (*exclusively* and *solely*).

A brief comparison to Strawson downward entailment (von Fintel 1999) may be useful. von Fintel defines SDE as downward entailment plus a definedness condition on presuppositions. Concretely, if Gertrude only eats kibble in the widest domain, then Gertrude only eats kibble in narrower domains, presupposing that Gertrude eats kibble in narrower domains. To evaluate whether an SDE inference goes through, two conditions must hold: i) the consequent needs to follow from the premise, as long as ii) the presuppositions of the premise and consequent are satisfied.

Just and *merely* sentences do not satisfy condition i): on a rank-order scale, *exh* excludes the consequent. *Exclusively* and *solely* sentences do not satisfy condition ii): *exclusively/solely* exclude the presuppositions of the consequent, which are by definition D-ALT alternatives. So the effects of SDE are reconstructed here.

4 Conclusion

This paper argued that polarity contrasts between English exclusives result from restrictions on how the alternatives are ordered. The analysis has implications for our typology of exclusives: *just* and *merely* are restricted to rank-order scales, while *exclusively* and *solely* are not scalar at all. Aside from the present case study, the proposal provides a framework for analyzing sentences with multiple alternative-sensitive expressions whose dimensions interact.

[3]It follows that *exclusively* and *solely* do not exclude "innocently" (Fox 2007), which may go some way toward explaining why they resist operating on Horn scales (i).

(i) a. I only/#exclusively/#solely ate $[\text{some}]_F$ of the cookies, not all.
b. The movie was only/#exclusively/#solely $[\text{good}]_F$, not excellent.
c. Gertrude only/#exclusively/#solely played with Frederick $[\text{or}]_F$ Bruno, not both.

In general, the analysis predicts *exclusively/solely* to require logically independent alternatives. Alternatives that entail other alternatives are bad because they lead to contradiction. Mutually exclusive alternatives (as in (6)) are bad because presupposing the prejacent already resolves the other open alternatives, leaving *exclusively/solely* nothing to exclude.

References

Beaver, David and Brady Clark (2008). *Sense and sensitivity: how focus determines meaning.* Chichester: Wiley-Blackwell.

Callahan-Kanik, Taletha (2018). “An experimental study of the differences between just and only: NPI licensing and modal scope”. PhD thesis. CUNY.

Chierchia, Gennaro (2013). *Logic in grammar: polarity, free choice, and intervention.* Oxford: Oxford University Press.

Coppock, Elizabeth and David Beaver (2014). “Principles of the exclusive muddle”. In: *Journal of Semantics* 31, pp. 371–432.

Fox, Danny (2007). “Free choice and the theory of scalar implicatures”. In: *Presupposition and implicature in compositional semantics.* Springer.

Horn, Laurence (1969). “A presuppositional analysis of only and even”. In: *Proceedings of CLS 5.*

— (1972). “On the semantic properties of logical operators in English”. PhD thesis. UCLA.

— (2000). “Pick a theory (not just any theory)”. In: *Negation and polarity: syntactic and semantic perspectives.* Ed. by Laurence Horn and Yasuhiko Kato. Oxford: Oxford University Press.

Klinedinst, Nathan (2005). “Scales and *only*”. MA thesis. UCLA.

Krifka, Manfred (1995). “The semantics and pragmatics of polarity items”. In: *Linguistic Analysis* 25, pp. 209–257.

Panizza, Daniele and Gennaro Chierchia (2019). “Just exhaustification: a ‘two-stage’ theory of exclusives”. In: *Proceedings of Amsterdam Colloquium 22.*

Roberts, Craige (1996/2012). “Information structure in discourse: Towards an integrated formal theory of pragmatics”. In: *Semantics and Pragmatics* 5.6, pp. 1–69. DOI: 10.3765/sp.5.6.

Rooth, Mats (1992). “A theory of focus interpretation”. In: *Natural Language Semantics* 1, pp. 75–116.

von Fintel, Kai (1999). “NPI licensing, Strawson entailment, and context dependency”. In: *Journal of Semantics* 16.2, pp. 97–148.

Wagner, Michael (2006). “Association by movement: evidence from NPI-licensing”. In: *Natural Language Semantics* 14, pp. 297–324.

Xiang, Yimei (2017). “*Only*: an NPI-licenser and NPI-unlicenser”. In: *Journal of Semantics* 16.2, pp. 97–148.