NPIs, intervention, and collectivity

Brian Buccola

Michigan State University

Luka Crnič

The Hebrew University of Jerusalem

October 8, 2020

Abstract

Negative polarity items are subject to so-called intervention effects (Linebarger, 1980, 1987). Specifically, they are unacceptable in the immediate scope of certain non-downward-entailing operators, even if they occur in the scope of a (higher) downward-entailing operator. By studying the behavior of *any* in configurations with collective predicates, we provide new empirical arguments that the descriptive condition concerning intervention must be stated with reference to the content of the clausal constituents in which NPIs may occur, and not merely with reference to operators c-commanding them. This is in line with recent arguments for environment-based formulations of NPI licensing conditions (e.g., Homer, 2008; Gajewski, 2011). We conclude by discussing how the condition fits in with some recent theories of intervention (especially Guerzoni, 2006; Chierchia, 2013).

Keywords: negative polarity items, intervention, distributivity, collectivity, conjunction

1   The received view

Negative polarity items (NPIs) like *any whisky* have a more restricted distribution than other elements of the same syntactic category. An important advancement in our understanding of their behavior consisted in identifying semantic conditions on their acceptability (see, e.g., Ladusaw, 1979; Fauconnier, 1975; Heim, 1984; von Fintel, 1999, among many others). A variant of Ladusaw's influential description of the condition is provided in (1).[1, 2]

(1)   **NPI Licensing Condition**
       An NPI is acceptable only if it is c-commanded by an operator that is downward-entailing.

The NPI Licensing Condition in (1) is stated merely as a necessary condition on the acceptability of NPIs due primarily to an observation by Linebarger (1980, 1987) that occurrences of NPIs in

---

[1] An operator is downward-entailing if and only if (iff) it denotes a downward-entailing function. A function f of type $\sigma\tau$ is downward-entailing iff for all x and y of type σ such that $x \Rightarrow y$, $f(y) \Rightarrow f(x)$, where '$\Rightarrow$' is cross-categorial entailment. (See von Fintel, 1999 for a qualification.)

[2] Cross-categorial entailment, notated as '$\Rightarrow$', is defined recursively as follows. If α and β are of type t, then $\alpha \Rightarrow \beta$ iff $\alpha = $ F or $\beta = $ T. If α and β are of type $\sigma\tau$, then $\alpha \Rightarrow \beta$ iff $\alpha(x) \Rightarrow \beta(x)$ for all x of type σ.

the scope of a downward-entailing operator may be unacceptable—in particular, if they occur in the immediate scope of certain operators that are not downward-entailing, such as *and*.[3] These operators are then said to 'intervene' in the licensing of the NPI and have been dubbed 'interveners'. An intervention configuration is exemplified in (2): in both cases, an NPI occurs in the scope of a downward-entailing operator—*doubt* and negation—and yet both sentences are unacceptable.

(2)   a.   *I doubt that Mary and any boy have blue eyes.
      b.   *John didn't drink any whisky and the soda.

In order to have a more constrained characterization of the distribution of NPIs, Linebarger (1987, p. 338) suggested an additional restriction on their distribution, provided in (3).

(3)   **Additional Restriction**
      An NPI is unacceptable if it occurs in the immediate scope of an operator that is not downward-entailing.

This constraint has been further refined. It turns out, namely, that not all operators are interveners. In (4), we see that *or* does not intervene in the licensing of *any*, in contrast to *and*.

(4)   a.   I doubt that Mary or any boy has blue eyes.
      b.   John didn't drink any whisky or the soda.

Chierchia (2004, 2013) notes that the property that appears to distinguish between interveners and non-interveners pertains to the relation the operators stand in with their scalar alternatives: "[i]nterveners are strong members of a scale; non-interveners are the weakest ones" (Chierchia, 2004, p. 84) and "[w]hen a scalar item induces an intervention effect, what seems to be playing a role is not so much its intrinsic nature but rather its position in the scale" (Chierchia, 2013, pp. 378ff). A corresponding refinement of the Additional Restriction would be to restrict the class of intervening operators as stated in (5); the pertinent scales referred to in (5) are provided in (6).[4]

(5)   **Revised Additional Restriction**
      An NPI is unacceptable if it occurs in the immediate scope of an operator (i) that is not downward-entailing, and (ii) that does not occupy the lowest (logically weakest) position on its scale.

(6)   **Some example scales** (e.g. Horn, 1972; Sauerland, 2004)
      a.   ⟨*or, and*⟩
      b.   ⟨*some, every*⟩
      c.   ⟨*one, two, three, …*⟩

Alternative statements of the Additional Restriction are possible, potentially involving an incorporation into the NPI Licensing Condition (see esp. Gajewski, 2011). Given the intervention data described above, and the extant data in the literature, however, it is not obvious that an

---

[3] β occurs in the immediate scope of a logical operator α iff α c-commands (or m-commands) β, and there are no other logical operators that c-command (or m-command) β and are c-commanded (or m-commanded) by α.

[4] This is a sufficient condition for something to be an intervener. There may be interveners that do not satisfy this condition—for example, certain additive particles (see Homer, 2008; Gajewski, 2011; Chierchia, 2013, for a more extensive discussion).

alternative statement of (5) would improve on its empirical adequacy.

In the remainder of this remark, we present evidence that casts doubt on (5). We provide new arguments that the descriptive condition on NPI licensing, (1), must be environment-based (rather than operator-based), and must, additionally, reference full sentential alternatives (rather than scalemates), thus replacing (5) (see, e.g., Kadmon and Landman, 1993; Lahiri, 1998; Homer, 2008; Gajewski, 2011; Chierchia, 2004, 2006, 2013; Crnič, 2014, 2019, 2020; Buccola and Spector, 2016, for further arguments). Specifically, we argue that the acceptability of a sentence instantiating an intervention configuration does not depend simply on the position that the relevant operator occupies in its scale, but rather depends on the logical relation that the pertinent constituent dominating the operator (i.e. the pertinent environment) bears to its alternatives.

2   The observation

We present a new observation: there are cases where *and* and an NPI stand in an intervention configuration—that is, their configuration violates the condition in (5)—but where the NPI is nevertheless systematically acceptable. This is the case in the following near-minimal pairs: the (a)-sentences are judged to be unacceptable, while the (b)-sentences are judged to be acceptable. In particular, (7b) conveys that I don't think Mary has ever collaborated with a boy, and (8b) conveys that John didn't mix the soda with any portion of whisky. (We adopt a cross-categorial treatment of conjunction on which it can combine two DPs for reasons of presentation. Our conclusions extend to treatments of conjunction as a clausal operator only; see Hirsch, 2017; Schein, 2017.)

(7)   a.   *I don't think that [Mary and any boy here] have ever <u>laughed at my jokes</u>.
       b.   I don't think that [Mary and any boy here] have ever <u>collaborated</u>.

(8)   a.   *John didn't <u>drink</u> [the soda and any whisky].
       b.   John didn't <u>mix</u> [the soda and any whisky].

A feature of the acceptable (b)-examples above that distinguishes them from the unacceptable (a)-examples is that the conjoined DPs combine with a collective predicate in the (b)-cases but not the (a)-cases (*mix* is collective with respect to its object argument). A collective predicate is one that may hold of a plurality without holding of any of the proper parts of that plurality. This observation is generalized in (9), which is stated as a necessary condition on the acceptability of conjunctions formed from *any NP*.[5, 6]

---

[5]The constraint in (9) applies only to NPI occurrences of *any NP*, not to *any NP* in general.

[6]A reviewer notes that if the conjunction that combines with a collective predicate were not scope-bearing, then it would not be subject to the (Revised) Additional Restriction (as defined in Linebarger, 1980, 1987). Following the reviewer's suggestion, we demonstrate its scope-bearing nature by means of an interaction with disjunction: sentence (i) has the two relevant readings described in (ia)–(ib), which depend on the scope of disjunction relative to conjunction. See §3 for definitions and related discussion.

(i)   The physicists or the chemists and the biologist collaborated on a project.

          a.   [or > and]: the physicists collaborated ∨ the chemists collaborated with the biologist
          b.   [and > or]: the physicists collaborated with the biologist ∨ the chemists collaborated with the biologist

(9)   **Constraint on *any NP* conjunction**
      Any NP conjoined with another DP is acceptable only if the conjunction combines with a collective predicate.

The collectivity of the predicates need not be lexical, but can be derived in syntax. It may spring from using expressions that require a plural argument in the sentence. These include a reciprocal anaphor, as in (10a), a so-called internal *same*, as in (10b), and a collectivizing adverbial like *together*, as in (10c).

(10)   a.   I don't think that Mary and any boy here have ever laughed at <u>each other's</u> jokes.
       b.   The zookeeper didn't put any monkey and the lion <u>into the same cage</u>.
       c.   John denies that Mary and any student of hers have ever written a paper <u>together</u>.

Relatedly, if a predicate is mixed (can in principle be interpreted either distributively or collectively), then the only interpretation that one may obtain with a conjoined *any NP* argument is the one that applies the predicate collectively to the conjoined plurality. For example, (11) can only mean that I doubt that any son of mine x is such that my wife and x's combined weight is exactly 150 kg; it cannot mean that I doubt that my wife's weight is exactly 150 kg and that, at the same time, some son of mine's weight is exactly 150 kg. In the absence of an NPI, (12), both interpretations are in principle possible.

(11)   I doubt that my wife and any son of mine <u>weigh exactly 150 kg</u>.

       a.   Doubt: wife's weight + x's weight = 150 kg, for some son x.
       b.   #Doubt: wife's weight = 150 kg and x's weight = 150 kg, for some son x.

(12)   I doubt that my wife and a son of mine <u>weigh exactly 150 kg</u>.

       a.   Doubt: wife's weight + x's weight = 150 kg, for some son x.
       b.   Doubt: wife's weight = 150 kg and x's weight = 150 kg, for some son x.

3   The puzzle

The observation summarized in (9) is puzzling on the formulation of the condition on interveners in (5), at least given the common approaches to conjoined DPs. Before revising the condition, we describe how the puzzle surfaces for three families of approaches to *and*.

3.1   A uniform boolean semantics of DP conjunction

If one assumes that the semantics of DP conjunction is derived from the basic meaning of conjunction in propositional logic by appropriately type-shifting it and its arguments (e.g. Partee and Rooth, 1983; Keenan and Faltz, 1985; Winter, 2001; Champollion, 2015), then one predicts that all occurrences of conjunction should qualify as interveners. Namely, propositional conjunction and its type-shifted counterparts on such an approach entail, respectively, propositional disjunction and its type-shifted counterparts, as illustrated in (13) and (14): for all arguments, the output of

conjunction applied to them entails the output of disjunction applied to them.[7]

(13)   a. $[\![\text{and}]\!]_{t(tt)} = \lambda p_t . \lambda q_t . p = \text{T} \wedge q = \text{T}$
       b. $[\![\text{or}]\!]_{t(tt)} = \lambda p_t . \lambda q_t . p = \text{T} \vee q = \text{T}$
       c.   For all p and q of type t, $[\![\text{and}]\!]_{t(tt)} (p)(q) \Rightarrow [\![\text{or}]\!]_{t(tt)} (p)(q)$.

(14)   a. $[\![\text{and}]\!]_{(ett)((ett)(ett))} = \lambda f_{ett} . \lambda g_{ett} . \lambda h_{et} . f(h) = \text{T} \wedge g(h) = \text{T}$
       b. $[\![\text{or}]\!]_{(ett)((ett)(ett))} = \lambda f_{ett} . \lambda g_{ett} . \lambda h_{et} . f(h) = \text{T} \vee g(h) = \text{T}$
       c.   For all f and g of type et, $[\![\text{and}]\!]_{(ett)((ett)(ett))} (f)(g) \Rightarrow [\![\text{or}]\!]_{(ett)((ett)(ett))} (f)(g)$.

A simplified structure of sentence (15a) is provided in (15b) (the structure is simplified by dropping the attitude predicate). In addition to other operators, negation c-commands *and*, which in turn c-commands *any boy* in this representation (see Winter, 2001, though his proposal differs in details). Accordingly, we are clearly dealing with an intervention configuration, as defined in (3)/(5).

(15)   a.   I don't think that Mary and any boy collaborated.
       b.   [neg [∃ [Min [[Lift Mary] [and [any boy]]]] collaborate]]

For concreteness, we provide the computation of the meaning of (15) in (16): Lift lifts the denotation of *Mary* to a quantifier (Montague, 1970); Min takes a set of predicates that hold of, respectively, Mary and a boy, and returns the set of all the minimal subsets of that set—that is, the set of all subsets consisting of Mary and a boy (Winter, 2001); ∃ stands for existential closure over sets of individuals. Accordingly, if we treat pluralities as sets of individuals, which we do for expository reasons, then the meaning of the sentence is that none of these minimal sets consisting of Mary and a boy is in the denotation of *collaborate*.[8]

(16)   a. $\neg \exists X \exists y [\text{boy}(y) = \text{T} \wedge X = \{\text{Mary}, y\} \wedge \text{collaborate}(X) = \text{T}]$
       b. $\equiv \neg \exists y [\text{boy}(y) = \text{T} \wedge \text{collaborate}(\{\text{Mary}, y\}) = \text{T}]$

To summarize, an appropriately type-shifted conjunction counts as an intervener on the condition in (5). Thus, the condition, coupled with this approach to *and* (and *or*), undergenerates—it does not admit examples of conjoined NPIs that combine with a collective predicate.

3.2   A uniform non-boolean semantics of DP conjunction

An alternative approach assumes that DP conjunction effectively takes individuals as arguments and returns sets of them—that is, pluralities of them (e.g. Hoeksema, 1988; Krifka, 1990; Lasersohn,

---

[7]More generally, for any boolean type τ, we have the following, where '$\sqcap_\tau$' and '$\sqcup_\tau$' denote the meet and join operators, respectively, defined over the domain associated with τ:

(i)   a. $[\![\text{and}]\!]_{\tau(\tau\tau)} = \lambda f_\tau . \lambda g_\tau . f \sqcap_\tau g$
       b. $[\![\text{or}]\!]_{\tau(\tau\tau)} = \lambda f_\tau . \lambda g_\tau . f \sqcup_\tau g$
       c.   For all f and g of type τ, $[\![\text{and}]\!]_{\tau(\tau\tau)} (f)(g) \Rightarrow [\![\text{or}]\!]_{\tau(\tau\tau)} (f)(g)$.

[8]The reason we need Min is that we want a sentence like *Mary and John lifted the piano together* to be true only if Mary and John did it as a two-person group; without Min, the sentence would mean merely that a group containing John and Mary (and possibly others) lifted the piano (see Winter, 2001; Champollion, 2015, for discussion).

1995). On this kind of approach, the semantics of *and* that combines quantifiers can be stated as in (17), where it effectively corresponds to pointwise set union.

(17) $[\![\text{and}]\!]_{(ett)((ett)(ett))} = \lambda f_{ett} . \lambda g_{ett} . \lambda h_{et} . \exists i_{et} \exists j_{et}[f(i) = \text{T} \land g(j) = \text{T} \land h = i \cup j]$

A simplified structure of sentence (18a) is provided in (18b), and its interpretation is provided in (19). As above, negation c-commands *and*, which in turn c-commands *any boy*. Thus, we may again be dealing with an intervention configuration.

(18)   a.   I don't think that Mary and any boy collaborated.
        b.   [neg [∃ [[Min [Lift Mary]] [and [Min [any boy]]]] collaborate]]

(19)   a. $\neg \exists X \exists y[\text{boy}(y) = \text{T} \land X = \{\text{Mary}\} \cup \{y\} \land \text{collaborate}(X) = \text{T}]$
        b. $\equiv \neg \exists y[\text{boy}(y) = \text{T} \land \text{collaborate}(\{\text{Mary}, y\}) = \text{T}]$

In this case, however, given that no sensible definition of disjunction can be provided that would stand in an entailment relation with (19)—that is, we lack a sensible non-boolean definition of disjunction—the restriction in (5) does not apply to the conjunction (namely, this version of *and* does not form an entailment scale with *or*), thus potentially capturing the acceptability of (18). An unfortunate consequence of this logic, however, is that occurrences of *any NP* in conjunction would be predicted to be acceptable even when they combine with distributive predicates. This is illustrated in (20), where for simplicity we assume that the distributive predicate is cumulative (which we mark with a *-operator; see Kratzer, 2007 for discussion).

(20)   a.   *I don't think that Mary and any boy laughed at my jokes.
        b.   [neg [∃ [[Min [Lift Mary]] [and [Min [any boy]]]] *laughed]]

(21)   a. $\neg \exists X \exists y[\text{boy}(y) = \text{T} \land X = \{\text{Mary}\} \cup \{y\} \land {}^{*}\text{laugh}(X) = \text{T}]$
        b. $\equiv \neg \exists y[\text{boy}(y) = \text{T} \land {}^{*}\text{laugh}(\{\text{Mary}, y\}) = \text{T}]$
        c. $\equiv \neg \exists y[\text{boy}(y) = \text{T} \land \text{laugh}(\text{Mary}) = \text{T} \land \text{laugh}(y) = \text{T}]$

Accordingly, the condition in (5), coupled with a non-boolean approach to *and*, overgenerates—it admits infelicitous examples of conjoined NPIs that combine with a distributive predicate.

3.3   Ambiguity of DP conjunction

An approach that takes DP conjunction to be ambiguous—that is, an approach that assumes that there are boolean and non-boolean lexical entries for *and*—initially appears to be better off than its alternatives discussed above. Namely, if a non-boolean lexical entry is used, as may be necessary with collective predication, then one would correctly predict no intervention effects given the condition in (5). However, an issue of overgeneration still arises: as it stands, nothing would prevent one from using non-boolean conjunction also with distributive predicates (e.g. Hoeksema, 1988; Krifka, 1990; Lasersohn, 1995, carefully demonstrate this), thus incorrectly allowing for obviation of intervention effects in those cases as well. While a theory that would force different derivations with collective vs. distributive predicates can be devised, we refrain from exploring this possibility here, not least because there may be good independent reasons to avoid an ambiguity approach to conjunction (see esp. Winter, 2001; Champollion, 2015; Schein, 2017). Rather, we take the patterns in §2 to support a revision of the condition in (5). The revision that we end up with is

agnostic with respect to the details of the analysis of conjunction (and disjunction).

4 The revision

We concluded that the facts described in §2, and the generalization/constraint stated in (9), contradict the refined characterization of interveners in the Revised Additional Restriction in (5). We propose that the key to understanding the source of (9) involves understanding how the semantic difference between distributive and collective predicates affects the relation between the sentence containing the NPIs and their alternatives, which includes alternatives in which conjunction is replaced by disjunction. We expose this relationship in terms of the semantic property in (22) (focusing here just on subject-collective predicates for simplicity).[9]

(22)   a.   For distributive VP: $\neg(A$ or B VP$) \Rightarrow \neg(A$ and B VP$)$.
        b.   For collective VP: $\neg(A$ or B VP$) \nRightarrow \neg(A$ and B VP$)$.

For instance, (23a) entails (23b).

(23)   a.   It's not the case that the girls <u>or</u> the boys have blue eyes.
        b. $\Rightarrow$ It's not the case that the girls <u>and</u> the boys have blue eyes.

However, (24a) does not entail (24b) (on its collective reading). Consider a scenario in which the girls and the boys all wrote a paper together, but no group of girls wrote a paper together, nor did any group of boys. In this scenario, the *or*-sentence is true, while the *and*-sentence (on its collective reading) is false.

(24)   a.   It's not the case that the girls <u>or</u> the boys wrote a paper together.
        b. $\nRightarrow$ It's not the case that the girls <u>and</u> the boys wrote a paper together.

In light of this observation, we suggest that, rather than checking whether a potential intervener cross-categorially entails some alternative operator, one must evaluate whether a pertinent sentence containing the NPI and the operator is entailed by its alternatives (which are induced by the operator). A pertinent sentence is one that is downward-entailing with respect to the NPI—that is, one in which replacing the NPI with a stronger expression results in a weaker meaning overall (see, e.g., Kadmon and Landman, 1993; Gajewski, 2005; Homer, 2008; Chierchia, 2004, 2006, 2013; Buccola and Spector, 2016; Crnič, 2014, 2019, for further arguments for such a switch).[10, 11] (A

---

[9]This property may need to be qualified for some collective predicates, for which the entailment pattern in (22b) may hold (Križ, 2015; Bar-Lev, 2018). To the extent that such predicates exist, and obligatorily validate the entailment pattern in (22b), we expect them to pattern with distributive predicates in creating intervention effects with conjoined *any NP*. On the other hand, if the validation is only optional (e.g. the predicates allow for multiple construals), then, in the presence of an NPI, we expect a disambiguation to a construal that does not validate (22b).

[10]A sentence S is downward-entailing with respect to (an occurrence of) α iff (i) S dominates α, and (ii) for any β such that $\beta \Rightarrow \alpha$, $S \Rightarrow S^{\alpha \to \beta}$, where $S^{\alpha \to \beta}$ is the result of replacing (the occurrence of) α with β in S. See Gajewski (2005) and Homer (2008) for slightly different formulations.

[11]Clause (ii) of the constraint needs to be further constrained in order to deal with sentences like (ia), which is entailed by its alternative in (ib). A proper statement would restrict the pertinent alternatives to those that are induced by the material that is appropriately local to the NPI (see Chierchia, 2013, for a proposal).

(i)   a.   Few students read any book.

revision of what was previously split off from the NPI Licensing Condition—viz. the Revised Additional Restriction in (5)—is crucially encoded as a part of the licensing condition because recourse to the constituent in which the NPI would be otherwise acceptable is required.)

(25)   **Revised NPI Licensing Condition**
        An NPI is acceptable only if it occurs in a sentence (i) that is downward-entailing with respect to the NPI, and (ii) whose scalar alternatives do not entail the sentence.

The condition in (25) has the generalization in (9) as an immediate consequence. Consider, for example, the unacceptable sentence in (26).

(26)   *I don't think that the girls and any boys have blue eyes.

Here, *and* is dominated by a sentence S that is downward-entailing with respect to the NPI—this is illustrated in (27); but at the same time, S is entailed by the *or*-alternative of S—this is illustrated in (28) (see also (23)). Thus, the sentence violates the Revised NPI Licensing Condition, yielding unacceptability.

(27)   a.   I don't think that the girls and some <u>boys</u> have blues.
        b.   ⇒ I don't think that the girls and some <u>tall boys</u> have blue eyes.
                                                [satisfies condition (i) of (25) ✓]

(28)   a.   I don't think that the girls <u>or</u> some boys have blue eyes.
        b.   ⇒ I don't think that the girls <u>and</u> some boys have blue eyes.
                                                [violates condition (ii) of (25) ✗]

Now consider the acceptable sentence in (29).

(29)   I don't think that the girls and any boys have ever written a paper together.

Here, *and* is again dominated by a sentence S that is downward-entailing with respect to the NPI—this is illustrated in (30); but now S is not entailed by the *or*-alternative of S—this is illustrated in (31) (see also (24)). Thus, the sentence respects the Revised NPI Licensing Condition, yielding acceptability.[12]

(30)   a.   I don't think that the girls and some <u>boys</u> have written a paper together.
        b.   ⇒ I don't think that the girls and some <u>tall boys</u> have written a paper together.
                                                [satisfies condition (i) of (25) ✓]

(31)   a.   I don't think that the girls <u>or</u> some boys have written a paper together.
        b.   ⇏ I don't think that the girls <u>and</u> some boys have written a paper together.
                                                [satisfies condition (ii) of (25) ✓]

---

        b.   No students read any book.

In addition, clause (i) of the constraint needs to be further revised to deal with acceptable cases of *any NP* in presuppositional, modal, and non-monotonic environments (Kadmon and Landman, 1993; Gajewski, 2011; Crnič, 2014, 2019).

    [12]If the alternatives involve singular DPs, then the *or*-alternative is ill-formed, and thus perhaps does not count as an alternative. The sentence would thus vacuously satisfy the condition.

5 Two predictions

5.1 Numeral intervention

Importantly, the core observation described in (9) holds not just for conjunction, but also for numerals above *one*, e.g. *four*, which, like *and*, are considered "strong", and hence interveners, in Chierchia (2013). For instance, (32a) and (32b), which both include the distributive predicate *read any paper of mine*, exhibit an acceptability contrast between *one*, which is acceptable, vs. *four*, which is unacceptable. However, when the predicate is collective (*write any paper together*), *four* is acceptable.[13]

(32)   a.   I don't have <u>one</u> colleague who has <u>read any paper of mine</u>.
        b.   *I don't have <u>four</u> colleagues who have <u>read any paper of mine</u>.
        c.   I don't have <u>four</u> colleagues who have <u>written any paper together</u>.

Consider first the matrix sentence in (32b). It is downward-entailing with respect to *any paper of mine*, as illustrated in (33). However, it also holds that the alternative obtained by replacing *four* with, say, *three* entails the sentence, as illustrated in (34): if I do not have (even) three colleagues who have read my paper, then of course I do not have four such colleagues. Accordingly, the sentence violates the Revised NPI Licensing Condition.[14]

(33)   a.   I don't have four colleagues who have read a <u>paper</u> of mine.
        b.   ⇒ I don't have four colleagues who have read a <u>long paper</u> of mine.

[satisfies condition (i) of (25) ✓]

(34)   a.   I don't have <u>three</u> colleagues who have read a paper of mine.
        b.   ⇒ I don't have <u>four</u> colleagues who have read a paper of mine.

[violates condition (ii) of (25) ✗]

In contrast, the sentence in (32c) is downward-entailing with respect to the NPI, but it is not entailed by the alternatives obtained by replacing *four* with other numerals. This is illustrated with *three* in (36): there may well not be (a group of) three colleagues who wrote a paper together, while there is (a group of) four colleagues who wrote a paper together (see fn. 14 for more details).

(35)   a.   I don't have four colleagues who have written a <u>paper</u> together.
        b.   ⇒ I don't have four colleagues who have written a <u>long paper</u> together.

---

[13]Chierchia (2013) notes that the examples with numerals need not always exhibit an intervention effect due to the fact that one can accommodate the pertinent scale beginning with the numeral. This is more difficult with *and* (and *every*, *always*), where this would result in a scale containing a single element.

[14]Slightly more formal representations of the meanings of the sentences discussed in this subsection are provided in the following. The crucial difference between them pertains to the distributivity of *read* vs. the non-distributivity of *write together*. See Buccola and Spector (2016) for evidence for this analysis.

(i)   a. $\neg \exists X[\#X = 4 \wedge \forall x \in X[\text{colleague}(x) = \text{T}] \wedge \exists y[\text{paper}(y) = \text{T} \wedge \forall x \in X[\text{read}(x, y) = \text{T}]]]$
       b. $\equiv \neg \exists X[\#X \geq 4 \wedge \forall x \in X[\text{colleague}(x) = \text{T}] \wedge \exists y[\text{paper}(y) = \text{T} \wedge \forall x \in X[\text{read}(x, y) = \text{T}]]]$

(ii) a. $\neg \exists X[\#X = 4 \wedge \forall x \in X[\text{colleague}(x) = \text{T}] \wedge \exists y[\text{paper}(y) = \text{T} \wedge \text{write.together}(X, y) = \text{T}]]$
       b. $\not\equiv \neg \exists X[\#X \geq 4 \wedge \forall x \in X[\text{colleague}(x) = \text{T}] \wedge \exists y[\text{paper}(y) = \text{T} \wedge \text{write.together}(X, y) = \text{T}]]$

[satisfies condition (i) of (25) ✓]

(36)   a.   I don't have <u>three</u> colleagues who have written a paper together.
       b.   ⇒ I don't have <u>four</u> colleagues who have written a paper together.

[satisfies condition (ii) of (25) ✓]

The condition in (25) predicts these contrasts: substituting the numeral with a smaller numeral yields a logically stronger sentence in the cases with distributive predicates, hence the intervention effect, whereas in the case of collective predicates, there is no logical relation between the various numerical alternatives, hence the lack of an intervention effect.

5.2   Other interveners

We have shown that conjunction and numerical phrases are not interveners *simpliciter*; in particular, they do not induce intervention in configurations with collective predicates. Can similar configurations be constructed with other potential interveners? It turns out that conjunction and numerical phrases may be uniquely able to avoid inducing intervention effects in a way that obeys the condition in (25). Consider *every*, *all*, and *always*, which tend to give rise to intervention effects.

(37)   a.   *Not all students did any homework.
       b.   *Mary doesn't always read any books.

In order not to violate the condition in (25), one would need to find a configuration in which the alternative with *some*, *Not <u>some</u> (= No) NP VP*, does not entail the sentence with *all*, *Not <u>all</u> NP VP*. But this entailment always holds: to the extent that universal quantifiers are acceptable with collective predicates, the negation of such predication will be entailed by the negation of their counterparts with *some*. This is exemplified in (38) and stated more generally in (39) (on the assumption that *every*/*all* entails existence). (Similar considerations extend to *always* and *sometimes*).

(38)   a.   No students met/collaborated.
       b.   ⇒ Not all students met/collaborated.

(39)   For collective VP: every/all NP VP ⇒ some NP VP.

Accordingly, configurations in which NPIs occur in the immediate scope of *every NP* or *always* cannot satisfy the Revised NPI Licensing Condition, resulting in their unacceptability.

6   Towards an explanation

We have provided a descriptive condition for what constitutes an intervention configuration as part of the NPI Licensing Condition, as in (25). We conclude this remark by briefly discussing how (25) relates to two families of recent theories of NPI licensing and intervention. The first is tied to operators, while the second is not.

6.1 Movement-based approaches

One family of approaches to intervention with NPIs can be stated as requiring the relation between the NPI and its putative 'licensing' operator to involve a syntactic dependency, for example formed by covert phrasal movement. This means that the sentence in (40) would be acceptable if the NPI could move to its licensing operator (negation), but this is not possible in (40): *any boy* cannot extract out of the conjoined phrase, which is an island for (covert) phrasal movement. This is demonstrated by the unavailability of *wh*-movement in (41a), and the impossibility of QR of *every boy* above *a different person* in (41b).

(40)   *I don't think that Mary and any boy have laughed at my jokes.

(41)   a.   *Which boy do I think Mary and have laughed at my jokes?
        b.   %A different person thinks Mary and every boy have laughed at my jokes.
             (intended: ∀ > ∃; only discourse-anaphoric interpretation of *different* is available)

An obvious issue for such an approach arises with the acceptability of sentences like (42): all else being equal, they should be unacceptable since movement out of the conjoined phrase is constrained precisely as it is in (41), as demonstrated in (43).

(42)   I don't think that Mary and any boy have collaborated.

(43)   a.   *Which boy do I think Mary and have collaborated?
        b.   %A different person thinks Mary and every boy have collaborated.
             (intended: ∀ > ∃; only discourse-anaphoric interpretation of *different* is available)

Another movement-based theory, potentially better poised to capture the data, comes from Guerzoni (2006), who argues that NPIs can be licensed in either of *two* ways: by phrasal movement (p-movement) or by feature movement (f-movement). As just discussed, the acceptable NPIs in conjunctions like (40) cannot be captured by p-movement, since the conjunctions are islands that block p-movement. But can the NPI be licensed by f-movement? Guerzoni (2006), building on Pesetsky (2000), argues that f-movement is not subject to the same constraints on movement as p-movement, but is instead blocked by 'interveners'. On her theory, whether or not an expression is an 'intervener' is diagnosed by whether or not it creates *wh*-intervention effects. If it can be shown that *and* is an intervener in (40), but not in (42), then we may get some insight into why (42) is acceptable, but not (40). The pertinent data are in (44) (judgment marks omitted):

(44)   a.   Which student thinks that Mary and which boy have laughed at my jokes?
        b.   Which student thinks that Mary and which boy have collaborated?

For the f-movement account to capture the NPI facts, there would need to be a contrast in acceptability between the two sentences in (44): (44a) should be unacceptable, and (44b) acceptable. We found it hard to elicit this contrast. However, we note that the judgments are subtle and thus mandate further testing.

Furthermore, some general questions arise for the movement approaches to intervention in view of being tied to an operator-based characterization of NPI licensing. One set of questions is theoretical in nature. For example, even if the approaches captured the data, they seem to us to provide little insight into why the two occurrences of *and* in (40) and (42) differ in terms of inter-

vention effects. This is different from the environment-based approach discussed in the upcoming section, on which the intervention effects are explained by how they affect exhaustification.

The other set of issues is empirical in nature. On the one hand, due to being operator-based, the movement approaches face an issue with the arguments for the environment-based approach to NPI licensing. This is illustrated by the sensitivity of NPIs to the collectivity of the main predicate in (45) (see Buccola and Spector, 2016, for further arguments).

(45) a. #Fewer than ten soldiers surrounded any castle.
      b. Fewer than ten soldiers visited any castle.

On the other hand, the approaches also face an issue with certain configurations that do not exhibit intervention for f-movement. For example, given the felicity of (46), which would be acccounted for by f-movement of *which philosopher* to matrix, we would expect that (47) should be acceptable as well (namely, the pertinent NPI feature could f-move out of the singular definite description and be checked by negation), contrary to fact (see Crnič and Buccola, 2019, for exceptions).

(46) Which student read the book that praised which philosopher?

(47) #Mary didn't read the book that praised any philosopher.

6.2 Exhaustification-based approaches

A second family of approaches to intervention arises from the work of Chierchia (2004), Gajewski (2011), and Chierchia (2013). On such approaches, the alternatives induced by operators that c-command NPIs and that occur in constituents that are downward-entailing with respect to the NPIs obligatorily enter into determining the acceptability of the NPIs. These alternatives are, then, responsible for the unacceptability of the sentences because their incorporation into subsequent computations results in semantic anomaly—at least if these alternatives are stronger than the sentence.

Chierchia (2004)'s core idea is that intervention effects are the result of implicatures triggered by an exhaustification operator that associates with the NPI—and all the intervening scalar items. For instance, in **John didn't drink the soda and any whisky*, the occurrence of *and* leads to the implicature that the *or*-alternative (*John didn't drink the soda or any whisky*) is false. Overall, then, the sentence conveys that John didn't drink both the soda and a portion of whisky, but he did drink one or the other. The implicature ends up destroying the downward-entailingness of the NPI's environment, hence is responsible for the unacceptability of the NPI, as illustrated in (48).

(48) a. ¬(John drank the soda and some <u>whisky</u>) ∧ (John drank the soda or some <u>whisky</u>)
      b. ⇒ ¬(John drank the soda and some <u>Irish whisky</u>) ∧ (John drank the soda or some <u>Irish whisky</u>)

What about acceptable sentences with collective predicates, discussed above, such as *John didn't mix the soda and any whisky*? The same interference also arises for them, as shown in (49).

(49) a. ¬(John mixed the soda and some <u>whisky</u>) ∧ (John mixed the soda or some <u>whisky</u>)
      b. ⇒ ¬(John mixed the soda and some <u>Irish whisky</u>) ∧ (John mixed the soda or some <u>Irish whisky</u>)

However, sentences with collective predicates differ from those with distributive predicates in one important respect, which can be capitalized on in the full system of Chierchia (2013). Specifically, in this system, the sentence with the distributive predicate (*drink*) ends up having the interpretation in (50), which is inconsistent and thus reason for the sentence to be unacceptable (see Chierchia, 2013, ch. 7, for details). On the other hand, the sentence with the collective predicate has the interpretation in (51), which is consistent and should thus be acceptable. The consistency of this meaning is a consequence of the pertinent scalar alternatives (including subdomain alternatives in Chierchia, 2013) not entailing the sentence with the NPI.[15]

(50) #¬(John drank the soda and some whisky in D)
  ∧ John drank the soda
  ∧∀$D' \subseteq D$: John drank some whisky in D'

  (prediction: *John drank the soda and any whisky* is unacceptable)

(51) ¬(John mixed the soda and some whisky in D)
  ∧ John mixed the soda
  ∧∀$D' \subseteq D$: John mixed some whisky in D'

  (prediction: *John mixed the soda and any whisky* is acceptable)

While it seems that the data we discussed fits with proposals like that of Chierchia, the

---

[15]Here we provide the derivations in a simplified form. D refers to the domain of discourse, over which portions of whisky (etc.) are quantified. The distributive sentence (with *drink*) asserts the proposition in (ia) and has the scalar alternatives in (ib) and the subdomain alternatives in (ic) (we omit the assertion itself from these sets). Within the system of Chierchia (2013), these alternatives get negated, yielding the contractory overall meaning in (id).

(i) John didn't drink the soda and any whisky.
  a. Assertion: ¬(J drank the soda ∧ J drank some whisky in D)
  b. Scalar alternatives: $\{$¬(J drank the soda ∨ J drank some whisky in D)$\}$
  c. Subdomain alternatives: $\{$¬(J drank the soda)$\}$
      $\cup \{$¬(J drank some whisky in D') | $D' \subseteq D\}$
      $\cup \{$¬(J drank the soda ∧ J drank some whisky in D') | $D' \subseteq D\}$
  d. Overall meaning: ¬(J drank the soda ∧ J drank some whisky)
      ∧ J drank the soda ∨ J drank some whisky in D
      ∧ J drank the soda
      ∧∀$D' \subseteq D$: J drank some whisky in D'

The collective sentence (with *mix*), by contrast, works as in (ii), whose overall meaning is non-contradictory.

(ii) John didn't mix the soda and any whisky.
  a. Assertion: ¬(J mixed the soda & some whisky in D)
  b. Scalar alternatives: $\{$¬(J mixed the soda ∨ J mixed some whisky in D)$\}$
  c. Subdomain alternatives: $\{$¬(J mixed the soda)$\}$
      $\cup \{$¬(J mixed some whisky in D') | $D' \subseteq D\}$
      $\cup \{$¬(J mixed the soda ∧ J mixed some whisky in D') | $D' \subseteq D\}$
  d. Overall meaning: ¬(J mixed the soda & some whisky in D)
      ∧ (J mixed the soda ∨ J mixed some whisky in D)
      ∧ J mixed the soda
      ∧∀$D' \subseteq D$: J mixed some whisky in D'

approach does predict non-trivial inferences for sentences like *John didn't mix the soda and any whisky*. Specifically, *John didn't mix the soda and any whisky* is, all else being equal, predicted to convey that John mixed the soda and that he mixed (all portions of) the whisky, as provided in (51). Since this inference does not seem to necessarily accompany such sentences, the question arises what its absence may be due to in Chierchia's system. We point to two possibilities.

Constraint on pruning.   The logical properties holding between the sentence and its alternatives points to one possible direction of answering this question. Chierchia assumes in his system that all the scalar and subdomain alternatives induced by a constituent in the scope of an exhaustification operator are relevant. This is necessary in order to derive intervention effects. Crucially, the scalar alternatives whose exhaustification yields ungrammaticality are stronger than the respective constituent itself, as in (52a)–(52b). As we rehearsed above, this is crucially not the case for the alternative to conjunction with a collective predicate, as in (53).

(52)   a.   *Not every boy read any book.
                    ¬(a boy read a book) ⟹ ¬(every boy read a book)
        b.   ?*Mary doubts that four boys read any books.
                    ¬(three boys read a book) ⟹ ¬(four boys read a book)

(53)   John didn't mix the soda and any whisky.
            ¬(John mixed the soda or some whisky) ⇏ ¬(John mixed the soda and some whisky)

Accordingly, if the absolute constraint on pruning of alternatives is replaced by a constraint against the pruning of *stronger* alternatives, then we may account for the absence of the inference under discussion—in the case of pruning of logically independent alternatives, the problematic inference disappears.

Timing of pruning.   An alternative explanation relies on an architectural underpinning of Chierchia's system (cf. Gajewski, 2003; Fox and Hackl, 2006): the acceptability of NPIs is effectively determined at a level that is blind to non-logical content (in the so-called 'deductive system', Fox and Hackl, 2006). Accordingly, if one obtains a consistent meaning at that level, as is the case of exhaustification with collective conjunction, the NPI is licensed; it is possible that contentful considerations, including the pruning of certain alternatives, are effected later. We have to leave it open here which of these two options, if either, is on the right track.[16]

---

[16]A similar state of affairs with (non-)intervention may obtain also on other alternative-sensitive approaches to NPI licensing, in particular the approach that takes the licensing of *any* to involve a covert *even* operator that associates with *any NP* (see, e.g., Lahiri, 1998; Crnič, 2014, 2019). If we adopt the assumption that *even* must associate with all the alternatives induced in its scope (following Chierchia, 2013), then we obtain the following predictions: (i) in the case of conjoined NPIs with distributive predicates, the pertinent disjunctive alternatives will entail the sentence, and so the sentence will end up having a contradictory presupposition; and (ii) in the case of conjoined NPIs with collective predicates, the disjunctive alternatives will not entail the sentence, and so the presupposition of *even* will be consistent. As in the case with the exhaustification-based approach, many questions arise and further study is mandated.

7 Conclusion

NPI intervention effects with conjunction are sensitive to the collectivity of the predicate that combines with the conjunction: an NPI conjoined with another DP is acceptable only if the conjunction combines with a collective predicate. We proposed to capture this distribution by imposing a constraint on the pertinent constituent that is downward-entailing with respect to the NPI: it must not be entailed by its scalar alternatives. This distribution of NPI intervention effects provides further support for an environment-based statement of the condition on NPI licensing (see Heim, 1984; Gajewski, 2005, 2011; Homer, 2008; Chierchia, 2004, 2013; Crnič, 2019, for further discussion).

References

Bar-Lev, Moshe (2018). Free Choice, Homogeneity, and Innocent Inclusion. PhD thesis. Jerusalem, Israel: The Hebrew University of Jerusalem. URL: https://semanticsarchive.net/Archive/2JiYWEyM/.

Buccola, Brian and Benjamin Spector (2016). Modified Numerals and Maximality. In: *Linguistics and Philosophy* 39.3, pp. 151–199. DOI: 10.1007/s10988-016-9187-2.

Champollion, Lucas (2015). Ten Men and Women Got Married Today: Noun Coordination and the Intersective Theory of Conjunction. In: *Journal of Semantics* 33.3, pp. 1–62. DOI: 10.1093/jos/ffv008.

Chierchia, Gennaro (2004). Scalar Implicatures, Polarity Phenomena, and the Syntax/Pragmatics Interface. In: *The Cartography of Syntactic Structures*. Ed. by Adriana Belletti. Vol. 3. Structures and Beyond. Oxford, England: Oxford University Press, pp. 39–103.

Chierchia, Gennaro (2006). Broaden Your Views: Implicatures of Domain Widening and the "Logicality" of Language. In: *Linguistic Inquiry* 37.4, pp. 535–590. DOI: 10.1162/ling.2006.37.4.535.

Chierchia, Gennaro (2013). *Logic in Grammar: Polarity, Free Choice, and Intervention*. Oxford, England: Oxford University Press.

Crnič, Luka (2014). Non-Monotonicity in NPI Licensing. In: *Natural Language Semantics* 22.2, pp. 169–217. DOI: 10.1007/s11050-014-9104-6.

Crnič, Luka (2019). *Any*: Logic, Likelihood, and Context. The Hebrew University of Jerusalem. URL: https://ling.auf.net/lingbuzz/004552. Submitted.

Crnič, Luka (2020). Number in NPI Licensing. The Hebrew University of Jerusalem. URL: https://ling.auf.net/lingbuzz/004954.

Crnič, Luka and Brian Buccola (2019). Scoping NPIs out of DPs. In: *Snippets* 37, pp. 19–21. DOI: 10.7358/snip-2019-037-crbu.

Fauconnier, Gilles (1975). Polarity and the Scale Principle. In: *Chicago Linguistics Society (CLS)* 11, pp. 188–199.

von Fintel, Kai (1999). NPI Licensing, Strawson Entailment, and Context Dependency. In: *Journal of Semantics* 16.2, pp. 97–148. DOI: 10.1093/jos/16.2.97.

Fox, Danny and Martin Hackl (2006). The Universal Density of Measurement. In: *Linguistics and Philosophy* 29.5, pp. 537–586. DOI: 10.1007/s10988-006-9004-4.

Gajewski, Jon (2003). On Analyticity in Natural Language. Manuscript. Massachusetts Institute of Technology. URL: http://www.gajewski.uconn.edu/papers/analytic.pdf.

Gajewski, Jon (2005). Neg-Raising: Polarity and Presupposition. PhD thesis. Cambridge, MA: Massachusetts Institute of Technology. URL: http://hdl.handle.net/1721.1/33696.

Gajewski, Jon (2011). Licensing Strong NPIs. In: *Natural Language Semantics* 19.2, pp. 109–148. DOI: 10.1007/s11050-010-9067-1.

Guerzoni, Elena (2006). Intervention Effects on NPIs and Feature Movement: Towards a Unified Account of Intervention. In: *Natural Language Semantics* 14.4, pp. 359–398. DOI: 10.1007/s11050-007-9008-9.

Heim, Irene (1984). A Note on Negative Polarity and Downward Entailingness. In: *North East Linguistic Society (NELS)*. Vol. 14, pp. 98–107.

Hirsch, Aron (2017). An Inflexible Semantics for Cross-Categorial Operators. PhD thesis. Cambridge, MA: Massachusetts Institute of Technology. URL: http://hdl.handle.net/1721.1/113782.

Hoeksema, Jack (1988). The Semantics of Non-Boolean "and". In: *Journal of Semantics* 6.1, pp. 19–40. DOI: 10.1093/jos/6.1.19.

Homer, Vincent (2008). Disruption of NPI Licensing: The Case of Presuppositions. In: *Semantics and Linguistic Theory (SALT)*. Vol. 18, pp. 429–446. DOI: 10.3765/salt.v18i0.2483.

Horn, Laurence R. (1972). On the Semantic Properties of Logical Operators in English. PhD thesis. Los Angeles, CA: University of California, Los Angeles.

Kadmon, Nirit and Fred Landman (1993). Any. In: *Linguistics and Philosophy* 16.4, pp. 353–422. DOI: 10.1007/BF00985272.

Keenan, Edward L. and Leonard M. Faltz (1985). *Boolean Semantics for Natural Language*. Dordrecht, Holland: D. Reidel Publishing Company.

Kratzer, Angelika (2007). On the Plurality of Verbs. In: *Event Structures in Linguistic Form and Interpretation*. Ed. by Johannes Dölling, Tatjana Heyde-Zybatow, and Martin Schäfer. Berlin, Germany: Walter de Gruyter, pp. 269–300.

Krifka, Manfred (1990). Boolean and Non-Boolean "and". In: *Papers from the 2nd Symposium on Logic and Language*. Ed. by László Kálmán and László Pólos. Budapest, Hungary: Akadémiai Kiadó, pp. 161–188. URL: http://amor.cms.hu-berlin.de/~h2816i3x/Boolean-and-Non-Boolean-And.pdf.

Križ, Manuel (2015). Aspects of Homogeneity in the Semantics of Natural Language. PhD thesis. Vienna, Austria: University of Vienna. URL: http://othes.univie.ac.at/37457/.

Ladusaw, William A. (1979). Polarity Sensitivity as Inherent Scope Relations. PhD thesis. Austin, TX: University of Texas at Austin.

Lahiri, Utpal (1998). Focus and Negative Polarity in Hindi. In: *Natural Language Semantics* 6.1, pp. 57–123. DOI: 10.1023/A:1008211808250.

Lasersohn, Peter (1995). *Plurality, Conjunction and Events*. Vol. 55. Studies in Linguistics and Philosophy. Dordrecht, Holland: Kluwer. DOI: 10.1007/978-94-015-8581-1.

Linebarger, Marcia C. (1980). The Grammar of Negative Polarity. PhD thesis. Cambridge, MA: Massachusetts Institute of Technology. URL: http://hdl.handle.net/1721.1/16067.

Linebarger, Marcia C. (1987). Negative Polarity and Grammatical Representation. In: *Linguistics and Philosophy* 10.3, pp. 325–387. DOI: 10.1007/BF00584131.

Montague, Richard (1970). English as a Formal Language. In: *Linguaggi nella Società e nella Tecnica.* Ed. by Bruno Visentini. Milan, Italy: Edizioni di Comunità. Reprinted in Montague, 1974, pp. 188–221.

Montague, Richard (1974). *Formal Philosophy: Selected Papers of Richard Montague.* Ed. by Richard Thomason. New Haven, CT: Yale University Press.

Partee, Barbara and Mats Rooth (1983). Generalized Conjunction and Type Ambiguity. In: *Meaning, Use, and Interpretation of Language.* Ed. by Reiner Bäuerle, Christoph Schwarze, and Arnim von Stechow. Berlin, Germany: Walter de Gruyter, pp. 361–383.

Pesetsky, David (2000). *Phrasal Movement and Its Kin.* Cambridge, MA: MIT Press.

Sauerland, Uli (2004). Scalar Implicatures in Complex Sentences. In: *Linguistics and Philosophy* 27.3, pp. 367–391. DOI: 10.1023/B:LING.0000023378.71748.db.

Schein, Barry (2017). *'And': Conjunction Reduction Redux.* Cambridge, MA: MIT Press.

Winter, Yoad (2001). *Flexibility Principles in Boolean Semantics: The Interpretation of Coordination, Plurality, and Scope in Natural Language.* Cambridge, MA: MIT Press.

Word count (excluding abstract and references): 4,734 (texcount) / 6,437 (Monterey tool)