Dynamic Intervention
A DRT-based Characterization of Interveners in NPI-Licensing

Manfred Sailer
(manfred.sailer@phil.uni-goettingen.de)

1 Data

Negative Polarity Items (NPIs) such as English *ever*, *any*, *give a damn* in (1) must occur in the scope of a licenser — negation or another appropriate items (Klima 1964, Ladusaw 1980). NPIs will be underlined in this paper.

(1) a. Kim didn't give a damn about this issue.
b. I doubt that Kim gave a damn about this issue.
c. Few linguists give a damn about this issue.

If a universal quantifier takes scope between the negation and the NPI, the licensing is blocked, (2-b). This has led Linebarger (1980) to postulate that the NPI must be *in the immediate scope* of the licenser. In this paper, we will say that a universal quantifier is an *intervener* (for NPI licensing), or that it shows an *intervention effect*.

(2) a. Kim didn't give any apple to every teacher.
b. *Kim didn't give every teacher any apple.

Besides universal quantification, other quantified NPs (such as *most N*), adverbial clauses (*because*-clauses) also constitute interveners. In this paper, we will focus on the difference in intervention between *and* and *or*: While *or* does not block NPI licensing, *and* is a clear intervener.

(3) a. I doubt that Kim did her homework or went to any classes this week.
b. *I doubt that Kim did her homework and went to any classes this week.

According to Postal (2005), the difference between conjunction and disjunction in intervention in NPI-licensing was first mentioned in Ross (1967). The data, however, did not receive much attention in NPI research until recently (Chierchia 2004, Postal 2005). Postal (2005) shows that *and* blocks NPI licensing in all of its conjuncts, whereas *or* is transparent for NPI licensing in either disjunct.

(4) a. I did not investigate any verbs or/ *and any nouns.
b. I did not investigate that verb or/ *and any nouns.
c. I did not investigate any verbs or/ *and that noun.

We will argue that the few existing accounts for the contrast in (3) are not satisfactory. Taking a DRT perspective, however, the quantificational interveners and *and* group together in a natural way: they can all be captured as a dynamic connection of two DRSs, i.e. the first DRS can change the information state with respect to which the second DRS is evaluated. In contrast to this, the non-intervening elements, including disjunction, do not establish such an internally dynamic relation.

2 Previous Approaches

Linebarger (1980) heavily relies on intervention effects in her theory of NPI licensing. An NPI must be in the immediate scope of a negation at the Logical Form (May 1977) of the sentence in which it occurs, or at the Logical Form of an implicated sentence (the so-called *negative implicatum*, NI). This theory predicts the disjunction-conjunction asymmetry, since the *or*-sentence in (3) has (5) as its NI.

(5) I think that Kim did not do her homework and that Kim did not go to any classes this week.

Here, the NPI *any* is in the immediate scope of a negation. For the conjunction in (3) we cannot find a similar NI. While this is a very simple account of the facts, there are general problems with Linebarger's theory. To account for NPI licensing by *few N* in (6-a), Linebarger derives an NI of the form in (6-b).

(6) a. Few students ever enjoyed syntax classes.
b. Many students didn't ever enjoy syntax classes.

Note (6-b) is only an implicature on the strong reading of *few*, i.e. on the reading where there is a presupposed set of students. The NPI licensing in (6-a), however, also works with the weak reading of *few*. We conclude that while the NI approach could directly account for the data in (3) it has independent, fundamental problems.

Chierchia (2004) presents the class of interveners for NPI licensing as a natural class: they are maximal elements on a contextually relevant scale. Thus, *and* is the maximal element on the scale $\langle$*or*, *and*$\rangle$, whereas *or* is not. Similarly *every* is maximal, whereas *some* is the minimal element on the same scale. This characterization accounts for the asymmetry in (3).

Chierchia shows with example (7) that while universal quantifiers are interveners for NPI licensing, *if*-clauses are not. This is a potential problem for a theory which treats implication as a universal quantification over situations and relates intervention effects to universal quantifiers. Instead, Chierchia argues, the data follow from the fact that *if* is not a maximal element on a scale.

(7) I doubt that if John gets drunk, anyone will be surprised.

We will argue that there are two readings of *if*-clauses which do form a scale and that, contrary to Chierchia's expectation, the maximal element on this scale can be found in the complement clause of *doubt*. (8) repeats the standard examples for the two readings of *if*-clauses. In (8-a) every donkey that is owned is taken care of, whereas in (8-b), only some dime needs to be put into the parking meter. This, however, puts the two readings of *if*-clauses on a scale. Chierchia would predict that under negation only the weak reading, (8-b), is possible.

(8) a. If John owns a donkey, he cares for it.
b. If John has a dime, he puts it into the parking meter.

(9) I doubt that if Kim gets an invitation to a Halloween party, he will miss it.

However, (9) is true in a situation in which Kim gets two invitations but only goes to one party. This corresponds to a strong reading in the scope of negation. This shows that Chierchia's explanation for (7) is not compatible with his own system. We will show in Section 5 that there is a much simpler explanation of the non-intervention of *if*-clauses.

Postal (2005) lists an impressive amount of data to illustrate the conjunction-disjunction asymmetry. He assumes that the disjunction cases are derived by an underlying coordination, where a negation is present in each conjunct. This negation is extracted "across the board", and as a consequence, the *and* is realized as *or*. Even though the nature of the assumed lexical substitution of *and* with *or* is unclear, the NPI licensing in disjunction is correctly accounted for. However, it remains questionable whether Postal also accounts for the ungrammaticality of the *and* examples. For instance, how/why is across the board extraction of negation from disjunction banned?

3 Discourse Representation Theory

We will assume that the semantic representation of a sentence is a Discourse Representation Structure (DRS, as in Kamp and Reyle (1993) or von Genabith, Kamp and Reyle (2004)). A DRS

is a pair consisting of a universe of discourse referents (U) and a set of conditions (C). We assume the original DRT-vocabulary, i.e. conditions are either atomic ($x_1 = x_2$, or $R(x_1, \ldots, x_n)$) or of the form $\neg K$, K_1**or**K_2, $K_1 \Rightarrow K_2$. In addition we adopt the sequencing/merge operator as used in Muskens (1996) (";") which combines two DRSs into a new DRS. We will use the sequencing operator as the representational reflex of syntactic co-ordination. The interpretation of a DRS is formulated in terms of its *context change potential*. In other words, a DRS maps an input information state g into some output information state h, where an information state is conceived of as a partial function from the set of discourse referents to the individuals in the model. Following Muskens (1996), we assume that a DRS denotes a set of pairs of information states, where $[\![\langle x_1 \ldots x_n | C_1 \ldots C_m \rangle]\!] = \{\langle g, h\rangle |\ g[x_1 \ldots x_n]h \ \&\ h \in [\![C_1]\!] \cap \ldots \cap [\![C_m]\!]\}$ and $[\![K_1;K_2]\!] = \{\langle g, h\rangle | \exists i(\langle g, i\rangle \in [\![K_1]\!] \& \langle i, h\rangle \in [\![K_2]\!])\}$. A condition denotes a set of information states, where $[\![x_1 = x_2]\!] = \{g | g(x_1) = g(x_2)\}$, $[\![R(x_1 \ldots x_n)]\!] = \{g |\ \langle g(x_1), \ldots g(x_n)\rangle \in [\![R]\!]\}$, $[\![\neg K]\!] = \{g |\ \neg \exists h \langle g, h\rangle \in [\![K]\!]\}$, $[\![K_1$**or**$K_2]\!] = \{g |\ \exists h(\langle g, h\rangle \in [\![K_1]\!]$ or $\langle g, h\rangle \in [\![K_2]\!])\}$, and $[\![K_1 \Rightarrow K_2]\!] = \{g |\ \forall h(\langle g, h\rangle \in [\![K_1]\!] \rightarrow \exists i \langle h, i\rangle \in [\![K_2]\!])\}$

When two DRSs, K_1 and K_2, are combined into a condition or a DRS, the second DRS, K_2, can either be interpreted with respect to the information state of the combination, or with respect to the output state of the first DRS, K_1. In the latter case, we will speak of an *internally dynamic* DRS-combination. It follows from the indicated semantics of DRSs and conditions, that $K_1 \Rightarrow K_2$ and $K_1; K_2$ are internally dynamic, whereas K_1**or**K_2 is not.

To add generalized quantifiers to the basic DRT language, the syntax is enriched by conditions of the form **Quant**xK_1K_2, where **Quant** is some determiner, x is the variable bound by this determiner, K_1 is the restrictor and K_2 is the nuclear scope. The interpretation of such conditions depends on the choice of the quantifier, but in each case the condition is internally dynamic (see von Genabith et al. (2004)).

4 Analysis

Since we do not discuss the nature of NPI licensing in this paper, we will simply assume that an NPI must occur in the scope of an appropriate operator. In (10) the licensing operators are characterized as the negation and the antecedent of an implication. The latter characterization accounts for NPI licensing in *if*-clauses and in the restrictor of universal quantifiers.

(10) **NPI Licensing:** NPI is licensed when it is embedded within a DRS K which occurs in a negation ($\neg K$) or as the antecedent of a conditional ($K \Rightarrow K'$).

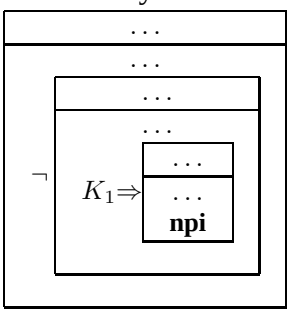
The semantics of DRSs gives us a natural characterization of the interveners mentioned in Section 1: Interveners introduce internally dynamic operators that stand between the semantic contribution of the NPI and the licensing operator.

(11) **Intervention:** There may not be an internally dynamic operator intervening between the semantic representation of an NPI and its licensing operator.

This simple constraint accounts for the intervention effect found with universal quantifiers and co-ordination, as it excludes the potential DRSs in Figure 1. It is important for our approach that we use the sequencing operator ";" as an explicit representation of the semantics of the co-ordination particle *and* instead of merging the DRSs of the two conjunctions. With this representation the parallelism between universal quantification and co-ordination is captured in the presence of the internally dynamic operators ("$\Rightarrow$" and ";" respectively). If, instead of the coordination or the universal quantifier, there is a disjunction, as shown in Figure 2, the constraint in (11) does not lead to a blocking of the licensing relation, since **or** is not internally dynamic.

The definition of the intervening operator correctly excludes NPIs in both conjuncts and allows them in both disjuncts. It also excludes them in the nuclear scope of a universal quantifier, but allows them in its restrictor, since principle (10) licenses NPIs in this position.

* I don't think that every student read any book.



* John didn't drink wine and any coffee.

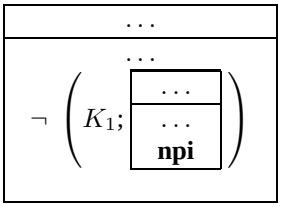


Figure 1: Potential DRSs with interveners.

John didn't drink wine or any coffee.

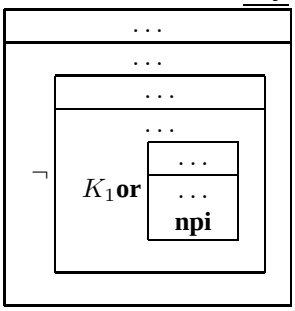


Figure 2: DRS for a sentence with disjunction

5 Extensions

The account also extends to generalized quantifiers. As mentioned in Section 3, generalized quantifiers are internally dynamic. Thus, they are correctly predicted to show intervention effects. The same is true for numerals. It has been observed that numerals show intervention effects if they have an *at least* n interpretation. Under such an interpretation, the numerals will be treated a generalized quantifier rather than as an indefinite, and the intervention effect follows directly.[1]
Chierchia's observation that *if*-clauses are not interveners can also be accounted for. Consider the example in (12-a), whose paraphrase is given in (12-b), showing that the negation is interpreted in the consequent of the conditional. Had the negation wide scope over the entire complement clause, we would get a reading $\neg(\phi \rightarrow \psi)$, which is equivalent to $\phi \wedge \neg\psi$. This reading is not available for (12-a), as shown with the inadequacy of (12-c) as a paraphrase for (12-a).

(12) a. I doubt that if Mary goes to the party, she will wear a red dress.
b. = I think that if Mary goes to the party, she will not wear a red dress.
c. $\neq$ I think that Mary goes to the party and she will not wear a red dress.

Following common practice in DRT, we assume a lexical decomposition of verbs that incorporate a negation. Thus, we treat *doubt* as *think that not*, which gives us the operators needed to represent (12-a) as in (12-b). The resulting DRS condition for the complement clause is $K \Rightarrow \boxed{\begin{array}{|c|}\hline \\ \hline \neg K' \\ \hline \end{array}}$. It follows from the NPI licensing condition in (10) that an NPI is licensed if it occurs within K'.

[1] An NPI which is embedded inside a definite NP is also not licensed (*I would not kill a/*the man who has ever helped me.*, Hoeksema (2000)). This follows immediately in a DRT-based perspective, since the definite description is not constructed in the scope of a licensing operator such as negation but rather enters the DRS via presupposition accommodation. Thus, the blocking of NPI-licensing inside definite NPs is an issue independent of the intervention effects discussed in this paper.

Since the *if*-clause is not in the scope of the negation, the problem with the scalar readings of *if*-clauses illustrated in (9) does not arise. However, at the same time Chierchia's argument against the analogy of conditionals and universal quantifiers vanishes.

6 Conclusion

Using a DRT perspective, we could characterize the operators that show intervention effects for NPI licensing in terms of their inherent dynamic properties. This immediately explains the asymmetry in intervening between disjunction and conjunction and derives the similarity between conjunction and universals and generalized quantifiers without further stipulation.
The question arises, of course, why the inherent dynamics of an operator should block an NPI licensing relation. At present we can only speculate. Corblin and Tovena (2001) argue that in negative concord languages, several indefinites take a "negative" form to show that they are participants of the negated event. A similar idea might be at work in NPI licensing: an NPI needs to be interpreted with respect to the information state introduced by its licensing DRS. Dynamic operators potentially change this information state and, thus, block the licensing.

References

Chierchia, G.: 2004, Scalar implicatures, polarity phenomena, and the syntax/pragmatics interface, *in* A. Belletti (ed.), *Structure and Beyond. The Cartography of Syntactic Structures*, Vol. 3, Oxford University Press, Oxford, New York, pp. 39–103.

Corblin, F. and Tovena, L. M.: 2001, On the multiple expression of negation in Romance, *in* Y. D'Hulst, J. Rooryck and J. Schroten (eds), *Romance Languages and Linguistic Theory 1999*, John Benjamin, Amsterdam, pp. 87–115.

Hoeksema, J.: 2000, Negative polarity items: Triggering, scope and c-command, *in* L. Horn and Y. Kato (eds), *Negation and Polarity*, Oxford University Press, Oxford, pp. 115–146.

Kamp, H. and Reyle, U.: 1993, *From Discourse to Logic*, Kluwer Academic Publishers, Dordrecht.

Klima, E.: 1964, Negation in English, *in* J. A. Fodor and J. Katz (eds), *The Structure of Language*, Prentice Hall, Englewood Cliffs, New Jersey, pp. 246–323.

Ladusaw, W.: 1980, *Polarity Sensitivity as Inherent Scope relations*, Garland Press, New York.

Linebarger, M. C.: 1980, *The Grammar of Negative Polarity*, PhD thesis, MIT. cited after the reproduction by the Indiana University Linguistics Club, Indiana, 1981.

May, R.: 1977, *The Grammar of Quantification*, PhD thesis, MIT.

Muskens, R.: 1996, Combining Montague semantics and discourse representation, *Linguistics and Philosophy* **19**, 143–186.

Postal, P.: 2005, Suppose (if only for an hour) that negative polarity items are negation-constaining phrases. Talk delivered at the Symposium *Polarity from Different Perspectives*, March 11–13, 2005, New York University.

Ross, J. R.: 1967, *Constraints on Variables in Syntax*, PhD thesis, MIT.

von Genabith, J., Kamp, H. and Reyle, U.: 2004, Discourse representation theory, *Handbook of Philosophical Logic*. draft, www.ims.uni-stuttgart.de/∼kamp.