The Great Scope Inversion Conspiracy

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1. Data and Claim

This paper deals with scope inversion of two operators. Relevant examples from German are given in (1) and (2) ((1.a) from Jacobs 1984, (1.b) from Löbner 1990):

(1) a. Alle Politiker sind nicht korrupt.
all politicians are not corrupt
i. 'No politician is corrupt.'
ii. 'It is not the case that all politicians are corrupt.'
b. Du mußt nicht soviel rauchen.
you must not so much smoke
i. 'You mustn't smoke that much.'
ii. 'You don't have to smoke that much.'

(2) a. /ALLE Politiker sind NICHT\ korrupt.
only reading (1.a'ii)
b. Du /MUSST NICHT\ soviel rauchen.
only reading (1.b'ii)

Unlike the sentences in (1), which are ambiguous as indicated in the translations, the string identical sentences in (2) are unambiguous. Note that in (2) we find a rising pitch accent - indicated by / - on the subject and the modal verb, respectively. This we call a *Topic accent*. In both sentences a falling accent - given as \ - is on the negation, the *Focus accent*. What I will try to show is that this disambiguating effect can be made to follow directly from the semantics and pragmatics of Topic and Focus marking as proposed in Büring 1994 and Büring in prep. In more detail, the plot goes as follows:

- The sentences are structurally ambiguous by LF at latest.
- The intonational contour, in particular the Topic accent, leads to certain implicatures which differ for both LFs.
- Depending on the lexical meanings of the items involved, these implicatures may be reasonable or not.
- In case only one of two LFs yields reasonable implicatures, that LF is the sole legitimate representation for the sentence in question.

It is worthwhile to stress the last point. The claim that I am making is that the requirement 'have reasonable implicatures' can act as a filter on LF representations. Given a structurally ambiguous sentence, we might end up with only one virtual meaning. This will happen if the intonational pattern induces

implicatures which - in one case - are not reasonable, in a sense to be made explicit below.

Before going on I should point out that the phenomenon illustrated in (1.a)/(2.a) is well known in and from the literature. The following examples are provided in Horn 1989:226ff.

(3) a. All that glitters is not gold.
b. Thank heaven, all scholars are not like this.
c. Tout ce qui reluit n'est pas or. (=(3.a))

The question why and under which circumstances scope inversion is possible has provoked a fair amount of approaches in the last 25 or so years, see references in Horn 1989:226ff. An extensive and ingenious analysis is provided by Jackendoff (1972:352ff) for the English counterparts to (1), given in (4).

(4) a. ALL the men didn't go.
_____/ (B accent: ¬∀)
b. ALL the men didn't go.
\----------\ (A accent: ∀¬)

The analysis to be presented here basically preserves Jackendoff's insights albeit in a quite different way.

I will proceed as follows. After introducing some basic assumptions (section 2), I'll first discuss sentence (1.a)/(2.a) in detail, analyze its syntactic structure, derive the implicatures and show the disambiguating effects (section 3). I'll then do the same for (1.b)/(2.b). After that I return to sentences of the former type and adduce some minimally contrasting examples showing the semantic nature of the phenomenon discussed (section 5). This will lead us to some more general reflections about the issues involved (section 6).

2. Topics

Topic and Focus marking are represented using subscripted brackets as illustrated in (5).

(5) a. $[\text{ALL}]_T$ the men did $[\text{not}]_F$ go.
b. $[\text{ALLE}]_T$ Politiker sind $[\text{NICHT}]_F$ korrupt.
all politicians are not corrupt
c. Du $[\text{MUSST}]_T$ $[\text{NICHT}]_F$ so viel rauchen.
you must not that much smoke

I assume that Topic and Focus marking in sentences like (5) have a two main semantic and pragmatic effects: i) they determine the set of contexts in which the sentence can be uttered; ii) they yield certain implicatures (see Féry 1993 for the phonological aspect of Topic marking). To flesh out what is meant by this we

need to introduce some machinery.

For each sentence S we derive three different semantic objects, called its *ordinary semantic value* $[\![S]\!]^o$, its *Focus value* $[\![S]\!]^f$ and its *Topic value* $[\![S]\!]^t$. Focus value and ordinary value are defined as in Rooth 1985: The ordinary value is a proposition, the Focus value is a set of propositions. What is new is the Topic value, a set of sets of propositions. Instead of going through the technical details, let us take (5.a) as an example.

(6) a. Ordinary meaning of (5.a): $[\![[\text{all}]_T \text{ men did } [\text{not}]_F \text{ go}]\!]^\circ$ = the proposition 'all men didn't go'
b. Focus value of (5.a): $[\![[\text{all}]_T \text{ men did } [\text{not}]_F \text{ go}]\!]^f$ = the set of propositions of the form 'all men did N go,' where *N* is some type identical alternative to *not* (presumably *not* and the identity function)
c. Topic value of (5.a): $[\![[\text{all}]_T \text{ men did } [\text{not}]_F \text{ go}]\!]^t$ = the set of Focus values F such that there is an alternative *Q* to *all* and F is a set of propositions of the form 'Q men did N go' where *N* is an alternative to *not*.

These values might look as in (7).

(7) a. ^all men didn't go
b. {^all men went, ^all men didn't go}
c. {{^all men went, ^all men didn't go}, {^most men went, ^most men didn't go}, {^some men went, ^some men didn't go}, {^one man went, ^one man didn't go}, ...}

What do we do with these objects? First, we can define the class of contexts in which a sentence with a certain Topic/Focus structure can be uttered. For the time being let us assume that a Context consists of a Common Ground CG, and a Discourse Topic, or D-Topic. The Common Ground is a set of worlds which represents the shared knowledge of speaker and hearer in much the sense of Stalnaker 1978. The D-Topic is a set of propositions. For the time being we will only consider contexts in which the D-Topic is established by a preceding question. The meaning of a question Q, $[\![Q]\!]^o$ is assumed to be the set of possible answers to Q. I assume that the following conditions must be met:

(8) a. Given a question answer sequence Q A, $[\![Q]\!]^\circ$ must be an element of $[\![A]\!]^t$.
b. Given a sentence A containing a Topic, there must be at least one disputable element in $[\![A]\!]^t$ after uttering A.

(9) a. Disputability: A set of propositions P is disputable wrt. a set of worlds CG (the *Common Ground*) if there is at least one element p in P such that both p and ¬p could informatively and coherently be added to CG.
a'. formally: $\text{DISP}(P,CG)$, iff $\exists p \varepsilon P: p \cap CG \neq CG \ \& \ p \cap CG \neq \emptyset \ \& \ (\neg p) \cap CG \neq CG \ \& \ (\neg p) \cap CG \neq \emptyset$

(10) Rephrasing (8.b): A sentence A containing a Topic is utterable given a common ground CG only if $\exists P \varepsilon [\![A]\!]^t$ & DISP(P,CG$\cap$[[A]]°)

A set of disputable propositions induced by a Topic (P in the sense of (10)) is called a *Residual Topic*. Let's go see some examples:

(11) A: Where are the unicorns?
B: $[\text{SOME}]_T$ unicorns are $[\text{in the GARden}]_F$

Residual Topic: Where are the other unicorns?

Speaker A asks for an answer of the type 'the unicorns are ____'. Speaker B does not provide an exhaustive answer to that. Note that without the Topic marking on *some*, (11B) would be illicit as an answer to (11A). The Topic accent marks a deviation from the original D-Topic established by A's question. Formally, $[\![(11B)]\!]^t$ contains sets of propositions of the form '____ unicorns are ____', where both Topic and Focus are replaced by alternatives. One of these sets consists of propositions like 'the unicorns are ____'. Thus the question meaning can be found in the Topic value of the answer, as required by (8.a). On the other hand, B's answer leaves open a number of issues regarding the locus of unicorns. Formally, there are sets in $[\![(11B)]\!]^t$ whose members might or might not be true. The whereabouts of the other unicorns are one such issue, a Residual Topic in the sense of (8.b). Residual Topics mark the way the conversation will take next. They establish the D-Topic for the next utterance.

In Büring 1994 and Büring in prep. I discuss a number of usages of Topics all of which can ultimately be reduced to the constraints given in (8). For example, Topics might shift a given D-Topic (this is sometimes called 'contrastive topic'):

(12) A: Do you think that Fritz would buy this suit?
B: Well $[\text{I}]_T$ certainly $[\text{WOULDN'T}]_F$.

Residual Topic: Would Fritz buy this suit?

The implicature induced by a Topic can sometimes be used for its own sake, consider (13).

(13) A: Where were you at the time of the murder?
B: $[\text{I}]_T$ was $[\text{at HOME}]_F$.

Residual Topic: Where was the gardener?

Here the Topic marking is not strictly speaking necessary. The sequence would be wellformed with just the Focus accent. However, the Topic indicates that there are disputable alternatives to *I* wrt. to their alibi. Informally speaking, a Residual Topic is just an implicit question posed by an utterance containing a Topic

accent. A Residual Topic is reasonable (or disputable) if the answer to that question is not yet known given what is known through the Common Ground and the utterance itself.

I said above that a sentence S cannot be uttered given a Context if it does match the current D-Topic (i.e. the preceding question). Crucially, the same holds if there is no Residual Topic (formally one can think of this as (8.a)/(8.b) restricting the domain of the context changing function denoted by S; a sentence is infelicitous given a Context CX if ⟦S⟧ is not defined for CX). Let us add this to the record:

(14) If a sentence S with a Topic accent is uttered given some Context CX, and there is no disputable Residual Topic the sentence establishes, the utterance of S in CX is infelicitous.

This effect of Topic marking and in particular Residual Topics is crucial for the analysis to be presented.

3. The Analysis of *all...not*

3.1. The Structural Ambiguity

Consider again the pertinent example:

(15) a. /ALL politicians are NOT\ corrupt.
b. /ALLE Politiker sind NICHT\ korrupt.

As noted, this sentence can only be understood to mean (16.a) rather than (16.b).

(16) a. it is not the case that all politicians are corrupt
b. for all politicians: it is not the case that they are corrupt

In other words, despite the surface order the negation has to take scope higher than the universal quantifier. This is why the phenomenon has been dubbed ’Bereichsinversion’ or ’Negationsinversion’ (scope reversal/negation reversal). A reading like (16.b), with the quantifier taking higher scope, is semantically well-formed, but not available for (15). This is different if the sentence bears a different accent pattern. In (17) I give some examples:

(17) a. ALLE\ Politiker sind nicht korrupt
b. alle Politiker sind NICHT\ korrupt
c. alle Politiker sind nicht korRUPT\

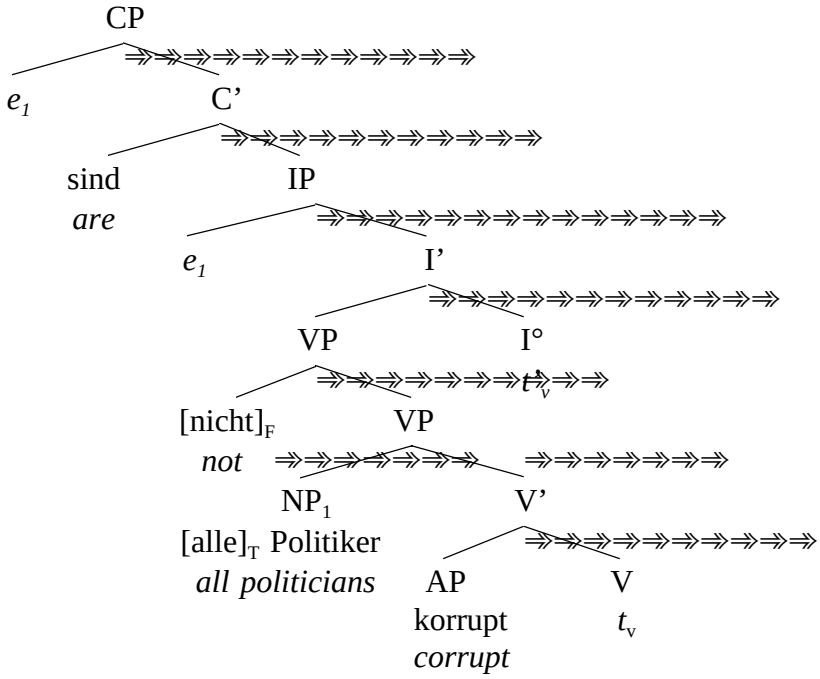
These examples contain but a single Focus accent. In all the examples, reading (16.b) is available, even preferred.

I assume that scope ambiguity as well as scope reversal is in fact a syntactic

phenomenon. More precisely, I assume that phrases which take scope in position different from their surface position can do so by virtue of a trace left in some other positions, e.g. their base position. We represent this as syntactic reconstruction.

One obvious possibility then is to reconstruct the subject *all politicians* in (15) to its base structure position, which by assumption is the specifier of VP, which in turn is c-commanded by the negation. We thus derive an appropriate LF for the interpretation (16.a) of (15).

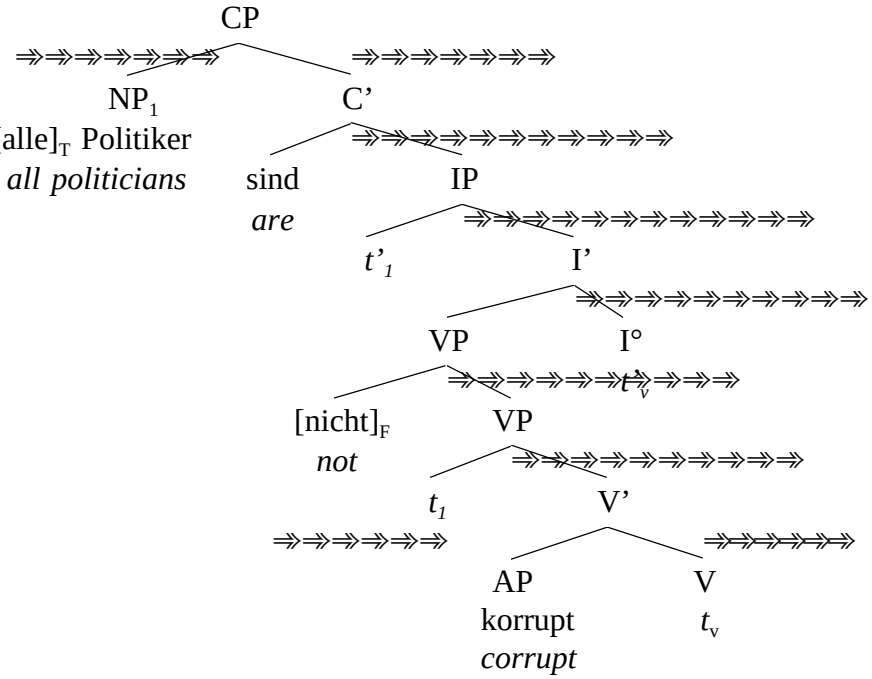
(18) a. LF¬∀:



b. not(all(politician)(corrupt))

That much is quite standard. However, reconstruction is not an obligatory process. Even for this sentence it is not, as seen in (17). The question we have to cope with then is what blocks a derivation in which *all politicians* remains in its surface position, yielding an LF corresponding to the unavailable reading (16.b). In other words, why isn't (15) ambiguous? Why isn't there a second LF like (19)?

(19) a. LF∀¬:



b. all(politicians)(λx.not(corrupt(x)))

3.2. The Semantic Conspiracy

For ease of reference, let us refer to (18) as LF¬∀ and to (19) as LF∀¬. What we have to show is that something is wrong with LF∀¬ - the one we cannot get for (15). Let us calculate the Topic implicatures for LF∀¬. First, what are the alternatives to *all* and to *not*? Let us assume that the alternatives to *all* are quantifiers such as *some*, *most* or *no* and that the sole alternative to *not* is the identity function. Then $[\![LF\forall\neg]\!]^t$ is characterized by the formula in (20.b), where **ALT(X)** is supposed to deliver type identical, contextually plausible alternatives to **X**. The set denoted by (20.b) might roughly look as in (20.c).

(20) a. [all politicians [$_{VP}$ not [$_{VP}$ are corrupt]]]

b. $\lambda P.\exists Q_{<et,<et,t>>}[Q\varepsilon ALT(\textbf{all}) \& P=\lambda p.\exists \pi_{<tt>}[\pi\varepsilon ALT(\textbf{not}) \& p=\hat{}Q(politicians)(\lambda x.\pi(corrupt(x)))]]$

c. { all(politicians)(λx.¬corrupt(x)), all(politicians)(λx.corrupt(x))},
{most(politicians)(λx.¬corrupt(x)), most(politicians)(λx.corrupt(x))},
{some(politicians)(λx.¬corrupt(x)), some(politicians)(λx.corrupt(x))},
{one(politicians)(λx.¬corrupt(x)), one(politicians)(λx.corrupt(x))},
{no(politicians)(λx.¬corrupt(x)), no(politicians)(λx.corrupt(x))} }

The implicature is...

(21) after asserting **all(politicians)(λx.¬corrupt(x))**, there is at least one set op propositions in $[\![LF\forall\neg]\!]^t$ (=(20.a)) which is disputable.

Can (21) possibly be true? Remember that a disputable set of propositions

corresponds to a question whose answer is neither entailed nor excluded by the Common Ground CG. And remember, too, that CG is the Common Ground *after* asserting that all politicians are non-corrupt. Since we are considering these sentences without any specific context, we can safely assume that CG=⟦(20.a)⟧^{o} (possibly plus its presuppositions).

Browsing through (20.c) we find that no disputable questions are left there. For one thing, any proposition of the form **Q(politician)(λx.¬corrupt(x))** (with the exception of **Q** = **no**) is implied by **all(politicians)(λx.¬corrupt(x))**. Likewise, their negations are excluded. For another, any proposition of the form **Q(politician)(corrupt)** (again with the exception of **Q** = **no**) is contradicted by **all(politicians)(λx.¬corrupt(x))**. Their negations are implied. Finally, **no(politician)(λx.¬corrupt(x))** (='every politician is corrupt') is contradicted by **all(politicians)(λx.¬corrupt(x))** while **no(politician)(λx.corrupt(x))** is equal to it, i.e. implied by it.

We conclude that (21) is not met. There is no Residual Topic in (20.a). So that's what is wrong with LF∀¬. As a next step we have to make sure that LF¬∀ - the one representing the available reading of sentence (15) - is not subject to the same objections. So let us calculate ⟦LF¬∀⟧^{t}:

(22) a. [$_{VP}$ not [$_{VP}$ all politicians [$_{V'}$ are corrupt]]]
b. λP.∃Q$_{<et,<et,t>>}$[QεALT(**all**) & P=λp.∃π$_{<tt>}$[πεALT(**not**) & p=^πQ(politicians)(corrupt)]]

Now again, let us search (22.b) for disputable Residual Topics wrt. to a CG that includes **¬all(politicians)(corrupt)**. In (22.c) I have crossed out all non-disputable propositions:

c. { ~~¬all(politicians)(corrupt)~~, ~~all(politicians)(corrupt)~~},
{¬most(politicians)(corrupt), most(politicians)(corrupt)},
{¬some(politicians)(corrupt), some(politicians)(corrupt)},
{¬one(politicians)(corrupt), one(politicians)(corrupt)},
{¬no(politicians)(corrupt), no(politicians)(corrupt)} }

With relieve we notice that practically every set in ⟦LF¬∀⟧^{t} remains a Residual Topic. None of the propositions is entailed or contradicted by the truth of **¬all(politician)(corrupt)**. We thus predict that sentence (15) - on its LF¬∀ reading - raises the question: 'But are there corrupt politicians at all? And if, how many? Or aren't there any?' And this is of course just what (15) expresses.

4. *Must...not*

Let us now turn to the second example, (1.b)/(2.b):

(23) Du mußt nicht so viel rauchen.
you must not so much smoke
'You mustn't smoke that much.'

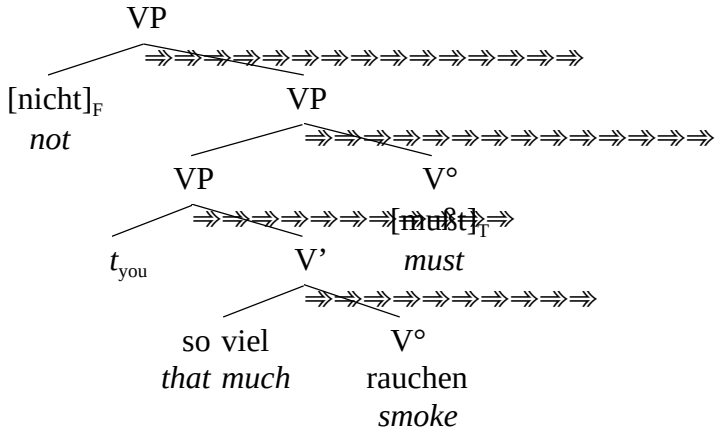
As before, the sentence as it stands is ambiguous between the 'don't smoke so much' and the 'you're not obliged to smoke that much' reading. If intonated in the by now familiar way, the former reading disappears.

(24) Du /MUSST NICHT\ so viel rauchen.

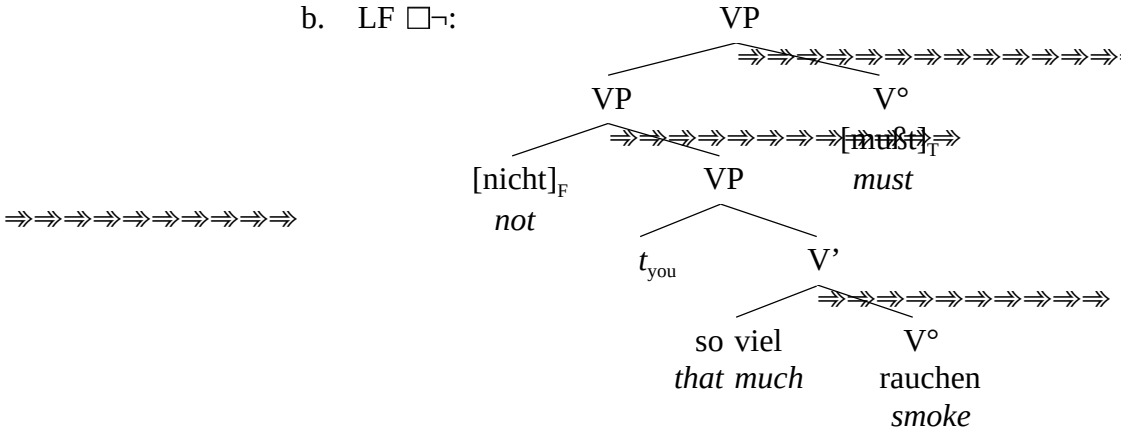
I should point out that the 'not allowed to' reading is hard to get for some speakers, while for others - including the author - it is almost the only available reading. These preferences seem to be dialectal as they can be assigned to certain regions.

It is not hard to figure out where the ambiguity of (23) originates. What we must realize is that *must not* and *need not* are part of a Duality Group. If *must* is translated by □, *must not* corresponds to □¬, while *need not* corresponds to ¬□ (see Löbner 1990 for extensive discussion; he also pointed out the disambiguating function of the accent in the example, although he offers no account for it). Given this, we can trace back the ambiguity of (23) to a structural fact, namely: Does the negation negate the inner VP (*rauchen*, 'smoke') or the outer one (*müssen*, 'must')? This is represented in (25).

(25) a. LF ¬□:



b. LF □¬:



This structural ambiguity straightforwardly explains the two different readings. So what we have to show is that out of the two possible structures for (23) only one yields a reasonable implicature (i.e. a non-empty Residual Topic) if the sentence has the intonational structure as in (24).

As indicated, (25.a) shall be called LF¬□, and (25.b) LF□¬. LF□¬ is the one we want to exclude. Let $[\![\textit{müssen}]\!]^f$ be the set of modal verb meanings, i.e. {**must, may, need-not, may-not**} and $[\![\text{nicht}]\!]^t$ be the set containing negation and identity. As before, we start by calculating the implicatures of the non-available reading:

(26) a. du [$_{VP}$ [$_{VP}$ nicht soviel rauchen] mußt]
b. ∃M[MεALT(must) & P=λp.∃π[πεALT(not) & p=^M(π(smokethatmuch(you)))]]
c. { {^must(not(smokethatmuch(you))), ^must(smokethatmuch(you))}, {^may(not(smokethatmuch(you))), ^may(smokethatmuch(you))}, {^need-not(not(smokethatmuch(you))), ^need-not(smokethatmuch(you))}, {^may-not(not(smokethatmuch(you))), ^may-not(smokethatmuch(you))} }

And again, we find that (26.c), in the light of the assertion made ('you have to not smoke that much'), contains no disputable propositions. To see this more clearly, let us use the following abbreviations: □=must, ¬□¬=may, ¬□=need-not, □¬=may-not, ¬=not, χ=smokethatmuch(you). Then (26.c) equals (27), where I have numbered the propositions for convenience (I have omitted the negated propositions since they are included in $[\![(26.a)]\!]^t$ anyway):

(27) { { $\square\neg\chi^a$, $\square\chi^b$ }, (must)
{ $\neg\square\neg\neg\chi^c$, $\neg\square\neg\chi^d$ }, (may)
{ $\neg\square\neg\chi^e$, $\neg\square\chi^f$ }, (need-not)
{ $\square\neg\neg\chi^g$, $\square\neg\chi^h$ }} (may not)

Next note that necessarily the following relations hold between the formulae in (27):

(28) a. a ↔ h, b ↔ g, d ↔ e, f ↔ c
b. a ↔ ¬d, f ↔ ¬b
c. a → ¬b

Now, by the assertion, a is given as an axiom. It follows that the truth value of every formula in (27)/(26.c) is determined, namely:

(29) a ∧ ¬b ∧ ¬d ∧ h ∧ ¬g ∧ f ∧ ¬e ∧ c

Since this is true in every possible world, it is immaterial what the actual Common Ground looks like. Once **a** - 'you have to not smoke that much' - is added to the Common Ground, the resulting Common Ground will necessarily

imply the truth of (29). So there are no disputable propositions in $[\![LF\Box\neg]\!]^t$, hence no Residual Topic.

As before, we have derived why LF□¬ is inappropriate given the intonational structure of (24). Finally we have to check whether LF¬□ is wellformed according to our criterion:

(30) a. du nicht [$_{VP}$ [$_{VP}$ soviel rauchen] mußt]

b. $\exists M[M\varepsilon ALT(must) \& P=\lambda p.\exists\pi[\pi\varepsilon ALT(not) \& p=\wedge\pi(M(smokethatmuch(you)))]]$

c. { {^not(must(smokethatmuch(you))), ^must(smokethatmuch(you))}, {^not(may(smokethatmuch(you))), ^may(smokethatmuch(you))}, {^not(need-not(smokethatmuch(you))), ^need-not(smokethatmuch(you))}, {^not(may-not(smokethatmuch(you))), ^may-not(smokethatmuch(you))} }

d. { { $\neg\Box\chi^a$, $\Box\chi^b$ }, (must)
{ $\neg\neg\Box\neg\chi^c$, $\neg\Box\neg\chi^d$ }, (may)
{ $\neg\neg\Box\chi^e$, $\neg\Box\chi^f$ }, (need-not)
{ $\neg\Box\neg\chi^g$, $\Box\neg\chi^h$ }} (may not)

e. a ↔ f, b ↔ e, a ↔ ¬b

In (30.d) I have given the modal logic formulae corresponding to (30.c), plus their logical relations ((30.e)). As can be seen, c/h and d/g are still disputable. In ordinary words:

(31) a. Du MUST NICHT soviel rauchen. Vielleicht DARFST du nicht einmal soviel rauchen.

b. You don't have to smoke that much. Perhaps you even mustn't smoke that much. [g/d vs. h/c].

This then concludes our argument. We have seen that with both examples, *all politicians are not corrupt* and *you mustn't/needn't smoke that much* a structural ambiguity is resolved by the intonation, more specifically by the Topic accent and its implicatures. To be sure, there are two LFs for each of these sentences which are well-formed by syntactic criteria. But one of them cannot be interpreted in a coherent way, i.e. respecting the function of the Topic accent. So that LF is 'filtered out'.

Formally, we saw that LF∀¬ and LF□¬ necessarily imply all their Topic alternatives. The context change functions denoted by these particular sentences (where sentence means: syntactic structure plus Topic/Focus structure) *has an empty domain*. There is no context in which these sentences could felicitously be uttered. Syntactically they are wellformed, but nevertheless they will never occur in natural language. The are 'unpragmatic', if you like.

5. The Impact of Lexical Choice

5.1. Quantifiers other than All/Every

A next thing to note is that there are cases parallel to Jacob's (2.a) - not discussed by him - in which scope reversal is not obligatory, e.g. the following.

(32) a. Two $[\text{thirds}]_T$ of the politicians are $[\text{not}]_F$ corrupt.
b. Zwei /DRITTEL der Politiker sind NICHT\ korrupt.

In these examples, the subject quantifiers may take scope either higher or lower than the negation. To elucidate both readings here, let me provide you with two different contexts:

(33) A: And so it seems to me that two thirds of the politicians are corrupt.
B: That's an exaggeration. Half of them might be, but two /THIRDS of the politicians are NOT\ corrupt. (...not...two thirds...)

(34) A: You can't deny the moral decline of politics. Just look at the statistics: 45 cases of corruption within one year.
B: Take a positive look at that: Two /THIRDS of the politicians are NOT\ corrupt. (...two thirds...not...)

This is just what we expect given a reconstruction treatment of these cases: Reconstruction of the subject NP to SpecV is optional, the sentence is ambiguous. But of course we predict that there is a further prerequisite for the virtual ambiguity of these sentences, namely that both LFs yield reasonable implicatures. In other words, there have to be alternative questions in $[\![(32.b)]\!]^t$ which are still disputable after uttering these sentences. Let me demonstrate this informally, starting with reading (33), i.e. the LF with reconstruction, yielding

(35) It is not the case that two thirds of the politicians are corrupt

Now, we might continue this sentence by saying

(36) ... and it might or might not be the case that there are in fact no corrupt politicians

Note that 'it is (not) the case that no politicians are corrupt' is among the alternatives in $[\![(32.b)]\!]^t$. So the requirement 'have reasonable implicatures' is met. This, however, is the simple case, basically parallel to the available reading of sentence (2.a). Let us now turn to the other reading, which was unavailable for the examples discussed so far:

(37) a. two thirds of the politicians are non-corrupt
b. ...and it may or may not be the case that some politicians are corrupt.

Again, (37.b) is an element of an element in $[\![(32.b)]\!]^t$ on that reading. So this LF, too, has a non-empty residual Topic, correctly predicting the ambiguity.

5.2. Foci different from not

So far, we have seen the contrast between quantifiers like *two thirds* or *almost all* which yield a sensible reading with and without reconstruction and quantifiers like *all* or *every* which do not. The next thing to note is that *all* and *every* allow for ambiguities as well, if the element in Focus is different from *not*. For example, the sentences in (38.a) and (38.b) are ambiguous between the reading in (38.c) and (38.c'), despite the fact that the Topic is a universal quantifier:

(38) a. /ALL politicians are RARELY\ drunk.
b. /ALLE Politiker sind SELTEN\ betrunken.
c. it is rarely the case that all politicians are drunk
c'. for every politician: it is rarely the case that she or he is drunk

(38.c) allows for some politicians being alcoholics and even for a number of them drinking together fairly often. (38.c') on the other hand is stronger. It asserts that no politician is drunk regularly. The latter reading might be harder to get, but consider the following sequence:

(39) /ALL politicians are RARELY\ drunk, and most of them never.

First, let me give an example of a possible residual Topic for each of the readings:

(40) a. it is rarely the case that all politicians are drunk
a'. ...but is it rare that most politicians are?
b. for every politician: it is rarely the case that she or he is drunk
b'. ...but are there politicians which are never drunk?

As can be seen, there are alternatives to *rarely* and *every* that yield disputable Residual Topics on both scopings. Intuitively speaking, *rarely* is less absolute than *not*. Accordingly, there are disputable alternatives to it. Which brings us straightforwardly to our next issue, namely...

6. Scales

Right now, we have extended our database to non-absolute elements such as *rarely*, *often* and *most* or *some*. So let us ask whether there is a more general principle to be deduced from the cases discussed. In general, we can say that unavailable readings occur only with elements that mark the end of some scale (for a much more thorough discussion of implicational scales see e.g. Horn 1989:chap.4). Such a scale we find with the quantifiers, with quantifying adverbials and with adverbials of completeness as in (41.c).

(41) a. all > most > some > one
a'. alle > die meisten > einige > ein
b. always > often > sometimes > once
b'. immer > oft > manchmal > einmal
c. totally > quite > somewhat > a little
c'. ganz > ziemlich > etwas > ein bißchen

The scales are ordered by implication, i.e. 'all Φ' implies 'most Φ', the latter implies 'some Φ' and so forth. Next recall that $\Phi \rightarrow \pi$ is equivalent to $\neg\pi \rightarrow \neg\Phi$, i.e. the scales in (41) can be inverted:

(42) a. no (not one) > not some > not most > not all
a'. kein (nicht ein) > nicht einige > nicht die meisten > nicht alle
b. never (not once) > not sometimes > not often > not always
b'. niemals (nicht einmal) > nicht manchmal > nicht oft > nicht immer
c. not at all (not a little) > not somewhat > not quite > not totally
c'. überhaupt nicht (nicht ein bißchen) > nicht etwas > nicht ziemlich > nicht ganz

'no Φ' implies 'not some Φ', the latter implies 'not most Φ' and so forth. As suggested in (42.c), we can understand *not*/*nicht* to be the endpoint of a scale as well.

If an element is not maximal on the scale, there will always be alternatives to it (i.e. other elements on the same scale) which are possibly true and possibly false, hence disputable. Those elements by themselves guarantee that there are viable alternatives to them. An element that marks the endpoint of a scale, call it an *extreme*, implies its scalar alternatives. It might yield disputable alternatives only by virtue of a second alternative inducing element. This is what happens in the case of 'not...all' or 'not...must' or 'never all'. Although for example 'never all Φ' implies the falsehood of 'sometimes all Φ' or 'often all Φ', it still could be the case that 'sometimes some Φ' or 'often most Φ'. On the other hand, with constellations like 'all...not' or 'must not', neither element can induce alternatives. Let us call elements like *all, always,* or *totally* positive extremes and expressions like *never, not* and *no* negative extremes. A look at the examples discussed so far reveals that exactly one case is excluded:

(43) if two extremes form a bridge accent, the positive extreme may not take scope over the negative extreme

For example, 'not...all' is permitted in such a configuration, but 'all...not' is not, because the positive extreme 'all' outscopes the negative one, 'not'. Why does (43) hold in this form? The reason can best be seen if we again translate our quantificational elements into quantifiers of second order predicate logic. Positive extremes are then represented by $\forall\Phi$, negative ones by $\neg\exists\Phi$, or, equivalently: $\forall\neg\Phi$. The two possible scope configurations of extremes can now be represented as in (44), where > stands to mean 'takes scope over':

(44) a. negative > positive: $\neg\exists\forall\Phi \equiv \forall\neg\forall\Phi$
b. positive > negative: $\forall\neg\exists\Phi \equiv \forall\forall\neg\Phi$

(44.b) is the unavailable reading, and the reason is now plain to see: Both universal quantifiers represent positive extremes on the scale, i.e. they both imply the truth of the formula for any of their scalar alternatives. In (44.a) on the other hand, the negation intervenes between the two universal quantifiers, switching the scale. In other words, a structure with two quantifiers will never have disputable alternatives, if both quantifiers are universal (i.e. extremes) and 'adjacent.' If this is correct, (43) can in fact be sharpened even more:

(45) If two extremes α ß form a bridge accent, with α taking scope over ß, α must not be a positive extreme.

In other words, the positive extreme should neither be able to outscope a negative extreme nor should it cooccur with another positive extreme. Scope ambiguities with bridge accents on scalar extremes should occur only if both elements involved are either negative extremes or non-extremes. As far as I can tell, these predictions are borne out:

(46) a.* /ALLE Politiker sind IMMER\ betrunken.
all politicans are always drunk
(two positives, both orderings impossible)
b. /KEIN Politiker ist NIE\ betrunken.
no politician is never drunk
(two negatives, both readings possible, surface order preferred)
c. /ALLE Politiker sind NIE\ betrunken.
all politicians are never drunk
(one positive, one negative: only neg>pos, i.e. obligatory scope inversion)
d. /KEIN Politiker ist IMMER\ betrunken.
no politician is always drunk
(one negative, one positive: only neg>pos, i.e. scope inversion impossible)

The cases of negation reversal thus reduce to this general case once we realize that *not* is a negative extreme on a (possibly two-membered) scale. Scope inversion - as well as 'scope fixing' as in (46.d) - with all sorts of 'quantificational' elements follow from very general principles of syntax and pragmatics, once the effect of the Topic marking is properly understood.

6.1. Modals that Express Possibility

Having said this we can readily account for another apparently puzzling fact about the scoping of modals and negation. Remember that in the *must...not* case discussed in section 5., a bridge accent forces the **not(must)** reading, i.e. highest scope for the negation. However, if we replace *müssen* by *können* 'can', the facts

seem to be the mirror image of the *müssen* case:

(47) a. Sie kann nicht so viel getrunken haben.
she can not so much drunk have
'She can't have drunk that much.'
b. Sie /KANN NICHT\ so viel getrunken haben.
'She might have not drunk that much.'
b'. She $[\text{might}]_T$ have $[\text{not}]_F$ drunk that much.

Sentence (47.b) displays exactly the same intonational pattern as (2.b) above. However, here the Bridge Accent forces a reading where the negation has scope lower than the modal, yielding: 'It is possible that she hasn't drunk that much.' That is, similar to the cases discussed in section 5., there is no straightforward correlation between Bridge Accent and scope of the negation. However, the data follow immediately from the account given here. For note that with *can*, the stronger reading is the one with the negation scoping over the modal, **not(can)** or $\neg(\Diamond(\pi))$, which is equivalent to $\Box(\neg(\pi))$. And again, given such a strong assertion there cannot possibly be alternatives **M** to **can** which would make **M(π)** disputable. So if the accent pattern indicates that there must be a Residual Topic, the weaker reading, **can(not)** or $\Diamond(\neg(\pi)) \equiv \neg(\Box(\pi))$ is forced, making room for alternatives as in (48).

(48) a. Sie $[\text{kann}]_T$ $[\text{nicht}]_F$ so viel getrunken haben, aber es ist wahrscheinlich, daß sie soviel getrunken hat.
b. She might have not drunk that much, but she is likely to have.

With the modal *müssen* 'must', on the other hand, the weaker reading is obtained by giving the negation wide scope, as we have seen above. So while the phenomenon is entirely the same semantically and pragmatically ($\neg\Box \equiv \Diamond\neg$ in the Bridge Accent case), the syntactic structure in the one case is the mirror image of that in the other.

7. Summary

This paper has lead us through quite a global conspiracy of syntax, intonation, (lexical) semantics and pragmatics. Since factors from all these domains enter into determining whether or not a sentence (with a given intonational contour) virtually has certain readings, the picture that has emerged is quite complex. On the other hand, the set of assumptions put to use to handle the scope inversion data discussed in this chapter is quite small, containing almost only assumptions independently proposed and needed. The Topic marking as discussed and formalized here and elsewhere provides us - I think - with the missing piece of the mosaic that we need in order to derive the facts correctly, abandoning the need for additional mechanisms. If the results of this paper are by and large correct, they provide evidence for both this intermodular but conceptually simple

way of treating scope inversion and the theory of Topics.

8. Endnotes

* (Part of) this material was presented at Frankfurt, Tübingen, Berlin, Copenhagen and Austin in 1994/5. I would like to thank the audiences for their helpful comments, in particular Regine Eckardt, Katharina Hartmann, Ray Jackendoff, Gerhard Jäger, Inga Kohlhof, Horst Lohnstein, and Arnim von Stechow.

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