German *noch so*: Scalar Degree Operator and Negative Polarity Item[*]

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1 Introduction

An approach pioneered by [1] relates polarity sensitivity to semantic triviality. [2], [3], and [4] let unlicensed negative polarity items (NPIs) yield contradictory presuppositions or implicatures. In these proposals, an NPI requires the asserted proposition to be stronger, or less likely, than certain alternative propositions. This requirement is designed to be satisfiable in licensing contexts only.

The present paper describes a problem for applying such a contradiction based anlaysis to the German expression *noch so*, a polarity sensitive degree operator. It is first shown that under standard assumptions about gradable predicates and degree operators, a contradiction based account is straighforward to state. It merely requires a minor innovation concerning the nature of alternative propositions: where in previous work propositions are generated by alternative predicates or domains restrictions, *noch so* invokes propositions generated by alternative degrees.

However, while such a contradiction based account helps derive polarity sensitivity of *noch so*, it is shown not to capture the contribution to meaning it makes in cases where it is licensed. An alternative analysis is presented, designed to capture this contribution. This analysis, however, does not without further assumptions derive polarity sensitivity. Ways of reconciling the requirements imposed by the distribution of *noch so* and its perceived contribution to meaning are discussed, although with no conclusive outcome.

2 Some properties of *noch so*

Noch so is a degree operator. It shares a signature distributional restriction with familiar comparative, equative or superlative morphemes: as (1) and (2) illustrate, *noch so* can combine with a gradable predicate such as *lang* 'long', but not with non-gradable predicates such as *zweiköpfig* 'two-headed'.

(1)   Peter hatte vor keiner [<u>noch so</u>   lang.en] Schlange Angst.
       Peter had of no   NOCH SO long.infl snake   fear
       'Peter wasn't even afraid of any LONG snake.'
(2)   #Peter hatte vor keiner [<u>noch so</u> zweiköpfig.en]   Schlange Angst.
        Peter had of no   NOCH SO two-headed.infl snake   fear

Noch so is also "scalar". As the translation in (1) indicates, *noch so* sentences allow
for paraphrases containing the scalar particle *even*.[2] Finally, *noch so* is a NPI. In (1),
noch so appears in the restrictor of the downward entailing determiner *kein* 'no'.
Example (3), where upward entailing *einige* 'some' replaces *kein*, is unacceptable.

(3)   *Peter hatte vor einigen [<u>noch so</u> lang.en] Schlangen Angst.
        Peter had of   some   NOCH SO long.infl snakes   fear

Also, (4) and (5) show that *noch so* can appear in the scope of downward entailing
keiner 'no one', but not in the scope of upward entailing *jeder* 'everyone'.

(4)   Keiner hat ein [<u>noch so</u> lukrativ.es] Angebot angenommen.
       no one has a NOCH SO lucrative   offer   accepted
       'No one even accepted a LUCRATIVE offer.'
(5)   *Jeder   hat ein [<u>noch so</u> lukrativ.es] Angebot angenommen.
        everyone has a   NOCH SO lucrative   offer   accepted

   Building most directly on [4], the following explores how, under standard
assumptions about gradable predicates and degree phrases, the polarity sensitivity of
noch so can be derived from its scalarity.

2 A Contradiction Based Account

The scalarity of certain polarity items is exploited in several existing accounts of
polarity sensitivity (e.g. [4], [5], [6], [7]). Most relevant here is Lahiri's work [4],
where the scalarity of certain NPIs in Hindi is argued to yield contradictions in
upward entailing contexts. This section formulates a Lahirian analysis of *noch so*.

2.1 Gradable predicates, degree phrases, and monotonicity

In a standard view (e.g. [8], [9]), gradable adjectives relate individuals to degrees
under an *at least* semantics. According to (6), for example, the denotation of *lang*
maps a degree d and individual x to the proposition that x's length is at least d.

(6) $\|lang\| = \lambda d. \lambda x. \lambda w.$ x's length in w $\geq$ d

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[2]   However, *even* not being a degree operator, the translations given are mere approximations.
      Note, for example, that the English translation given in (1) remains acceptable if non-
      gradable *TWO-HEADED* replaces gradable *LONG*.

Given such lexical meanings, degree phrases, including *noch so*, can be considered generalized quantifiers over degrees, which for interpretabilty move covertly from the adjective's degree argument position to combine with a derived degree property (cf. [9]). In this approach, (7) and (8) are conceivable logical forms for (3) and (1).

(7)   noch-so λd[Peter hatte vor einigen [d langen] Schlangen Angst]
(8)   noch-so λd[Peter hatte vor keiner [d langen] Schlange Angst]

The *at least* semantics in (6) ensures that the degree property denoted by the lambda abstract in (7) is downward monotone in the sense of (9) below (cf. [8]). That is, propositions to which it maps higher degrees entail propositions to which it maps lower degrees. If Peter is afraid of some snakes whose length is 60cm or more, then he is also afraid of some snakes whose length is 50cm or more.

(9)   P is *downward monotone* $:\Leftrightarrow$ $\forall d_1, d_2[d_1 \leq d_2 \rightarrow [P(d_2) \subseteq P(d_1)]]$
(10) P is *upward monotone* $:\Leftrightarrow$ $\forall d_1, d_2[d_1 \leq d_2 \rightarrow [P(d_1) \subseteq P(d_2)]]$

In contrast, the degree property denoted by the lambda abstract in (8) is upward montone in the sense of (10). It maps lower degrees to propositions that entail propositions to which it maps higher degrees. If Peter is not afraid of any snake that is 50cm long or more, then he is also not afraid of any snake that is 60cm long or more.

2.2 *Even ONE*

Entries like (6) invite an analysis of the polarity sensitivity of *noch so* in the spirit of [4]. [4] deals with Hindi, but English *even ONE* makes much the same point, participating in contrasts like the one between (11) and (12).

(11) *Even ONE student called.
(12) Not even ONE student called.

Following [10], [4] assumes that a scalar particle triggers the presupposition that the sentence minus the scalar particle expresses a proposition which is less likely than all relevent alternative propositions. In the case at hand, alternatives are obtained by replacing the focused numeral *one* with alternative numerals *two*, *three,* etc. Under an *at least* semantics for numerals, (11) is then predicted to presuppose that the proposition that one ore more students called is less likely than the proposition that two or more students called, etc. But this presupposition is contradictory. The asserted proposition is entailed by each of its alternatives, and so it has to be at least as likely as any of them. So the unacceptability of (11) can be credited to a necessarily false presupposition.

The contradiction is correctly predicted to dissipate in (12), where negation reverses the direction of entailment. The prejacent proposition now entails each of its alternatives, making it possible for it to be less likley than each of them, hence rendering the scalar presupposition satisfiable.

2.3 *Noch so* and contradictory scalar presuppositions

Assuming an *at least* semantics for gradable adjectives, the scalarity of *noch so* invites a straighforward Lahirian analysis of its polarity sensitivity. The entry in (13) lets *noch so* impose a condition on the common ground comparing propositions obtained by applying its degree property argument to different degrees.

(13) *noch-so* ϕ <u>presupposition</u>: $\forall d_1, d_2[\ d_1 < d_2 \rightarrow |\phi|(d_1) <<_c |\phi|(d_2)\ ]$

$p <<_c q$ conveys that p is less likley than q relative to the common ground c. So (13) requires that the   degree property argument of *noch so* maps higher degrees to contextually likelier propositions than lower ones.

This condition has the intended effect for (3). Recall that the degree property expressed by the lambda abstract in (7), is downward montone: propositions for higher degrees entail propositions for lower degrees. Given this, the presupposition that (13) assigns to (7) is necessarily false, again because a proposition is bound to be at least as likely, in any context, as any proposition entailing it. The unacceptability of (3) can be credited to this contradiction.

In contrast, no offending presupposition is predicted for (1). Recall that in the logical form (8), the lambda abstract denotes an upward monotone degree property, with propositions for lower degrees entailing propositions for higher degrees. As a consequence, the presupposition triggered according to (13) is consistent and (1) is correctly expected to be acceptable. The Lahirian analysis, then, offers a straightforward account of the polarity sensitivity of *noch so*.

It will be useful to also consider a minor variant of this account. The entry in (13) follows [4] in the assumption that scalar implications compare the (contextual) likelihood of propositions. This view goes back to the analysis of *even* in [10]. In an alternative approach, taken in [11], *even* compares propositions in terms of (contextual) semantic strength or informativity. In fact, [2] presents a general perspective on NPI licensing that is based on [4] but substitutes informativity for likelihood as the semantic relation operative in scalar implications. With that substitution, (13) becomes (14), where $p \subset_c q$ conveys that p asymmetrically entails q relative to the common ground c, that is, $p \cap c \subset q \cap c$.

(14) *noch-so* ϕ <u>presupposition</u>: $\forall d_1, d_2[\ d_1 < d_2 \rightarrow |\phi|(d_1) \subset_c |\phi|(d_2)\ ]$

Entry (14) also supports a contradiction based account of the polarity sensitivity of *noch so*, and even more straightforwardly so than (13). The condition is obviously contradictory in (7), where the degree property is downward monotone. Evidently, no proposition can be asymmetrically entailed, in any context, by a semantically weaker proposition. Again, the contradiction is avoided in (8), where the degree property is upward monotone.[3]

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[3] Apart from the issue discussed in the next section, a potential problem for this analysis (which it shares with the proposal in [4]) concerns possible licensing by expressions that are non-upward entailing without being downward entailing. The account predicts that a contradiction can be avoided if *noch so* scopes over a non-upward entailing expression,

3. When scalar presuppositions are too weak

While the conditions in (13) and (14) derive the polarity sensitivity of *noch so*, the question is whether they correctly characterize the meaning of acceptable *noch so* examples such as (1).

Note that the degree property in (8) is not merely upward monotone but moreover *strictly* upward monotone in the sense of (15). That is, it maps lower degrees to (strictly) stronger propositions than higher degrees.[4]

(15) P is *strictly upward monotone* $:\Leftrightarrow \forall d_1, d_2[\, d_1 < d_2 \rightarrow [P(d_1) \subset P(d_2)]\,]$

As a consequence, it does not take much for (8) to satisfy the condition in (14), which requires strict upward montonicity under common ground assumtions. For the condition not to be met, the context would have to obliterate the asymmetric entailment between some or all relevant propositions, rendering them contextually equivalent. This would be the case, for example, if the common ground entailed that Peter either was afraid of all snakes (of all lengths) or was not afraid of any snakes (of any lengths). A felicitous use of (1) should merely require that no such assumption is established.

More formally, asymmetric entailment between propositions p and q is obliterated in common ground c if $p \cap c = q \cap c$ despite $p \subset q$. The condition that no such obliteration obtains is the requirement that c contain a possible world where q is true while p is false, for all propositions p and q of the relevant form. It is worth noting that this condition is not a presupposition in the usual sense. Ordinarily, if a sentence is said to presuppose a proposition p, this is understood as the requirement that the common ground entail p (e.g. [13]). In the case at hand, in contrast, the common ground is required *not* to have certain entailments.

The situation is much the same if the condition in (13) is assumed instead of (14). If, as seems plausible, greater (contextual) semantic strength is a sufficient condition for lesser (contextual) likelihood, then (13) too is guaranteed to be satisfied in (8) unless the common ground contains assumptions rendering some or all of the relevant propositions contextually equivalent.[5]

To be sure, these predictions do not square well with the actual interpretation of (1). A felicitous utterance of the sentence does certainly not require that assumptions of any kind <u>not</u> be established in the conversation. Nor is it consistent with intuitions that the absence of established assumptions of any sort could be a sufficient condition for a felicitous use of the sentence.

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whether downward entailing or not. The data do not seem to bear out this predication for *noch so*. For example, *noch so* is never licensed by a quantifier like *genau drei Studenten* 'exactly three students', which is neither upward nor downward entailing.

[4] That degree properties like the ones in (7) and (8) are strictly monotone, even if the scale in question is dense, is proposed explicitly in [8].

[5] [6] makes a similar point (evaluating proposals in [7] and [12]) with regard to the analysis of *even*.

Instead, an utterance of (1) is judged to introduce a scalar implication similar to the one associated with the (merely approximate) English translation given: it suggests that fear of shorter snakes is less likely, or perhaps entails, fear of longer snakes.

This type of scalar implication is even more salient in (16), where *kein* 'no' is replaced by (equally downward entailing) *jeder* 'every'. In this case, a scalar implication is perceived that is diametrically opposed to default assumptions on how fear of snakes might relate to their length. Implausibly, (16) suggests that fear of longer snakes is less likely, or entails, fear of shorter snakes.

(16) #Peter hatte vor jeder [noch so lang.en] Schlange Angst.
  Peter had of every NOCH SO long.infl snake   fear
  'Peter was even afraid of every LONG snake.'

Replacing *lang* 'long' in (10) with (equally gradable) *teuer* 'expensive' has a similar effect. (17) implies that fear of snakes that cost less is less likely, or entails, fear of snakes that cost more. Since it is hard to see how a snake's price could have any bearing on its potential to induce fear, the implication is again implausible.

(17) #Peter hatte vor keiner [noch so teuer.en]   Schlange Angst.
  Peter had of no   NOCH SO expensive.infl snake   fear
  'Peter was even afraid of every EXPENSIVE snake.'

It is worth noting that the contradiction based accounts given above are correct in one respect: scalar implications are indeeed presuppositions. This, at least, is what their projection behavior suggests. For example, scalar implications are judged to survive embedding under the modal adjective *möglich* 'possible', and the plausibility contrasts described above persist under such embedding.

Having confirmed that *noch so* triggers a presupposition, it remains to determine its content, generalizing from the examples presented in this section.

4 Presupposing downward montonicity

The observations reported in the last section suggest that the correlation between the ordering of degrees and likelihood or informativity of propositions is roughly the reverse of what contradiction based accounts would posit. Settling on informativity as the relevant semantic notion, an entry like (18) suggests itself.

(18) *noch-so* ϕ presupposition: $\forall d_1, d_2[\ d_1 < d_2 \rightarrow |\phi|(d_2) \subseteq_c |\phi|(d_1)\ ]$

Here $p \subseteq_c q$ conveys that p entails q relative to the common ground c, that is, $p \cap c \subseteq q \cap c$. Using established terminology, (18) requires that the degree property in question is downward monotone under common ground assumptions.

Assuming as before that *noch so* must outscope its licenser, the entry in (18) makes sense of the observations reported in the last section. According to (18), the logical form of (1) in (8) presupposes that Peter's not being afraid of any longer snakes

entails his not being afraid of any shorter snakes, which is plausible enough. The corresponding logical forms for (16) and (17), shown in (19) and (20), are assigned less plausible presupposition, viz. that Peter's being afraid of all longer snakes entails his being afraid of all shorter snakes, and that Peter's not being afraid of more expensive snakes entails his not being afraid of less expensive ones.

(19) noch-so λd[Peter hatte vor jeder [d lang.en] Schlange Angst]
(20) noch-so λd[Peter hatte vor keiner [d teuer.en] Schlange Angst]

Similarly, (18) seems to apply correctly to example (4) above. The presupposition assigned to the logical form in (21) is that no one accepting a more lucrative offer entails no one accepting a less lucrative offer. Again, this presupposition is rather plausible and fits with intuitions on what the sentence conveys.

(21) noch-so λd[keiner hat ein [d lukrativ.es] Angebot angenommen]

Intuitions on meaning, then, suggest that the condition in (18) is on the right track. Moreover, this condition turns out to derive a distributional constraint on *noch so* not mentioned so far. While *noch so* is correctly characterized as a NPI in so far as it must occur in a downward entailing context, *noch so* is subject to an additional distributional restriction that it does not share with more familiar NPIs. Consider (22).

(22) *Kein Gedicht ist noch so lang.
      no   poem   is NOCH SO long

This case is structurally similar to the acceptable sentence in (4), the only relevant difference being that the adjective phrase hosting *noch so* is a modifier in (4) but the main predicate in (22). Why would this difference matter?

Under (18), a semantic explanation of the contrast becomes available. According to (18), the logical form of (22) in (23) presupposes that, if there is a given length that no poem reaches, then no poem reaches a lesser length either.

(23) noch-so λd[[kein Gedicht] ist d lang]

This scalar presupposition is in obvious conflict with the assumptions that every poem has some length or other and that there are lengths that no poem reaches.[6] The former assumption can in fact be considered another presupposition of the sentence: degree predicates can be assumed to only be defined for individual arguments in the domain of the underlying measure function (e.g. [14]); hence the denotation of *lang* will only be defined for individuals who have a length, and this presupposition is expected to project universally in (23). So the unacceptability of (22) can be blamed on inconsistent presuppositions.

This type of inconsistency is expected to be avoided in the otherwise similar case in (4). After all, while every poem necessarily has some or other length, it is not necessary for every, or any, person to have accepted a more or less lucrative offer.

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[6] The latter assumption follows from the assumption that the set of poems is finite.

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Likewise, no inconsistency is expected to arise in (1), as it is not necessary for Peter to have fear of any snakes. Examples (24) and (25) further illustrate the point.

(24) *Kein Student war [noch so vorsichtig].
         no   student was NOCH SO tentative
(25) Kein Student hat sich [noch so vorsichtig] beschwert.
         no   student has self NOCH SO tentatively   complained
         'No student complained even TENTATIVELY.'

This contrast is again expected. While (24) is expected to presuppose that every student was tentative (to some degree), (25) clearly does not presuppose that every student complained (with any degree of tentativeness).

5 Back to polarity sensitivity

The discussion in the last section continued to assume, without much comment, that *noch so* is a NPI that must outscope its downward entailing licenser. The question is whether the current analysis provides a rationale for this requirement. Another open question concerns the truth conditional content of *noch so*. These two related issues are addressed below, although with no conclusive outcome.

In the account explored here, a *noch so* sentence presupposes that the degree property combining with *noch so* is downward monotone under common ground assumptions. But, unless *noch so* scopes over a non-upward entailing operator, the relevant degree property is guaranteed to be downward monotone, irrespectively of assumptions established in the common ground. So, unless *noch so* scopes over a non-upward entailing operator, the presupposition derived is tautologous.

It is tempting to relate this observation to the polarity sensitivity of *noch so*. However, it is not clear that a necessarily true presuppositions alone can be the source of unacceptability. After all, a sentence that carries no (non-tautologous) presupposition might still be informative by virtue of its asserted content. This the raises to salience a question skirted so far: what is the asserted content of a *noch so* sentence? The following briefly explores two options, concluding that neither is able to derive the polarity sensitivity of *noch so*.

Sentence (1) is judged to convey that Peter was not afraid of snakes of any lengths. Similarly, (4) conveys that none of them accepted any offer of any degree of lucrativity. This implication could be captured straightforwardly by making *noch so* a universal quantifier, as in (26).

(26) *noch-so* ϕ assertion: $\lambda w.\ \forall d[|\phi|(d)(w) = T]$

One might hope that letting *noch so* quantifiy universally sheds light on its polarity sensitivity. In fact, (26) would render a sentence like (27) below contradictory, given that a poem's length is necessarily finite. Since the scale of length has no upper bound, the segment of the scale charcaterized by the relevant degree property in (23)

is guaranteed to be a proper subset of the scale of length, which contradicts the condition in (26).

(27) *Das Gedicht ist noch so lang.
       the poem   is NOCH SO long

Much the same applies to the unacceptable case in (3). One might hope, then, that all cases of unlicensed *noch so* can be excluded on the grounds of being contradictory. Note that, in contrast to the contradiction based accounts discussed above, here the contradiction would be in the asserted, not the presupposed, content.

Unfortunately, such an explanation falls short of excluding all cases of unlicensed *noch so*. One case that (26) would not render contradictory is (28). Assuming that the scale of fullness contains a maximal degree (see e.g. [15]), (26) predicts (28) to merely convey that the glass was full. Similarly, the truth conditions that (26) assigns to (29) could be met if the relevant modal base fails to set an upper bound for the permitted length of the poem.

(28) *Das Glas war [noch so voll].
       the glass was NOCH SO full
(29) *Das Gedicht darf [noch so lang] sein.
       the poem   may NOCH SO long be

The fact that (28) and (29) are neverthless no more acceptable than (27) suggests that the universal analysis is insufficient to derive the polarity sensitivity of *noch so*.

An alternative analysis makes *noch so* quantify over degree existentially as in (30), rather than universally.

(30) *noch-so* ϕ <u>assertion</u>: $\lambda w. \exists d[|\phi|(d)(w) = T]$

Note that (30) is still consistent with the intuition that acceptable *noch so* sentences quantify over degrees universally. Consider again (1) and the logical form in (8). There the degree property combining with *noch so* is necessarily upward monotone. Moreover, in order to satisfy the presupposition in (18), the degree property in (8) must also be downward monotone under common ground assumptions. According to (18), then, the degree property in (8) is presupposed to be either true of all degrees of length or false of all such degrees. So in conjunction with the scalar presupposition, the existential quantification in (30) acquires universal force.

Under the semantics in (30), a possible reason for the unacceptability of (27) is that it is tautologous at the level of both presupposition and assertion. As said, downward monotonicity of the relevant degree predicates guarantees satisfaction of the condition in (18). Under the assumption that every poem as some length, the existential condition is necessarily satisfied as well. Under (30), the examples in (28) and (29) arguably come out trivial as well. Perhaps, then, *noch so* must scope over a downward entailing licenser in order to avoid a trivially true interpretation.

Unfortunately, however, this rationale again does not extend to all examples of unlicensed *noch so*. Example (3) is a case in point. According to (30), the logical form in (7) has the contingent entailment that there are some snakes (of some length) that

Peter was afraid of. Similarly, (30) does not derive the contrast between (25) above and (31). Under (30), (31) should have the non-trivial entailment that some student complained.

(31) *Ein Student hat sich [noch so vorsichtig] beschwert.
        s*ome student has self NOCH SO tentatively complained*

As present, then, it is unclear whether the meaning contribution by *noch so* detectable in acceptable examples can help one derives the distribution of *noch so*.

6 Conclusion

This paper has identified a dilemma for the analysis of n*och so*. A contradiction based account of its distribution along the lines of [4] fails to account for its meaning in good cases. Conversely, an account that derives the perceived meaning of *noch* so does not seem to derive its polarity sensitivity. Hopefully future work will resolve the dilemma.

References

1. Kadmon, N., Landman, F.: Any. Linguistics and Philosophy 16, 353--422 (1990)
2. Chierchia, G.,: Broaden Your Views. Linguistic Inquiry 37, 535--590 (2006)
3. Krifka, M.: The Semantics and pragmatics of polarity items. Linguistic Analysis 25, 1--49 (1995)
4. Lahiri, U.: Focus and Negative Polarity in Hindi. Natural Language Semantics 6, 57--123 (1998)
5. Abrusàn, M.: *Even* and Free Choice *Any* in Hungarian. In: Puig-Waldmüller, E. (ed.), Proceedings of Sinn und Bedeutung 11, Universitat Pompeu Fabra, Barcelona, pp.1--15, (2007)
6. Guerzoni, E.: Why Even Ask?. PhD dissertation, MIT (2003)
7. Heim, I.: A Note on Negative Polarity and Downward Entailingness. In: Jones, C., Sells, P. (eds.), Proceedings of NELS 14, GLSA, University of Massachusetts, Amherst, pp. 98--107 (1984)
8. Fox, D., Hackl, M.: The Universal Density of Measurement. Linguistics and Philosophy 29, 537--586 (2006)
9. Heim, I.: Degree Operators and Scope. In: Proceedings of SALT X, CLC Publications, Cornell University, pp. 40--64 (2000)
10. Karttunen, L., Peters, S.: Conventional Implicature. In: Syntax and Semantics 11, pp. 1--56 (1979)
11. Kay, P.: *Even*. Linguistics and Philosophy 13, 59--112 (1990)
12. Schwarz, B.: Notes on *even*. Unpublished manuscript, Stuttgart University (2000)
13. Stalnaker, R., 'Presuppositions'. Journal of Philosophical Logic 2, 447--57 (1973)
14. Gajewski, J.: More on Quantifiers in Comparative Clauses. In Friedman, T. and Ito, S. (eds.), Proceedings of Semantics and Linguistic Theory XVIII, pp. 551--568 (2009)
15. Kennedy, C., McNally, L.: Scale Structure Degree Modification, and the Semantics of Gradable Predicates. Language 81, 345—381 (2005)