

# Negative Polarity in German: Some Experimental Results

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## Abstract

We discuss four experiments in which we investigated the acceptability of a large set of Negative Polarity Items (NPIs) in semantically and syntactically different environments. The first two experiments distinguish two subsets of NPIs whose behavior patterns with semantic definitions of weak and strong NPIs: One set (strong NPIs) is less acceptable in the local environment of non-anti-additive downward entailing operators than the other set (weak NPIs), but they are all equally acceptable in anti-additive environments. In the next two experiments we use these two sets of NPIs to investigate the impact of Neg-Raising environments with and without intervening quantifiers on their acceptability. Weak NPIs turn out to be more acceptable than strong NPIs, and intervening quantifiers lead to an equal reduction in acceptability for both sets, without making the occurrence of NPIs in these environments categorically unacceptable. We discuss the relevance of these theoretically unexpected results for an adequate analysis of NPIs in the grammatical system.

## 1 Introduction

Current theories of Negative Polarity Items (NPIs) typically distinguish at least two subclasses. *Weak* NPIs are expressions which are only accepted if they occur in the scope of a downward entailing operator. *Strong* NPIs are expressions which are only accepted if they occur in the scope of an anti-additive operator. The relevant properties of an operator  $f$  are easy to check. Assume that  $X$  and  $Y$  are sets. For a monotone decreasing (i.e. downward entailing) function it is the case that  $f(X \cup Y) \subseteq f(X) \cap f(Y)$ ; an anti-additive function, which intuitively represents a stronger type of negation, obeys a stricter condition, where the subsetrelation turns into an equality:  $f(X \cup Y) = f(X) \cap f(Y)$ .

These equations provide a simple recipe with which we can test if an expression is interpreted as a function of the relevant kind and can, therefore, act as an NPI *licenser* of a certain type. For example, we can demonstrate by the validity of the arguments in (1) and (2) that *few retailers* is monotone decreasing, whereas *nobody* is anti-additive:

- (1) *Few retailers whistle or run* implies *Few retailers whistle and few retailers run*.  
(with *few retailers* =  $f$ , *whistlers* =  $X$ , *runners* =  $Y$ )
- (2) a. *Nobody walks or talks* implies *Nobody walks and nobody talks*.  
(with *nobody* =  $f$ , *walkers* =  $X$ , *talkers* =  $Y$ )  
b. *Nobody walks and nobody talks* implies *Nobody walks or talks*.

The additional fact that *Few retailers whistle and few retailers run* does not entail that *Few retailers whistle or run*, i.e. the converse of (1) does not hold, demonstrates that *few retailers* is not anti-additive.

We may conclude from this argument that *nobody* is strong enough to *license* the occurrence of a strong NPI (it is a strong licenser), whereas *few retailers* is a weak licenser

and only capable of licensing weak NPIs.<sup>1</sup> Since anti-additive operators are a subclass of downward entailing operators, it follows immediately that weak NPIs are also licensed in the context of anti-additive operators (their licensors); but strong NPIs that occur in the scope of a downward-entailing operator which is not anti-additive are not. The idea in formal linguistics of NPI licensing under certain entailment conditions dates back to influential work by Fauconnier (1975) on pragmatic scales and by Ladusaw (1980) on the logical properties of NPI licensing environments, and is sometimes referred to as the Fauconnier-Ladusaw theory of NPIs. The theoretical framework underlying our experiments is a refinement of the Fauconnier-Ladusaw theory by the more fine-grained hierarchy of semantic licensing environments defined in Zwarts (1997), from which we took the laws of licensing weak and strong NPIs above. In the bigger picture of NPI licensing, we assume that this basic story will have to be embedded in a much more comprehensive theory of distributional restrictions that sees the relationship between NPIs and their licensing environments as a particular subclass of collocations (van der Wouden (1997), Richter and Soehn (2006)).

Returning to the licensors in (1) and (2), the noun phrase *niemand* ('nobody') is anti-additive, the NP *wenige Händler* ('few retailers') is downward-entailing but not anti-additive. The NP *einige Händler* ('some retailers') is not downward-entailing (it is upward-entailing). NPIs are expressions consisting of a single word or of several words. The single-word NPI *jemals* ('ever') and the multi-word NPI *eine müde Mark* ('a red cent') exhibit the following acceptability pattern in simple clauses with and without a licensor:

- (3) a. Niemand / b. \*Wenige Händler / c. \*Einige Händler verdienen-t/-en heutzutage  
 a. nobody / b. few retailers / c. some retailers earn(s) nowadays  
 eine müde Mark an einer Briefmarkensammlung.  
 a tired Mark at a stamp collection  
 'Nowadays nobody / few retailers / some retailers earn(s) a red cent with a stamp collection.'
- (4) a. Niemand / b. Wenige Händler / c. \*Einige Händler verdienen-t/-en jemals  
 a. nobody / b. few retailers / c. some retailers earn(s) ever  
 Geld an einer Briefmarkensammlung.  
 money at a stamp collection  
 'Nobody / few retailers / some retailers ever earn(s) money with a stamp collection.'

The judgments in (3) show that *eine müde Mark* requires an anti-additive licensor in its context. A plain downward-entailing licensor is insufficient (3b), and the expression may not occur felicitously in sentences without a licensor (3c). It follows that *eine müde Mark* is a strong NPI. (4) demonstrates that *jemals* is a weak NPI: Occurrences of *jemals* are licensed in the presence of an anti-additive and a non-anti-additive, downward-entailing operator ((4a) and (4b)), but not licensed in the absence of a downward-entailing operator (4c).

The data reviewed in (3) and (4) are uncontroversial, with the possible exception of the judgment going with (3b): Some speakers (and, indeed, some linguists) may contend that the sentence is not as "bad" as the asterisk suggests. In other words, the sentence might not be judged 'strictly ungrammatical' but merely 'significantly degraded', and, in any case, not as "bad" as (3c) and not as "good" as (4b). In fact, data collected from newspaper corpora in the repository of German NPIs in the Collection of Distributionally Idiosyncratic Items (CoDII)<sup>2</sup>, which contains a large electronic collection of German NPIs, reveals that there are instances of *eine müde Mark* in weak licensing contexts in newspapers.

<sup>1</sup>Other types of functors, *viz.* non-veridical and anti-morphic functions are assumed to be even weaker and even stronger licensors, respectively. We are not concerned with these additional distinctions in the present paper.

<sup>2</sup>URL: [www.english-linguistics.de/codii/](http://www.english-linguistics.de/codii/)

Several questions arise at this point. Is there a way to interpret the surprising corpus data and subtle judgments concerning the grammaticality status of (3b) in the light of a theory of NPIs? Can we explain why people disagree or are not sure about the grammaticality status of examples of that kind? What are “good” and “bad” licensing contexts of NPIs, and is it really a categorical distinction, as theories of semantic NPI licensing suggest?

An important open issue that is intimately connected to these questions concerns the empirical base of theories of NPIs and the significance of their primary classification into weak and strong NPIs.<sup>3</sup> As pointed out by Richter et al. (2010), the literature on NPIs in the Ladusaw-Fauconnier tradition drew on only a small set of items when it mapped out its classification system. Among its main categories are the distinction between strong and weak NPIs and the idea that NPIs are semantically located at the end of a scale, signalling smallest amounts, minimal size, and the like, which is thought to be pragmatically motivated. However, the number of NPIs which were considered when these concepts were established as theoretical landmarks is extremely small compared to our present knowledge of the extent of NPIs. In the case of German, recent corpus-based search and semi-automatic NPI-extraction from corpora has significantly increased the number of known NPIs (Lichte and Soehn (2007), Richter et al. (2010)). Whereas the older literature in formal frameworks investigates hardly more than a dozen items at a time, a repository of over 280 German NPIs is now available, with many of them not yet systematically classified with respect to the proposed theoretical sub-categories.<sup>4</sup> With this situation in mind, one may wonder how representative the set of NPIs is on which the older research was based, and if a classification system that was created on such a small selection will prove adequate for the properties found in a much larger set of items. More fine-grained distributional profiles of the kind that Hoeksema (2010) employs to investigate the evolution of the Dutch determiner *enig* (‘some/any’) might do better justice to the behavior of NPIs, and might even be necessary to understand the diachronic and synchronic distributional behavior of NPIs in general. If our present theoretical categories are much too coarse-grained and ignore significant facets in the data, this could explain why, according to native speaker intuitions, it does in fact not seem easy to classify NPIs such as *beileibe* (‘by no means’), *so recht* (‘all that’), *gleich gar* (‘not at all, not any’), *von ungefähr* (‘by accident’) and *beim besten Willen* (‘by any stretch of the imagination’) as weak or strong on the basis of introspective judgments (i.e. by deciding whether they may be used with a weak licenser, or whether they require a strong licenser).

In this study we built on the aforementioned collections of German NPIs to investigate some of their fundamental properties. We first established that, in simple sentences, speakers indeed consistently distinguish between weak and strong NPIs. This distinction is, in principle, compatible with theories of semantic NPI licensing which predict the pattern we saw in (3) and (4) and follows from dividing the set of licensers into ones that are anti-additive and those that are merely downward-entailing, or monotone decreasing. However, we also found that it is doubtful that the experimentally observed perceptual difference is strong enough to justify a categorical distinction between strictly (or grammatically) “good” and strictly “bad” occurrences of NPIs. In the second step we used the strong and weak NPIs confirmed in the first experiments to probe deeper into the nature of NPI licensing. To do so, we investigated the effect of more complex syntactic and quantificational environments on NPI licensing.

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<sup>3</sup>For present purposes we ignore potential further distinctions, such as non-veridical NPI licensing (Zwarts (1995)), and super-strong NPIs, which are even more restrictive than strong NPIs and require an anti-morphic licenser. Similarly, we do not distinguish a special subclass of antimultiplicative licensers (‘not every’, ‘not always’) from other monotone decreasing functors. Most of the NPIs we subsume under ‘weak’ might in fact be admissible under nonveridical licensers, and some theorists might want to divide our class of weak NPIs according to more recent semantic or pragmatic criteria. We believe that this would be unsuitable for first experimental explorations (but interesting for future research).

<sup>4</sup>NPIs cut across almost all major syntactic categories (with the exception of prepositions), and many of them are collocations and idiomatic expressions of varying syntactic structure and with differing degrees of frozenness. This also means that a large collection is needed to design experiments with many different NPIs.

We increased the syntactic complexity of the structures by moving from simple sentences to neg(ative)-raising constructions, in which NPIs were licensed in embedded clauses by a negation in the matrix clause. Here we were interested in differences between strong and weak NPIs and in the potential effect of quantifiers which intervene semantically between the NPI and its licenser. Theories of semantic NPI licensing within certain syntactic-semantic domains make clear predictions about these constellations, but whether or not the predictions are borne out has been notoriously hard to decide because the acceptability differences between the relevant constructions are extremely subtle. It is therefore hardly possible to put a theory on a firm footing without systematic experimental investigation. Our main results suggest that weak and strong NPIs might not be licensed in exactly the same way or for the same reasons, that licensing in neg-raising contexts is not as straightforward as has previously been thought, and that intervening quantifiers have a relatively weak but constant effect across our two types of NPIs, contrary to the assumption that intervening quantifiers of certain types prevent licensing of strong NPIs while still permitting licensing of weak NPIs.

When following the idea of semantic licensing conditions of weak and strong NPIs in our experiments, we have to pay attention to the fact that they are conceived of as *necessary* licensing conditions: Even in the scope of a monotone decreasing operator, other facts about the syntactic, semantic or pragmatic environment of an NPI might prevent the NPI from being properly licensed. Among such additional factors are (1) syntactic licensing domains which prescribe that the licenser must occur within (or outside of) a certain minimal syntactic environment, and (2) semantic restrictions such as the prohibition of certain types of operators intervening in the interpretation between the licenser and the NPI. These additional conditions will play a role in our second set of experiments, which are reported in Section 3. Conversely, in the experiments in the first step of our study, discussed in Section 2, we were careful to construct all sentences in such a way that no other operator intervened between a licenser and an NPI, and we were paying attention to the presumed syntactic licensing domain of each NPI. We chose all our NPIs in such a way that their natural occurrences in corpora and native speaker intuitions confirm that it is sufficient if their licenser occurs in the same clause as the NPI (as long as there is no semantic intervention effect).

Section 2 establishes two disjoint sets of NPIs with a licensing behavior that agrees with theories of semantic NPI licensing. These two sets of items form the basis for the subsequent investigation of weak and strong NPIs in neg-raising constructions in Section 3. In Section 4 we discuss our findings and the status of NPIs in the grammatical system.

## 2 Weak and Strong Negative Polarity Items

We started with two experiments in which we investigated the claim that speakers perceive a difference between strong NPIs in the context of weak vs. strong licensors, but do not perceive a difference between weak NPIs in the context of a weak vs. strong licenser, nor a difference between the last two constellations and a strong NPI in the context of a strong licenser. Our experiments departed from previous experiments with NPIs in several respects. Previous experiments often compared fully licensed NPIs and NPIs with no licenser, or an inaccessible licenser. They tested very few licensors and very few NPIs, and they focused on processing aspects (Drenhaus et al. (2004), Saddy et al. (2004), Vasisht et al. (2006)).

By contrast, we tested a large collection of NPIs and a number of different licensors. Our criterion for selecting the licensors in the experimental items was that they meet the relevant semantic properties and were either anti-additive or merely downward entailing. We avoided licensors that are controversial or might be lexically ambiguous in a given context between different readings. Our experiments were meant to clarify intuitions rather than to test the processing of NPIs.

## 2.1 Experiments 1 and 2: Weak-Strong Opposition

In this section we present two experiments which showed that the opposition between weak and strong NPIs is psychologically real. This is not trivial, as naive speakers often find it difficult to tell weak from strong NPIs when they are asked to judge individual examples. Still, our present binary distinction between weak and strong NPIs is obviously a simplification of contemporary Boolean semantic theories of NPIs, which distinguish more types of NPIs and NPI licensing.<sup>5</sup> However, further sub-classifications of NPIs make it much harder to obtain sufficiently large and reliable sets of NPIs of a particular kind for experiments. As the distinctions become more fine-grained, we observe that speakers' intuitions about the membership of any given NPI in a particular class become less stable, which might have to do with the inherent gradedness of polarity phenomena. To avoid complications, our experiments were confined to a possibly overly simplistic binary classification of NPIs into weak and strong. Future research will hopefully overcome this barrier.

### 2.1.1 Weak-Strong Experiment 1

In Experiment 1 the question was if there was evidence for a distinction between strong and weak NPIs. Based on the literature, the hypothesis was that (1) weak NPIs can occur with either a strong or a weak licenser, and (2) strong NPIs need a strong licenser. In order to test this hypothesis, we constructed items with four conditions, as shown in (5). The English translations try to mimic the structure of the German sentences as closely as possible. The licensers are printed in bold face, NPIs in italics.

- (5) a. Elisabeth hat i. **kaum** etwas / ii. **nichts** von dem *ausstehen können*,  
E. has i. hardly something / ii. nothing of that stand can  
was es zum Essen gab.  
what it to eat gave  
'Elisabeth could stand hardly any / none of what there was to eat.'
- b. Mit seinen komplizierten Beispielen hat er bei i. **wenigen** Studenten  
with his complicated examples has he with i. few students  
*einen* / ii. den Studenten **keinen** *Blumentopf gewinnen können*.  
a / ii. the students no flowerpot win can  
'With his complicated examples he could impress few / no students.'

(5ai) contains the weak licenser *kaum* ('hardly') and the (collocational) weak NPI *etwas ausstehen können* ('can stand something'). It is parallel to (5aii), which replaces the weak licenser with the strong licenser *nichts* ('nothing'). The other two conditions combine a strong NPI with the two types of licensers: In (5bi) we see the weak licenser *wenige Studenten* ('few students') and the strong NPI *einen Blumentopf gewinnen können* ('to impress someone'), which is an idiomatic expression.<sup>6</sup> (5bii) contains the same NPI and replaces the weak licenser with a strong licenser, in this case the negative determiner *keinen* ('no'). Our prediction was that the combination of a weak licenser with a strong NPI should receive lower ratings than the others.

We presented 12 items in four conditions in a Latin square design. We used each of the 6 weak and 6 strong NPIs twice, but a given participant only saw one combination of a particular NPI and licenser. As distractors we used ordinary grammatical sentences, as well as complex or stylistically marked sentences (6b), and modified idioms (6a):

<sup>5</sup>Moreover, alternative conceptions of weak and strong NPIs such as the one introduced by Krifka (1995), which establishes a connection to the pragmatics of assertions, are not considered at all here. For an overview, see Israel (2004).

<sup>6</sup>In principle, there is a literal but highly implausible reading of *einen Blumentopf gewinnen können*, 'to be able to win a flowerpot'.

- (6) a. Der Abteilungsleiter war sofort Feuer und Flammen, nachdem  
the department manager was immediately fire and flames when  
er von der Idee des neuen Mitarbeiters gehört hatte.  
he about the idea the new employee heard had  
‘The department manager was immediately enthused when he learned about  
the idea of the new employee.’
- b. Espresso ist eine Zubereitungsart von Kaffee, bei der Wasser mit  
espresso is a way of preparation of coffee at the water with  
hohem Druck durch gemahlene Kaffeebohnen gepresst wird.  
high pressure through ground coffee grounds pressed is  
‘Espresso is a way of preparing coffee by squeezing water at high pressure  
through coffee grounds.’

The distractor sentence in (6a) contains the idiom *Feuer und Flamme sein* (lit. ‘fire and flame be’, ‘to be enthused’), but instead of the obligatory singular form of the second noun, *Flamme*, it uses the idiomatically illicit plural form *Flammen*. The second example of a distractor, (6b), is a rather long and overly complicated construction, as it might occur in a certain newspaper register.

The participants were 48 – 1 native German speakers (students of the University of Tübingen), who rated the sentences on a 7-point scale in a paper-pencil questionnaire (1 = very bad, 7 = very good).

The results confirmed our predictions. Strong NPIs with weak licensors were rated significantly lower than the other three conditions (mean ratings: weak licensor–weak NPI 4.94, SE .180, weak licensor–strong NPI 3.89, SE .184, strong licensor–weak NPI 5.21, SE .179, strong licensor–strong NPI 5.20, SE .181). This resulted in a significant interaction:  $F_1(1, 46) = 26.729, p < .01, F_2(1, 11) = 9.878, p < .01$ . Paired t-tests further confirmed that the ratings of weak NPIs were not influenced by the type of licensor:  $t_1(46) = -1.98, p < .07, t_2(11) = -.869, p < .4$ ; whereas the combination of weak licensor and strong NPI received significantly lower ratings than the same NPIs with strong licensors:  $t_1(46) = -6.536, p < .01, t_2(11) = -4.656, p < .01$ .<sup>7</sup>

It was also visible that fully licensed NPIs were not perfect, i.e. they did not receive the highest possible rating. Conversely, NPIs with inappropriate licensors were not ungrammatical: The condition with strong NPIs and a weak licensor still received a rating of about 4 on a scale from 1 to 7. The ratings match those of our “good” and “bad” distractors (ordinary or stylistically marked sentences vs. modified idioms).

### 2.1.2 Weak-Strong Experiment 2

The second experiment was an extended replication of the first experiment in which we increased our database of experimentally confirmed weak and strong NPIs.

This experiment was conducted as an Internet questionnaire with WebExp2. We constructed 22 items with 21 weak NPIs and 22 strong NPIs. The initial classification of the NPIs was based on the findings about their distribution in corpora that was reported in the CoDII collection of German NPIs, and on (occasionally unstable) native speaker intuitions of linguists. All strong NPIs in this experiment were idiom-like. As distractors we used the same types of sentences as in the previous experiment, and it was again a Latin square design. Participants were 40 students of the University of Tübingen, all native speakers of German.

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<sup>7</sup>Strictly speaking, rating data do not meet the requirements for parametric statistical tests. For this reason, in each case we also calculated a Wilcoxon signed rank test as well, to corroborate the results of the t-tests. In this experiment, the results of the Wilcoxon signed rank test for the weak licensor–weak NPI vs. strong licensor–weak NPI contrast are  $p_1 = .687, p_2 = .589$ , for the weak licensor–strong NPI vs. strong licensor–strong NPI contrast the results are  $p_1, p_2 < .01$ .

The main ratings were weak licenser–weak NPI (WL/WNPI) 4.18, SE .183, weak licenser–strong NPI (WL/SNPI) 3.49, SE .179, strong licenser–weak NPI (SL/WNPI) 4.70, SE .207, strong licenser–strong NPI (SL/SNPI) 4.74, SE .176. We found a significant interaction that replicated the previous experiment ( $F_1(1, 39) = 6.68, p < .02, F_2(1, 21) = 4.819, p < .04$ ). As in Experiment 1, this interaction came from the combination of a weak licenser and a strong NPI leading to significantly lower ratings than in the other three conditions: weak licenser–strong NPI vs. strong licenser–strong NPI  $t_1(39) = -7.462, p < .01, t_2(21) = -5.119, p < .01$ .<sup>8</sup>

However, we also found an unexpected difference between the conditions WL/WNPI and SL/WNPI, i.e. between the licensing of weak NPIs by weak licensers and the licensing of weak NPIs by strong licensers ( $t_1(39) = 2.528, p < .02, t_2(21) = -1.328, p = .2$ ). According to the licensing theories we expected no difference between these conditions, an expectation that was confirmed by the first experiment.

A closer inspection of the NPIs used in the experiment identified the labelling of the NPI *im geringsten/das Geringste* (‘the least bit’) as weak as a possible source.<sup>9</sup> If the ratings for this NPI are removed, the resulting mean ratings are: weak licenser–weak NPI 4.45, SE .187, weak licenser–strong NPI 3.38, SE .188, strong licenser–weak NPI 4.83, SE .203, strong licenser–strong NPI 4.70, SE .177. The previous difference between weak licenser–weak NPI and strong licenser–weak NPI disappears:  $t_1(39) = -1.72, p < .1$ , whereas weak licenser–strong NPI is still significantly worse than strong licenser–strong NPI:  $t_1(39) = -7.199, p < .01$ .<sup>10</sup>

Under the assumption that *im geringsten/das Geringste* is a strong NPI, the discrepancy between the WL/WNPI and SL/WNPI disappears, and Experiment 2 fully replicates the findings of the first experiment.

## 2.2 Discussion / Conclusions

From the two experiments in Section 2.1 we conclude that the distinction between strong and weak NPIs is real. Within each class all NPIs show a uniform and very stable behavior, and participants’ ratings are very consistent as well. Simple sentences with one licensing operator and no other quantificational element that could interfere with NPI licensing are a good environment for confirming the distinction between weak and strong NPIs.

Our results also show that strong NPIs are not really bad without a strong licenser, as long as a weak licenser is available instead. In the presence of a weak licenser, simple sentences with strong NPIs are somewhat degraded. In fact an earlier pilot study where items similar to Experiment 1 were tested together with highly complex or ungrammatical sentences showed that the acceptability difference between strong NPIs licensed by the appropriate strong licenser and inappropriate weak licensers is considerably more subtle, and possibly of a different sort, than the drop in acceptability caused by highly complex or ungrammatical sentences. In the pilot study, the distinction between strong NPIs with weak vs. strong licensers disappeared, the participants found all our conditions equally acceptable. Given the subtlety of the data, the stability of the experimental findings is all the more remarkable

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<sup>8</sup>The results of the Wilcoxon signed rank test for the weak licenser–strong NPI vs. strong licenser–strong NPI contrast are  $p_1$  and  $p_2 < .01$ , for the weak licenser–weak NPI vs. strong licenser–weak NPI contrast  $p_1 = .037, p_2 = .443$ .

<sup>9</sup>In CoDII this NPI is labelled as weak, since the CoDII collection labels NPIs strictly according to corpus evidence, and there are occurrences of *im geringsten/das Geringste* in weak licensing environments in newspaper corpora. As intuitive judgments are inconclusive, this labelling was adopted for the experiment, but participants consistently treated it as a strong NPI. At the same time, we note that *im geringsten/das Geringste* is a typical example of a minimizer NPI (it denotes a smallest amount), and minimizer NPIs have a tendency toward acting like strong NPIs. However, this is only a tendency: Minimizers are not necessarily strong NPIs in the sense in which we defined the term above. The lack of a strict correlation made it possible for us to assume at first that *im Geringsten* could be treated as a weak NPI by German speakers. Once more we might be looking at a gradient phenomenon.

<sup>10</sup>The corresponding results of the Wilcoxon signed rank test are  $p_1 = .112$  and  $p_1 < .01$ , respectively.

(and encouraging).

Besides the main results we observe a suggestive pattern which we did not pursue any further in the present set of experiments. Those NPIs that were not fully licensed, i.e. strong NPIs in the context of weak licensors, received similar judgments as the distractors that we called modified idioms, e.g. (6a) (mean ratings for this distractor type in Experiment 1: 3.95, SE .160, in Experiment 2: 3.84, SE .174). This is interesting and makes sense if we think of the semantic strong licensing requirement of strong NPIs as not being completely met by a weak licensor. However, a weak licensor is still perceived as *almost* fulfilling the licensing requirement. Similarly, an idiomatic expression which contains a definite NP in place of an indefinite NP, or a plural NP instead of the required singular NP as illustrated in our example (6a), almost meets the lexical requirements of the idiomatic unit. The intended idiomatic phrase is clearly recognizable as such, and it still receives the idiomatic interpretation, although something about it does not feel ‘quite right’. It is then plausible to assume that there might be a similar effect with NPI licensing in which the licensor is not quite strong enough, and the parallel acceptability judgments hint in that direction. As we did not test this correlation here, we cannot draw any conclusions on the basis of the present observations.<sup>11</sup>

### 3 Neg-Raising

With the experiments in the previous section, we established two sets of NPIs which we can reliably discriminate, a set of weak NPIs and a set of strong NPIs. These two sets of NPIs form the foundation of our next step, in which we investigate the effect of quantifiers intervening between an NPI and its licensor in syntactically more complex structures.

Neg-raising constructions (Horn (1978)), illustrated in (7), are a well-known and widely studied environment in which we can test more complex cases of NPI licensing. Theories of neg-raising make clear predictions about the licensing of NPIs in clauses that are embedded under neg-raising matrix predicates. At the same time, it can be quite difficult to check these predictions by mere introspection, giving additional interest to a carefully controlled experimental approach.

- (7)
- a. I don’t think that Mary will win the election.
  - b. I don’t think that Peter will *lift a finger* to help Mary.
  - c. \*I don’t claim that Peter will *lift a finger* to help Mary.
  - d. \*I don’t think that every senator will *lift a finger* to help Mary.

(7a) is a standard example with the English neg-raising predicate *think*. The main observation about neg-raising predicates is that if they occur with sentential negation in the matrix clause as in (7a), the negation may be semantically (or pragmatically) interpreted as not taking scope over the matrix predicate (*think*) but only in the embedded sentence, leading to the interpretation *I think that Mary will not win the election* for (7a). What is interesting for our investigation of NPIs is the fact that NPIs are licensed in clauses that are embedded under neg-raising predicates in neg-raising constructions. The English NPI *to lift a finger* in (7b) is thus licensed by the syntactic negation in the matrix clause. In (7b) the negation is necessarily interpreted in the embedded clause, eliminating the possibility of wide scope negation over the neg-raising predicate. Corresponding constructions without a neg-raising predicate in the matrix clause are considered to be ill-formed (7c).<sup>12</sup> (7d) contains a quantifier, *every senator*, as subject of the embedded clause, which is the only difference from (7b), where the corresponding subject is a proper name. For that reason the ill-formedness of

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<sup>11</sup>In Richter and Radó (2011) we investigate these preliminary observations experimentally.

<sup>12</sup>These data are discussed in depth (and analyzed) in Sailer (2006).



(7d) is assumed to be caused by the intervening quantifier taking scope between the licensing negation and the NPI.

All current theories of neg-raising<sup>13</sup> agree that negation in (7b) is interpreted as taking scope in the embedded clause at the relevant level of representation, no matter whether these theories choose as their analytical tools (semantic) logical forms, presuppositions, entailments, or pragmatic properties. Moreover, apart from a few exceptional cases, negation takes widest scope in the embedded clause, outscoping all other logical operators that may occur in it. Exceptions to this strong tendency towards wide scope are some quantifiers such as *most*, and some modal operators (Horn (1978)). In our experimental items we paid attention to the nature of the logical operators that we used as potential interveners between negative licenser and NPI and made sure to choose only elements that are known to act as interveners.<sup>14</sup>

In line with the underlying semantic theory of NPI licensing and theories of neg-raising, we assume that the German sentential negation adverb *nicht* is an anti-additive licensing operator which takes wide scope over the proposition expressed by the embedded clause. We will then expect that, in the absence of any other disturbing syntactic or semantic property, weak and strong NPIs should be licensed equally well, because in the embedded sentence we find a licensing configuration that we know from the previous experiments: a strong licenser outscoping a strong or weak NPI. However, if there is a quantifier in the embedded clause, we expect the intervener to lead to a sharp decrease in acceptability for both strong and weak NPIs. This decrease in acceptability should reflect the assumption in the theoretical literature that an intervening quantifier breaks the licensing relationship between an anti-additive licenser and a (strong or weak) NPI, rendering the sentence ungrammatical.

### 3.1 Weak and Strong NPIs in Neg-Raising Constructions

In our third experiment, we investigated the effect of intervening quantifiers in neg-raising constructions. Based on the literature, the hypothesis was that (1) neg-raising predicates with sentential negation should license NPIs, but (2) an intervening quantifier should interfere with licensing, which should produce a strong decrease in acceptability. In order to test this hypothesis, we constructed items with four conditions, as shown in (8). The licensing sentential negation adverb is printed in bold face, NPIs in italics, and intervening quantifiers (in two of the four conditions) and their corresponding non-intervening counterparts (in the remaining two conditions) are underlined.

- (8) a. Der Professor rechnet **nicht** damit, dass i. die / ii. mehr als zehn  
the professor expects not it that i. the / ii. more than ten  
Dorfbewohner seine Ausführungen *so recht* verstehen.  
villagers his demonstrations all that well understand  
‘The professor does not expect the / more than ten villagers to understand  
his demonstrations all that well.’
- b. Der Professor rechnet **nicht** damit, dass i. seine / ii. mehr als zehn  
the professor expects not it that i. his / ii. more than ten  
seiner Studenten *einen blassen Schimmer* vom Prüfungsstoff haben.  
his students a pale gleam about-the exam material have  
‘The professor does not expect his / more than ten of his students to have  
a clue about the exam material.’

<sup>13</sup>For a comprehensive survey of neg-raising analyses, see Sailer (2009, p. 312–317).

<sup>14</sup>A reviewer remarks that the English counterpart of our intervener *viele seiner N* (‘many of his N’, see (10bii) below) might not be an equally good intervener in English. While cross-linguistic variation of this sort would not surprise us, a systematic and robust understanding of what constitutes a good intervener, and why, appears to be among the most challenging theoretical desiderata.

(8ai) contains the weak NPI *so recht* ('at all') and no intervening quantifier between the negation and the NPI, as definite noun phrases such as *die Dorfbewohner* ('the villagers') are not interveners (WNPI/-I condition; weak NPI, no intervener). (8aii) is analogous to (8ai), with the definite noun phrase replaced by the generalized quantifier *mehr als zehn Dorfbewohner* ('more than ten villagers'). As a monotone increasing proportional quantifier, this is a good intervener for the condition WNPI/+I. In (8bi), the SNPI/-I condition, there is no intervening quantifier between the negation and the strong NPI *einen blassen Schimmer haben* ('to have a clue'). In its counterpart (8bii), a definite noun phrase is again replaced with a proportional monotone increasing quantifier as intervener (SNPI/+I condition) without changing anything else.

In addition to the previous kinds of distractors (shown in (6) above), we added two new kinds. One of them we termed twice-removed idioms. These were idiomatic expressions which we modified in two ways at once. For example, the distractor sentence in (9) contains the idiomatic expression *jemandem den Geldhahn abdrehen* ('to make sure that someone loses their source of money'), but the number value of the noun phrase was changed from the obligatory singular to plural and the verb *abdrehen* was replaced by a near synonym, *verstopfen*.

- (9) Maria beschloss, der Verschwendung ein jähes Ende zu machen und ihren  
 Maria decided the waste a sudden end to make and her  
 ältesten Kindern *die Geldhähne* zu verstopfen.  
 eldest children the money-faucets to block  
 'Maria decided to stop the money wasting immediately and to dry up the money  
 resources of her eldest children.'

Due to the manipulation of the idiomatic phrase, the sentence is very clearly degraded, but its intended meaning is still recoverable. The other new distractor type included sentences with unusual predicate-argument combinations or highly untypical predicates. The inclusion of the additional types of distractors was motivated by our expectation that the syntactically and semantically more complex conditions in the present experiment lead to lower ratings in certain conditions than before. Intuitively, neg-raising constructions with NPI and intervening quantifier seem more degraded than any of the fillers of the previous experiments, which only comprised stylistically marked constructions and once-modified idioms. Distractors of the type shown in (9) were intended to match this change.

The participants were 40 native German speakers (students of the University of Bochum), who rated the sentences on a 7-point scale in an Internet questionnaire with WebExp2. We presented 20 items in four conditions in a Latin square design, with 20 strong and 20 weak NPIs. All strong NPIs were idiom-like. For the 60 distractors, we used four types of sentences: Complex or stylistically marked sentences, which we assumed would be perceived as "good"; modified idioms as in the previous experiments; the new, twice-removed idioms characterized above, which we assumed would be perceived as comparatively "bad"; and sentences with unusual predicate-argument combinations, which we assumed to be at the same level or below the simple modified idioms.

The mean ratings in the four conditions were WNPI/-I 4.32, SE .207, WNPI/+I 3.86, SE .182, SNPI/-I 3.93, SE .208, SNPI/+I 3.46, SE .204. The results confirmed the intervention effect of certain quantifiers for NPI licensing. First of all, we note that neg-raising constructions, while licensing both types of NPIs, were not perfect licensors for strong NPIs ( $F_1(1, 39) = 17.261, p < .01, F_2(1, 19) = 4.691, p < .045$ ). Secondly, the intervener had a constant effect on the licensing of strong and weak NPIs ( $F_1(1, 39) = 6.475, p < .015, F_2(1, 19) = 10.276, p < .01$ ; interaction both  $p$ 's  $< .96$ ).<sup>15</sup> We also observe that the SNPI/+I condition,

<sup>15</sup>We computed Wilcoxon signed ranks for the following contrasts: WNPI/-I vs. WNPI/+I  $p_1 = .078, p_2 = .081$ ; SNPI/-I vs. SNPI/+I  $p_1 = .034, p_2 = .038$ ; WNPI/-I vs. SNPI/-I  $p_1 = .064, p_2 = .075$ .

which was rated lowest, was still perceived as being much better than twice-removed idioms (mean ratings: 3.46 vs. 2.94). We can thus say that neg-raising constructions differentiate between strong and weak NPIs even in the presence of a strong licenser, which cannot be explained on the basis of a semantic theory of NPI licensing alone. However, even constructions in which an intervening quantifier interfered with the licensing of strong NPIs were not perceived as strictly “bad”. Comparing the results of Experiment 3 and the preceding two experiments, it seems that the SNPI/+I condition was being rated by speakers as roughly at the same level of acceptability as the not entirely felicitous licensing of strong NPIs by weak licensers.

### 3.2 Verbal NPIs with and without Neg-Raising

In our final experiment we investigated a specific syntactic type of NPIs, namely verbal NPIs. With verbal NPIs we mean NPIs that essentially consist of a single verb or a group of verbs. In the CoDII collection they are classified as weak NPIs. We investigated the licensing conditions of verbal NPIs, the effect of the neg-raising configuration on their acceptability, and checked the intervention effect on verbal NPIs in neg-raising constellations. The main question of this experiment was whether verbal NPIs differ in their licensing behavior from weak and strong NPIs.<sup>16</sup> The hypothesis was (1) that verbal NPIs are licensed in the same environments as the previously investigated weak NPIs and (2) that their licensing is subject to the same intervention effects in neg-raising constructions.

For testing the hypothesis, we constructed items with four conditions as shown in (10). Licensers are printed in bold face, NPIs (which may consist of several words) are printed in italics.

- (10) a. i. Die / ii. **Nicht alle** Freunde von Fritz *können* die Talkshows im  
i. the / ii. not all friends of Fritz can the talkshows on  
Fernsehen (i. **nicht**) *ausstehen*.  
TV not stand  
‘Fritz’ friends cannot / Not all of Fritz’ friends can stand TV talkshows.’
- b. Fritz glaubt **nicht**, dass i. seine / ii. viele seiner Freunde die Talkshows  
Fritz believes not that i. his / ii. many his friends the talkshows  
im Fernsehen *ausstehen können*.  
on TV stand can  
‘Fritz does not believe that his / many of his friends can stand TV talkshows.’

The first two conditions are simple clauses in which the NPI *ausstehen können* (‘can stand something’) is accompanied either by a strong licenser such as the sentential negation adverbial *nicht* (10ai), or by a weak licenser, in (10aai) the quantifying determiner *nicht alle* (‘not all’), which is downward entailing in its second argument (the verb phrase containing the NPI). Apart from the different licensers, the sentences in these two conditions were constructed in a parallel manner. The remaining two conditions looked at neg-raising environments. For this purpose, the clause of the previous conditions was embedded under a matrix clause containing a negated neg-raising predicate. In condition 3, there was no intervening quantifier between the negation and the NPI (10bi), whereas the last condition replaced a definite noun phrase with a generalized quantifier that can function as an intervener (10bii).

This experiment was conducted as a paper and pencil questionnaire with 40 native German speakers (students of the University of Tübingen). We used a Latin square design with 24 verbal NPIs, which each occurred in a clause-mate context with a strong and a weak licenser, and in a neg-raising context with and without an intervening quantifier. There were 72 fillers

<sup>16</sup>The hypothesis that verbal NPIs form a separate class of NPIs besides weak and strong NPIs has been pursued by Sailer (2009), who follows up on earlier proposals by Klooster (1994) and Falkenberg (2001).

of the four types previously described (stylistically marked constructions or newspaper style, once-modified idioms, twice-removed idioms, and sentences with odd predicate-argument combinations).

The mean ratings were SL 4.97, SE .153; WL 4.77, SE .146; NR/-I 4.22, SE .195; NR/+I 3.77, SE .169.<sup>17</sup> Although there was a difference in rating between strong (SL) and weak licensing (WL) of the verbal NPIs, the difference between the two conditions was far from significant ( $t_1(39) = 1.22, p < .23, t_2(23) = .9, p = .38$ ); Wilcoxon signed rank test:  $p_1 = .791, p_2 = .749$ . Weak licensors are sufficient for verbal NPIs. It is also clear that a neg-raising construction is not a perfect licenser, as the contrast between weak licensing and licensing in a neg-raising construction without an intervener (NR/-I) shows ( $t_1(39) = 3.25, p < .01, t_2(23) = 2.331, p = .03$ ); Wilcoxon signed rank test:  $p_1 < .01, p_2 = .016$ . In addition we found a clear intervener effect in the fourth condition, NR/+I, when compared to NR/-I ( $t_1(39) = 3.018, p < .01, t_2(23) = 1.93, p = .06$ ); Wilcoxon signed rank test:  $p_1 < .01, p_2 = .08$ . The NR/+I condition behaved roughly like the intermediate distractors, our once-modified idioms, and was clearly better than twice-removed idioms, which received the lowest judgments (mean ratings: stylistically marked distractors 5.52, idiom distractors 3.37, odd predicate-argument combinations 3.77, “bad” distractors 2.36).

According to these results, verbal NPIs behave like weak NPIs as they are licensed in the same environments. To confirm that they are in fact weak NPIs in every respect, the two groups would have to be directly compared in a single experiment.

One might notice that the conditions SL and WL were syntactically less complex than NR/-I and NR/+I, as the latter two add a matrix sentence to the constructions. It could then be tempting to assume that this increase in syntactic complexity could influence the acceptability of our neg-raising conditions. However, we do not believe that this is a good explanation for their systematically reduced acceptability. Our matrix sentences were very short and should not have added much processing demand to the sentences. Moreover, our stylistically marked fillers tended to be syntactically even more complex without this showing an effect on speakers’ judgments.

### 3.3 Summary

The experiments reported in this section reveal a number of interesting facts about weak and strong NPIs, some of which are not expected in the literature on NPI licensing.

The results confirm that NPIs are licensed under neg-raising predicates, and intervening quantifiers in the embedded sentence have a clear impact on NPI licensing and make the sentences less acceptable. Our intervening quantifiers were monotone increasing proportional quantifiers, as it is known from the literature since Horn (1978) that other quantifiers such as cardinal quantifiers, *most*, and a few other operators are not equally good interveners. Some of them might be interpreted as outscoping negation in the embedded sentences in the relevant constructions.

There are also a number of surprising facts about neg-raising environments revealed by our results. First of all, we see that neg-raising is not an ideal NPI licensing constellation. As Experiment 4 shows, weak NPIs in neg-raising constructions were significantly worse under an anti-additive licenser than they were when licensed by a merely downward-entailing licenser in the same clause.

Moreover, since we know from Section 2 that weak and strong NPIs are equally good under strong licensors, it is unexpected that neg-raising constructions distinguish between the two types of NPIs under the same anti-additive licenser: strong NPIs are not as good in neg-raising constructions as weak NPIs. All of this means that the distinction cannot be completely reduced to semantic licensing facts, as the semantic licensing environments are

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<sup>17</sup>Abbreviations: Strong licenser: SL; weak licenser: WL; neg-raising without intervener: NR/-I; neg-raising with intervener: NR/+I

kept constant. From a semantic point of view, the same anti-additive licenser was available at the same distance to the weak or strong NPI that needed to be licensed. If we add intervening quantifiers to the construction, these have a constant impact on weak and on strong NPIs, i.e. their acceptability is reduced to the same degree. This is not consistent with occasional assumptions in the literature that strong NPIs become “bad” in neg-raising constructions with interveners while weak NPIs stay acceptable.<sup>18</sup> What might have caused this perception is probably the fact that strong NPIs start out worse under neg-raising, and the equal decrease in acceptability in the two conditions might intuitively push strong NPIs under a certain threshold such that they seem categorically worse introspectively than weak NPIs in the same environment.

At this point it is also important to recall that strong NPIs with interveners are still far better than twice-removed idioms. Overall, all our NPI constructions are much better than ungrammatical sentences in which syntactic mismatches such as missing subject-verb agreement or infelicitous case assignment occur. We see that the effect of interveners on the acceptability of NPIs in neg-raising constructions is quite subtle, which is reflected by the fact that the condition with interveners in the last experiment corresponds roughly to how speakers perceive intermediate fillers, i.e. idioms that are slightly syntactically modified either in number or definiteness vs. indefiniteness.

## 4 Discussion: The Nature of NPIs in Grammar

Our findings confirm that the distinction between strong and weak NPIs made in the linguistic literature can be found in the systematic investigation of naive native speaker judgments. Speakers do perceive a stable difference between strong NPIs in the context of an anti-additive operator and weak NPIs in the context of anti-additive and downward entailing operators on the one hand, and strong NPIs in the context of a merely downward entailing operator on the other, although the difference in judgment is subtle. Therefore we can confirm that the semantic distinction between these two classes is real.

On the other hand, the investigation of NPIs in neg-raising contexts shows that a semantic story of NPI licensing cannot be complete, and other factors must come into play. Whereas in simple clauses weak and strong NPIs are equally licensed by anti-additive operators, neg-raising constructions, which also involve an anti-additive operator as potential licenser, do not license the two types of NPIs equally well. It is an open question why this should be the case. A possible answer could be that neg-raising is not, or is only partially, a semantic licensing environment. Other factors of the construction might be important to which strong and weak NPIs respond differently. Whatever the source of this effect is, it should ideally also explain why neg-raising contexts are not perfect licensers for either type of NPI.

Further insight into these questions might be attainable by going beyond the limitations of our chosen experimental paradigm; nowhere did we address processing aspects of NPI licensing. The actual sources of the observed acceptability judgments are not known, and it is not implausible to assume that different types of processing effects contribute in varying degrees to what became visible to us in a single measurement, i.e. as observed mean. Other experimental techniques such as eye-tracking and self-paced reading could reveal more about the processing of e.g. anti-additive vs. downward entailing licensers, and of different NPIs. Similarly, in the neg-raising experiment with verbal NPIs (Section 3.2) we cannot be certain that the only relevant factors for the obtained acceptability judgments are the distinction between strong and weak licenser and the presence or absence of an intervener. Although we constructed simple sentences and embedded sentences as parallel as possible, there are un-

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<sup>18</sup>Sailer (2009, p. 122–123) builds this idea directly into his occurrence constraints for strong and weak NPIs, which exclude interveners for strong NPIs and permit exactly one intervener for weak NPIs. An *Immediate Scope Constraint* for NPI licensing already features prominently in the early syntactic account of Linebarger (1987, p. 338).

avoidable word order differences caused by the verb-second vs. verb final pattern of German sentence structure, and the two sentence types induce varying distances between licenser and licensee (with possibly discontinuous realizations of the licensee in one condition and continuous realizations in the other). While we do not think that these differences can explain the observed patterns (and are even less likely to be their single cause), we cannot exclude that they contribute to the relative degradation of neg-raising constructions compared to licensing in simple clauses. As we believe to have demonstrated that NPI licensing is an inherently non-categorical, gradient phenomenon, these distinctions clearly deserve attention in future research. Once neg-raising is investigated at that level of granularity, it will also be important to reconsider how pragmatic levels of representation might interact with semantics, and whether varying computational costs regarding different levels of representations and different available readings at different points during processing can be identified as meaningful ingredients of a more comprehensive theory of gradient NPI licensing in neg-raising environments.

Finally, the nature of interveners and how exactly they influence NPI licensing is far from clear. First of all, it is generally recognized that not all quantificational expressions are interveners. Secondly it is not apparent why an intervening quantifier interferes with the NPI licensing relationship between an appropriate negative operator and the NPI that it outscopes. While we do not have answers to these questions, we were able to show that the effect of interveners is relatively small but constant for weak and strong NPIs. This result contradicts the assumption, sometimes found in the literature, that licensing of strong NPIs in neg-raising constructions breaks down, whereas weak NPIs are still licensed. We speculated that this perception of the data is due to the rather subtle differences in acceptability between these two conditions and the fact that strong NPIs are not as good to begin with as weak NPIs in neg-raising constructions. Considering the constant effect of interveners in making NPIs less acceptable, it seems questionable to assume that we are looking at a strictly grammatical phenomenon. Intervention is clearly not a matter of a categorical distinction between grammatical and ungrammatical utterances, it is the cause of a gradual deterioration of the licensing relationship between NPIs and their required contexts.

These considerations lead to the big and, in our opinion, still open questions of NPI research: What is the status and place of NPIs in the grammatical system? What kind of general linguistic mechanism accounts for their behavior? Why is their licensing typically gradual and not a matter of categorical decisions? Especially with the large numbers of NPIs in languages such as German and Dutch which have surfaced in recent research, it is far from clear that existing syntactic, semantic and pragmatic theories of NPIs that were built on a much smaller set of data can give a comprehensive explanation of why NPIs occur in natural languages in the first place, and which grammatical mechanisms govern their distribution.

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