

Projective Behaviour of *Nur* – Quantitative Experimental Research

Agata Maria Renans

Universität Potsdam, Institut für Linguistik
SFB 632 – Informationsstruktur
Karl-Liebknecht-Str. 24-25,
D-14476 Potsdam
renans@uni-potsdam.de

Abstract. The paper presents the results of the experiment on the projective meaning of *nur* (German: *only*). The data from German shows that the prejacent of *nur* projects easily out of counterfactual *if*-clauses, whereas its projective behaviour changes when it is embedded in indicative *if*-clauses. The obtained results classify projection out of counterfactuals as a reliable test for projective meanings in the cross-linguistic perspective, on the one hand, while shedding more light on the semantics of *nur* and conditionals, on the other.

1 Introduction

The meaning of a sentence with *only* can be fully described by two meaning components: (1) the prejacent (the meaning of the sentence without an exclusive particle), and (2) the universal (the negative, exclusive meaning of the sentence with *only*), e.g.:

- (1) Only Mike ate ice-cream.
 - a. Prejacent → Mike ate ice-cream.
 - b. Universal → Nobody else but Mike ate ice-cream.

In the case of sentence (1), the prejacent is the proposition that *Mike ate ice-cream*, and the universal is the proposition that *Nobody else but Mike ate ice-cream*. Whereas it is commonly assumed that the universal is asserted, there are many competing theories regarding the semantic status of the prejacent of *only*, e.g., claiming that the prejacent is presupposed (Horn 1969), conversationally implicated (McCawley 1981, van Rooij & Schulz 2005), entailed (Atlas 1993), or a non-speaker-oriented implicature (Roberts 2006).

The question is which diagnostics we can use to detect the projective meaning components and how we can distinguish different kinds of them. The bench of tests for identifying projective meaning are gathered and described by Beaver, Roberts, Simons, and Tonhauser (2009). One of the most popular tests for detecting a projective meaning is the so-called *family of sentences* test. It is claimed

that the projective meaning should be interpreted outside the scope of (1) negation, (2) interrogation, (3) modals, and (4) the antecedent of a conditional.

In the experiments, I evaluate the *projection out of the antecedent of a conditional* test. The results show that the choice of the *if*-clause (counterfactual or indicative) influences the results of the experiment/elicitation on the projective meaning which is conducted with the help of this test. Projective meaning components (including the prejacent of *nur*) behave differently depending on whether they are embedded in counterfactual or indicative *if*-clauses.

2 Projective Behaviour of *Nur* — Experiments

2.1 Experimental Set-Up

To check whether the projective behaviour of the prejacent of the sentences with *nur* changes when the given sentence is embedded in the antecedent of the counterfactual and indicative conditionals, four experiments were conducted. Since in German indicative conditionals can be expressed either with the use of the particle *wenn* (\approx *if*) or *falls* (\approx *if, in case*), in order to eliminate the possibility that the results are modulated by the semantics of the given particle, two experiments with *wenn* and two experiments with *falls* were conducted. Moreover, experiments differed in the associated elements of *nur*: *nur* was associated either with Subject or with Direct Object. All conditionals in all four experiments were past-oriented and in each experiment the same lexical material was used in the antecedents of the conditionals¹. The summary of the properties of all four experiments is presented in Table 1.

Table 1. Experiments

	Indicative introduced by:	Element associated with <i>nur</i>
Experiment 1	<i>Wenn</i>	Subject
Experiment 2	<i>Wenn</i>	Direct Object
Experiment 3	<i>Falls</i>	Subject
Experiment 4	<i>Falls</i>	Direct Object

17–26 first and second-year-students of linguistics took part in each of 4 experiments (84 participants together, 75 women, 9 men, average age: 21,91, all German native speakers). Each experiment comprised 6 items per condition (24 target sentences in total) and 26 fillers (50 tasks together). All the experiments were balanced: each participant saw the same amount of conditions and no participant saw the same item twice.

¹ The consequents differed due to different association patterns with *nur*. Keeping the same lexical material in the consequent of the conditionals in all four experiments would make the conditional sentences pragmatically infelicitous.

2.2 Methodology

The design of the experiments is based on the methodology presented in Renans et al. (2011). Each task in each experiment consisted of a short context description, a target conditional sentence with *nur* (either (i) counterfactual or (ii) indicative) and a question (a) about the prejacent or (b) about the universal together with three possible answers *ja* (yes), *nein* (no), and *nicht erkennbar* (It's not known). The experiments were in the standard 2x2 conditions design, which is presented in Table 2. The informant's task was to answer the given questions.

Table 2. 2x2 conditions design in experiments (1)–(4)

	Type of conditional:	Question about
Condition a	counterfactual	prejacent
Condition b	counterfactual	universal
Condition c	Indicative	prejacent
Condition d	Indicative	universal

The tasks looked like as the following example². Here is the exemplification of the counterfactual *if*-clause and *nur* associated with the Direct Object:

- (2) Am Montag sollte jedes Kind seine Lieblingsspielzeuge mit in den
 On Monday should each child his favourite.toy with in ART
 Kindergarten bringen. **Wenn Franz nur ein Bärchen**
 kindergarten bring. If Franz only ART teddy-bear
mitgebracht hätte, wären die Erzieherinnen sehr erstaunt
 bring.PAST have.KONJ, be.KONJ ART teacher very surprise
 gewesen.
 be.PART
 ‘On Monday every child was to bring his favourite toys to the kinder-
 garten. If Franz had brought only a teddy-bear, the teachers would have
 been surprised.’
- a. Hat Franz ein Bärchen mitgebracht?
 have.PAST Franz ART teddy-bear bring.PART
 ‘Did Franz bring a teddy bear?’
 -ja (yes) -nein (no) -nicht erkennbar (It is not known)
- b. Hat Franz noch etwas außer einem Bärchen
 have.PAST Franz PART something beside ART teddy-bear
 mitgebracht?
 bring.PART
 Did Franz bring anything else than a teddy-bear?
 -ja (yes) -nein (no) -nicht erkennbar (It is not known)

² Notice that in the experiment, informants saw either question (a) or question (b).

If the participant answers a question about the prejacent (condition *a* and *c*) with *yes*, this means that the prejacent is interpreted outside the scope of the *if*-clause and hence projects out of the respective *if*-clause type. In the case of the universal, the interpretation of the results depends on the type of the conditional. In the case of (i) counterfactuals (condition *b*), answer *yes* means that the universal does not project out of the *if*-clause and answer *no* means that the universal projects out of the *if*-clause. In the case of (ii) indicatives (condition *d*), answer *It is not known* means that the universal does not project and answer *no* means that the prejacent projects. The interpretation of the results are shown in Table 3 (expected answers, assuming that the prejacent of *nur* projects and the universal is asserted, are written in boldface).

Table 3. Interpretation of the results

	No	Yes	?
Counterfactual Prejacent (<i>a</i>) \neg projection + projection			?
Universal (<i>b</i>) + projection \neg projection			?
Indicative Prejacent (<i>c</i>) \neg projection + projection \neg projection			
Universal (<i>d</i>) + projection \neg projection \neg projection			

2.3 Results

The results of the experiments are shown in Tables 4, 5, 6, and 7. In all four experiments the answer patterns are similar. The results concerning the projective behaviour of the universal are as expected. They suggest that the universal does not project out of the *if*-clauses and its projective behaviour does not change with the change of the used conditionals. In all four experiments there are significantly more *yes* answers than *no* and *It's not known* answers in the case of the counterfactuals and there are significantly more *It's not known* answers than *no* and *yes* answers in the case of the indicatives, which are the expected answer patterns for the non-projective meaning components. Results concerning the projective behaviour of the prejacent are more surprising. We can observe the differences in its behaviour when it is embedded in the counterfactual and indicative *if*-clauses: prejacent of *nur* projects easily out of the counterfactual *if*-clauses, whereas it does not project so easily out of the indicative *if*-clauses.

The *chi-square* test showed that there was a significant interaction between conditions and the given answers, which means that the conditions influenced the answer patterns (for all experiments $p < 0.001$).

To check whether the different answers were influenced by the type of the used conditional *linear mixed-effects models* (*LME*) were calculated. These models correspond to (logistic) regression models that take into account the variation due to participants and items. Since *no* answers were rare, *LME* models were

Table 4. Experiment1: *Nur* associated with Subject, indicatives with *wenn*

		No	Yes	?
Counterfactual	Prejacent (<i>a</i>)	8 (8%)	86 (80%)	12 (12%)
	Universal (<i>b</i>)	5	90 (88%)	7 (7%)
Indicative	Prejacent (<i>c</i>)	2 (2%)	41 (40%)	59 (58%)
	Universal (<i>d</i>)	16 (16%)	5 (5%)	81 (79%)

Table 5. Experiment 2: *Nur* associated with Object, indicatives with *wenn*

		No	Yes	?
Counterfactual	Prejacent (<i>a</i>)	7 (6%)	86 (71%)	27 (23%)
	Universal (<i>b</i>)	0	104 (87%)	16 (13%)
Indicative	Prejacent (<i>c</i>)	1 (1%)	41 (34%)	78 (65%)
	Universal (<i>d</i>)	11 (9%)	7 (6%)	102 (85%)

Table 6. Experiment 3: *Nur* associated with Subject, indicatives with *falls*

		No	Yes	?
Counterfactual	Prejacent (<i>a</i>)	7 (6%)	111 (88%)	8 (6%)
	Universal (<i>b</i>)	5 (4%)	113 (90%)	8 (6%)
Indicative	Prejacent (<i>c</i>)	5 (4%)	48 (38%)	73 (58%)
	Universal (<i>d</i>)	6 (5%)	21 (17%)	99 (78%)

Table 7. Experiment 4: *Nur* associated with Object, indicatives with *falls*

		No	Yes	?	-
Counterfactual	Prejacent (<i>a</i>)	9 (6%)	123 (79%)	24 (15%)	
	Universal (<i>b</i>)	5 (3%)	133 (85%)	18 (12%)	
Indicative	Prejacent (<i>c</i>)	5 (3%)	49 (31,5%)	102 (64,5%)	
	Universal (<i>d</i>)	4 (2,4%)	11 (7%)	140 (90%)	1 (0,6%)

calculated for *yes* and *It's not known* answers³. *LME* models showed that in all four experiments the type of the used conditional influenced the probability of *yes* and *It's not known* answers for the questions about the prejacent (*Yes* answers: Exp. 1: $z = -6.095$, $p < 0.001$, Exp. 2: $z = -6.092$, $p < 0.001$, Exp. 3: $z = -7.815$, $p < 0.001$, Exp. 4: $z = -8.786$, $p < 0.001$; *It's not known* answers: Exp. 1: $z = 6.687$, $p < 0.001$, Exp. 2: $z = 6.798$, $p < 0.001$, Exp. 3: $z = -7.781$, $p < 0.001$, Exp. 4: $z = 9.069$, $p < 0.001$). It means that *Yes* and *It's not known* answers for the question about the prejacent are modulated by the type of the conditional.

To assess the difference between the probability of *Yes* and *It's not known* answers in the case of the question about the prejacent in the indicative *if*-clauses (condition *c*), *LME* models were calculated on the proportions of each answer for each participant. There were significantly higher proportions⁴ of *Yes* than *It's not known* answers for Exp. 2 ($t = -4.933$) and 4 ($t = -4.046$), indicating that the prejacent of *nur* does not project out of the indicative *if*-clauses when it is associated with the Direct Object. For Exp. 3, the effect was marginal but with a trend in the same direction. However for Exp. 1 the effect was not significant. Nevertheless, the tendency towards non-projecting is also visible (40% of *Yes* answers vs. 58% of *It's not known* answers).

Summarizing, the results of the experiments show that the prejacent of *nur* behaves differently when it is embedded in counterfactual and indicative *if*-clauses: the prejacent does not project or tends not to project out of the scope of the indicative *if*-clauses. In order to check whether the obtained results are due to the semantics of *nur* specifically or due to the properties of the projective meaning components in general, an experiment on projective behaviour of *auch* (German: *too, also*) was conducted.

2.4 Projective Behaviour of *Auch* – Experiment

The experimental set-up, the methodology, and the lexical material of the *auch*-experiment was the same as in Exp. (1). The tasks looked as follows:

- (3) Am Montag sollte jedes Kind seine Lieblingsspielzeuge mit in den Kindergarten bringen. Wenn **auch** Franz ein Bärchen mitgebracht hätte, wären die Erzieherinnen nicht erstaunt gewesen.
 ‘On Monday every child was to bring his favourite toys to the kindergarten. If also Franz had brought a teddy-bear, the teachers would not have been surprised.’
 - a. Hat Franz noch etwas außer einem Bärchen mitgebracht?
 ‘Did Franz bring anything else than a teddy-bear?’
 - b. Hat Franz ein Bärchen mitgebracht?
 ‘Did Franz bring a teddy bear?’

³ Because of the lack of space, only the most important calculations are referred.

⁴ For these post-hoc comparisons, $|t| \geq 2.4$ was taken to be significant

In the case of (i) counterfactuals for both questions, answer *Yes* suggests that the respective meaning component projects, whereas answer *No* suggests that the respective meaning component does not project. In the case of (ii) indicatives for both questions, answer *It's not known* suggests that the respective meaning component does not project, whereas answer *Yes* suggests that it projects. The interpretation of the results of *auch*-experiment is presented in Table 8 (expected answers are written in boldface).

Table 8. Interpretation of the results: *auch*-experiment

		No	Yes	?
Counterfactual	Additive meaning (a)	\neg projection + projection		?
	Core meaning (b)	\neg projection + projection		?
Indicative	Additive meaning (c)	\neg projection + projection	\neg projection	
	Core meaning (d)	\neg projection + projection	\neg projection	

13 second-year students of linguistics (11 women, 2 men, average age: 23,23, all German native-speakers) took part in the experiment. The results are presented in Table 9.

Table 9. Experiment 5: *Auch* associated with Subject, indicatives with *wenn*

		No	Yes	?
Counterfactual	Additive meaning (a)	2 (2,5%)	63 (80,8%)	13 (16,7%)
	Core meaning (b)	77 (98,7%)	0 (0%)	1 (1,3%)
Indicative	Additive meaning (c)	1 (1,3%)	37 (47,4%)	40 (51,3%)
	Core meaning (d)	3 (4%)	11 (14%)	64 (82%)

As in the case of Exp. (1)–(4), results for counterfactuals are as expected. They show that the additive meaning component projects easily out of the counterfactual *if*-clauses. The results for the indicative *if*-clauses are more surprising. Similar amount of *Yes* and *It's not known* answers for the question about the additivity in the case of the indicative *if*-clauses suggests that the additive meaning component can be interpreted both in and out of the scope of the *if*-clause. Moreover, as in the case of the preajcent of *nur*, we can observe the difference in the projective behaviour of the additive meaning component of *auch* depending on the type of the used *if*-clause.

The *chi-square* test showed that an interaction between the conditions and the given answers was significant ($p < 0.001$). In order to see whether the answers were modulated by the type of the conditional *LME* were calculated. They showed that the probability of *Yes* and *It's not known* answers were influenced by the type of the used conditional (*Yes* answer: $z = 4.636$, $p < 0.001$, *It's not*

known answer: $z = -4.782, p < 0.001$). The results from Exp. (1) – (5) suggest that the described asymmetry is more systematical and is not caused by the specific semantics of *nur*. Notice, however that the observed effects are stronger in the case of the sentences with *nur* than with the sentences with *auch*.

3 Analysis

To analyse the results of Exp. (1)–(5) I adopt the restrictor analysis of conditionals in Kratzer (2011). She claims that in both indicative and counterfactual conditionals there is overt or covert modality. To understand conditional modality, we must start from Kratzer’s approach to modals in general (Kratzer 1981). She captures the semantics of modals with the use of three notions: conversational background (CB), modal base, and ordering source. CB (a function from possible worlds to premise sets, which are sets of propositions) indicates the premises from which one can resolve the truth-value of the sentence with modals. There are many types of CB, however here we are interested in the realistic CB and stereotypical CB.

Definition 1. *Realistic CB is a function f such that for any world $w, w \in \cap f(w)$. That is, f assigns to every possible world a set of propositions that are true in it. (Kratzer 2011a)*

A realistic CB indicates a **modal base** (a set of accessible worlds) by transferring the premises to the closely related worlds. Note that the truth-values of modal sentences are resolved only regarding the modal base, not all the possible worlds. I hypothesize that the presuppositions (and other projective meaning components) should be present in a modal base.

Definition 2. *Stereotypical CB is a function f such that for any world $w, f(w)$ represents what is normal in w according to some suitable normalcy standard for w . (Kratzer 2011a)*

A stereotypical CG which orders the worlds according to how closely they are related to the evaluation world taking into consideration the normal course of events in the evaluation world is an **ordering source**.

Given the above definitions, Kratzer (2011a) defines conditional modality. She claims that an *if*-clause additionally restricts the modal base of the consequent in reference to which the conditional sentence is interpreted.

Definition 3. *For any conversational backgrounds f and g : $[[if\alpha\beta]]^{f,g} = [[\beta]]^{f^+,g}$, where for all $w \in W, f^+(w) = f(w) \cup [[\alpha]]^{f,g}$. (Kratzer 2011a)*

Different kinds of conditionals are defined by different settings of the modal base and ordering source. Counterfactuals (in contrast to indicatives) are interpreted with the use of an empty modal base (Kratzer 2011a).

The modal base restricts the set of the possible worlds over which the covert modal in the consequent of the conditional quantifies. Since presuppositions are

in a modal base f , they also restrict the quantification domain of the covert modal in the consequent of a conditional. The crucial thing is that in the case of counterfactual *if*-clauses an initial modal base f (from Def. 3) is empty. A modal base in reference to which the consequent is interpreted (f^+) is updated with the asserted proposition carried by the antecedent. However, since an initial modal base $f = \emptyset$, there are no presuppositions in f^+ . Hence, the presuppositions do not take part in the restriction of the quantification domain of the consequent of the conditional. It follows that they are interpreted outside of the scope of the *if*-clause. Let us consider the following example:

- (4) Also Mira came to the party.
- a. core-meaning \rightarrow Mira came to the party.
 - b. additive meaning \rightarrow Somebody else than Mira came to the party.
 - c. If also Mira had come to the party, Anne would have been happy.

From Def. 3 follows that the consequent in (4-c) is interpreted in reference to the modal base f^+ , which is the union of the empty set and the proposition expressed by the antecedent: $f^+(w) = \emptyset \cup [[\text{Mira came to the party}]]^{\emptyset, g}$. We can see that the presupposition (here: proposition that somebody else than Mira came to the party) does not restrict the possible worlds regarding to which the consequent is evaluated. Hence, the additive meaning component of *auch* is interpreted outside of the scope of the *if*-clause.

Indicative conditionals are interpreted in reference to a non-empty modal base. It means that the presuppositions (which are present in the initial modal base f) can restrict the modal base in reference to which the consequent is evaluated. Let us consider (4) and let us embed it in the indicative *if*-clause:

- (5) If also Mira came to the party, Anne was happy.

Sentence (5) is interpreted with respect to a non-empty modal base f which includes the presupposition carried by the antecedent, i.e. the proposition that somebody else than Mira came to the party. The consequent is evaluated in reference to the modal base f^+ which includes both the presupposition and the core-meaning of the antecedent: $f^+(w) = f(w) \cup [[\text{Mira came to the party}]]^{f, g}$, where the presupposition $[[\text{Somebody else came to the party}]]$ is included in $f(w)$. The presupposition (a proposition that somebody else came to the party) restricts the worlds over which the consequent quantifies.

Note that in the case of the indicatives, the presuppositions can be interpreted twice: in and out of the scope of the *if*-clause. The presupposition is present in a modal base, but it is still a projective meaning component, that is why there is still possible to interpret it out of the scope of the *if*-clause, what is indicated by the results of Exp. (5).

The difference between counterfactuals and indicatives is that the counterfactuals do not allow for the interpretation of the presuppositions within the scope of the *if*-clause, whereas indicatives provide such a possibility. The empty modal base prevents presuppositions to be interpreted in the scope of the counterfactual

if-clause. A non-empty modal base which characterizes indicative conditionals allows us to interpret the presuppositions within the scope of the *if*-clause.

The mechanism of interpreting the conditionals with *nur* is the same as in the case of these with *auch*. The stronger effect of not projecting out of the scope of the indicative *if*-clauses is caused by the universal, which is an asserted part of the proposition in the antecedent and therefore obligatorily restricts the modal base. In sentence *If only Mira came to the party, Anne was sad*, the universal is a proposition that *nobody else than Mira came to the party*. In order to indicate all the possible worlds where nobody else than Mira came to the party, it is possible (but not obligatorily) to select the worlds where Mira came to the party. That is why the results of Exp. (1)–(4) showed a tendency to interpret the prejacent of *nur* in the scope of the indicative *if*-clause.

4 Conclusion

The paper reports the results of the experiments based on the methodology presented in Renans et al. (2011). Exp. (1)–(5) showed that there is a significant difference in the behaviour of the projective meaning components when they are embedded in indicative and counterfactual *if*-clauses. The analysis of the results explained where this difference comes from. Therefore, the *Projection out of the indicative if-clause* test is evaluated as being inappropriate for the semantic fieldwork. The results of Exp. (1)–(5) showed that the quantitative experimental research can shed a new light on old (formal) semantic problems.

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