

Marking and Interpretation of negation: A bi-directional OT approach

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0. Abstract

Negation and negative indefinites raise problems for the principle of compositionality of meaning, because we find both double and single negation readings in natural language. De Swart and Sag (2002) solve the compositionality problem in a polyadic quantifier framework. All negative quantifiers are collected into an N-store, and are interpreted by means of iteration (double negation) or resumption (negative concord) upon retrieval. This paper extends the earlier analysis with a typology of negation and negative indefinites using bi-directional optimality theory (OT). The constraints defined are universal, but their ranking varies from one language to the next. In negative concord languages, the functional motivation for the marking of ‘negative variables’ wins out. Double negation languages value first-order iteration. The bi-directional set-up is essential, for syntactic and semantic variation go hand in hand.¹

1. Introduction

Languages generally have ways to express negation, i.e. something that corresponds to the first-order logic connective \neg . In English this would be *not*. Many languages also have nominal expressions negating the existence of individuals having a certain property, i.e. something that corresponds to $\neg\exists x$. In English, this would be *nobody*, *nothing*. If we assume that knowledge of first-order logic is part of human cognition, we would seem to predict that negation and negative quantifiers behave alike across languages. From empirical research by typologists and theoretical linguists, we know that this is not the case. The key insight is that languages make use of the same underlying mechanisms, but exploit the relation between form and meaning in different ways. Optimality theory (OT) can capture this kind of generalization. I adopt a bi-directional version of Optimality Theory that calculates the optimal form for a given meaning, and the optimal meaning for a given form on the basis of a ranking of violable constraints. The constraints are universal, but the ranking of the constraints is language specific, which accounts for typological variation.

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The organization of the paper is as follows. Propositional negation is discussed in section 2. Section 3 gives an overview of indefinites under negation, and introduces the analysis of double negation (DN) and negative concord (NC) proposed by de Swart and Sag (2002). Section 4 develops a typology of DN and NC languages in bi-directional OT. Section 5 extends the analysis to the occurrence, position and interpretation of markers of sentential negation. Section 6 concludes the paper.

2. Propositional negation

The expression of propositional negation ($\neg p$) and negative quantifiers ($\neg \exists x$) takes various forms across languages (cf. Jespersen 1917, 1933, Dahl 1979, Payne 1985, Horn 1989, Ladusaw 1996, Bernini and Ramat 1996, and Haspelmath 1997 for overviews of the facts). This paper does not aim at typological completeness, but it is in line with what typologists have observed. The aim of this section is to determine how languages express a meaning that could be written in first-order logic as $\neg p$, and how they interpret sentential negation. We treat this question in an OT syntax where the input is a meaning (a first-order formula), the set of candidates generated by GEN is a set of possible forms, and a ranked set of violable constraints selects the optimal form for the given meaning. Furthermore, we set up an interpretation mechanism in OT semantics, where the input is a form (a well-formed sentence), the set of candidates is a set of possible meanings (first-order formulae), and a ranked set of violable constraints selects the optimal interpretation for the given form.

Negative sentences are formally and interpretationally marked with respect to affirmative sentences. Now negation is not a sentential force in the sense of Portner and Zanuttini (2003), because it is compatible with different clause types (declaratives, interrogatives, exclaimatives). However, there are certain similarities. According to Portner and Zanuttini (2003) all exclaimatives share the need to represent in the syntax two semantic properties, namely that exclaimatives are factive and that they denote a set of alternative propositions. Similarly, we require that the syntax reflects, in some way, the fact that negative sentences are not affirmative by means of the constraint that we call FaithNeg (Faith negation):

- ◆ **FaithNeg**
Reflect the non-affirmative nature of the input in the output.

FaithNeg is a faithfulness constraint, i.e. a constraint that aims at a faithful reflection of input features in the output. Within a generation perspective (OT syntax), FaithNeg means that we reflect negation in the meaning (input) in the output (form). In OT, faithfulness constraints are usually balanced by markedness constraints, which are output oriented and aim at the reduction of structure in the output. The markedness constraint that plays a role in negative statements is *Neg:

- ◆ ***Neg**
Avoid negation in the output

*Neg is in conflict with FaithNeg, which requires a reflection in the output of negative features we find in the input. Such conflicting constraints are characteristic of OT style analyses. The conflict is resolved by the ranking of constraints in terms of strength. If we rank FaithNeg higher than *Neg, making it a stronger, more important constraint, we can derive the fact that negative meanings are formally expressed:

Tableau 1 (generation of negative sentences)

Meaning	Form	FaithNeg	*Neg
$\neg p$	S	*	
\Rightarrow	not S		*

Note that the input in tableau 1 is a meaning, and the output candidates evaluated by the grammar are forms. All our generation tableaux will have this set-up. The ranking FaithNeg >> *Neg reflects the generally accepted view that negative statements are cross-linguistically more marked in form than their affirmative counterparts (Payne 1985, Horn 1989, Haspelmath 1997). All the sentences in (1) express a negative proposition, and contain a linguistic marker expressing negation (in italics):

- (1) a. John *is not* sick. [English]
 b. *Ou* petetai Sokrates. [Ancient Greek]
 Not flies Sokrates. ‘Socrates doesn’t fly’
 c. Dokumenty *ne* obnaružilis [Russian]
 Documents not were found. ‘Documents were not found.’
 d. Mtoto ha-ku-lia. [Swahili]
 Child neg-past-cry. ‘The child did not cry.’

We assume that there are no languages in which *Neg outranks FaithNeg. So negation is, in some sense, claimed to be a universal category (Dahl 1979).

The interpretation of negative sentences is a mirror image of their generation:

Tableau 2 (interpretation of negative sentences)

Form	Meaning	FaithNeg	*Neg
not S	P	*	
\Rightarrow	$\neg p$		*

Note that the input in tableau 2 is a form, and the output candidates evaluated by the grammar are meanings. All our interpretation tableaux will have this set-up. For lack of time and space, we restrict ourselves in this paper to mono-clausal examples, setting aside the problems of negation, neg-raising, and negative concord in multi-clausal constructions. For the expression of indefinites under negation, we need additional constraints.

3. Indefinites under negation

Section 3.1 develops an empirical classification of the expression of indefinites under negation ($\neg\exists x_1\exists x_2\dots\exists x_n$ in first-order logic). We base our analysis of negative concord on de Swart and Sag (2002), which we discuss in section 3.2.

3.1 Empirical classification

Haspelmath (1997: 193-4) and Corblin and Tovena (2003) describe how natural languages express the meaning $\neg\exists x_1\exists x_2\dots\exists x_n$. We roughly follow their classification, and distinguish three main cases: indefinites, negative polarity items, and n-words.

Case 1: indefinites under negation

Simplest possible forms that expresses the meaning $\neg\exists x_1\exists x_2\dots\exists x_n$: marker of sentential negation/ negative quantifier with n/n-1 indefinites in its scope.

- (2) a. Ik heb daar toen *niet iets* van durven zeggen. [Dutch]
 I have there then *not something* dare say.
 ‘I didn’t dare to say anything about that at that time.’
 b. *Niemand* heeft *iets* gezien.
Nobody has *something* seen. ‘Nobody saw anything.’

Haspelmath (1997: 193) gives an example from Turkish:

- (3) Bir şey duy-ma-dı-m.
 Something hear-neg-past-1sg. ‘I didn’t hear anything.’

So what seems to be the simplest possible formal combination from a (first-order) logical point of view is actually realized in several natural languages. However, not all languages allow this straightforward expression of indefinites under negation.

Case 2: negative polarity items

Simplest possible forms as in case 1 are blocked, because indefinites are positive polarity items (PPIs) that are allergic to negative contexts. Instead, negative polarity items (NPIs) are used to express existential quantification in the scope of negation.

- (4) a. #I did *not* buy *something*. [English]
 b. I did *not* buy *anything*.
 (5) a. #*Nobody* saw *something*.
 b. *Nobody* saw *anything*.
 c. *Nobody* said *anything* to *anyone*.

Negative polarity items occur in a wider range of contexts than just negation, e.g.:

- (6) a. If you saw *anything*, please tell the police.
 b. Did *anyone* notice *anything* unusual?
 c. Few people wrote down *anything*.

The examples in (6) illustrate that NPIs such as *anything* do not inherently carry a negative meaning. Rather they correspond with existential quantifiers with some additional meaning component (characterized as ‘widening’ of alternatives by Kadmon and Landman 1993, or as indicating the bottom of a scale by Fauconnier 1975, 1979, Krifka 1995, Israel 1996, de Swart 1998).

Haspelmath (1997) gives the following example from Basque:

- (7) Ez dut inor ikusi.
 Neg I:have:him anybody seen.

'I haven't seen anybody.'

Case 3: n-words

Simplest forms as in case 1 are blocked, because indefinite pronouns are PPIs. Instead, existential quantification in the scope of negation is expressed by means of 'n-words'. N-words behave as negative quantifiers in isolation (8a), or in sentences in which they are the only expression of negation (8b), but express a single negative statement in combination with sentential negation or other n-words (8c,d).

Example: Romance languages:

- (8) a. A:Qué viste? B: Nada [Spanish]
A: What did you see? B: Nothing
- b. Nessuno mangia. [Italian]
Nobody ate.
- c. No vino nadie. [Spanish]
Not came nobody. = Nobody came
- d. Nadie miraba a nadie
Nobody looked at nobody. = Nobody looked at anybody

N-words differ from negative polarity items in three ways, according to Ladusaw (1992), Vallduví (1994), Bernini and Ramat (1996), Haspelmath (1997). First, they behave as negative quantifiers in isolation (8a,b), whereas negative polarity items behave as indefinites, and contribute an existential quantifier \exists rather than a negative existential quantifier $\neg\exists$ (cf. 6). NPIs like *anything* do not mean 'nothing' as the elliptical answer to a question and do not occur in subject position, because they must be licensed by an operator with the right semantic properties (downward entailing, non-veridical or whatever, cf. Fauconnier 1975, 1979, Ladusaw 1979, Zwarts 1986, Van der Wouden 1997, Giannakidou 1998, etc.).² N-words can occur in the context of another anti-additive operator, but they don't need a licenser; they are 'self-licensing' (Ladusaw 1992). As a result, n-words can be used in sentences in which no other expression conveys a negative meaning (8b).³ This paper concentrates on n-words, and does not provide an OT analysis of the generation and interpretation of NPIs.

Languages that use n-words express what is known as *negative concord*: a sequence of seemingly negative expressions gets a single negation reading. Negative concord (NC) raises major questions for semantics, because it seems to violate the principle of compositionality of meaning. Many existing proposals try to answer this question (e.g. Zanuttini 1991, Ladusaw 1992, Van der Wouden and Zwarts (1997), Corblin (1996), Déprez (1997, 2000), Giannakidou (2000), Herburger (2001), de Swart and Sag (2002), and others. For lack of space, I will not compare the different theories, but refer the reader to Corblin et al. (2004) for a review. This paper builds on the proposals made by de Swart and Sag (2002), so we will only discuss this analysis.

3.2 An HPSG analysis of double negation and negative concord.

The main semantic claims made by de Swart and Sag (2002) are that n-words are inherently negative, and that both double negation and negative concord involve

² This observation holds modulo the observations about inverse scope made by de Swart (1998).

³ Obviously, this criterion is only applicable in languages that do not require the presence of a marker of sentential negation in all negative sentences. In such languages (labelled class I languages in section 5 below), this criterion is not falsified, but cannot be tested.

polyadic quantification. Double negation involves iteration (function application), and is first-order definable. Negative concord is interpreted in terms of resumption.

- Resumption of a k-ary quantifier (Keenan and Westerståhl 1997).
 $Q_E^{A_1, A_2, \dots, A_k} (R) = Q_{E^k}^{A_1 \times A_2 \times \dots \times A_k} (R)$.

In words, we have a sequence of k monadic quantifiers Q binding just one variable each, interpreted on the universe of discourse E , with a one-place predicate A as their restrictor, and taking a k -ary relation R as its scope. This sequence is interpreted as one polyadic quantifier Q binding k variables, interpreted in the universe of discourse E^k , taking the subset $A_1 \times A_2 \times \dots \times A_k$ of E^k as its restrictor, and the k -ary predicate R as its scope. So a sequence of quantifiers *No x, No y, No z R(x,y,z)* is interpreted as $NO_{x,y,z} R(x,y,z)$, indicating that there is no triple $\langle x,y,z \rangle$ satisfying the three-place relation R . At the first-order level, the resumptive quantifier is equivalent to $\neg \exists x \exists y \exists z R(x,y,z)$, so we obtain the NC reading as desired.

The syntax-semantics interface defines how we obtain the DN and NC readings from the syntax. HPSG uses a notion of Cooper storage in which all quantifiers are collected into a store, and interpreted upon retrieval from the store (cf. Manning, Iida and Sag 1999). This mechanism is generally used to account for scope ambiguities, but de Swart and Sag (2002) extend it to polyadic quantification. All negative (anti-additive) quantifiers are collected into a so-called N-store. Interpretation upon retrieval from the store is by means of iteration of monadic quantifiers (leading to DN) or by resumption, building a polyadic quantifier (leading to NC). We will not spell out the retrieval mechanism here, but refer to de Swart and Sag (2002) for formal details. What is crucial for us here is that the grammar does not decide between DN and NC. This is what we need for a language like French, in which both readings are available. Consider the ambiguity of the following sentence in the HPSG analysis of de Swart and Sag (2002):

- (9) *Personne n'aime personne.* [French]
- (a) Arg-St<[Store { $NO_{\{x\}}^{\{Person(x)\}}$ }}, [Store { $NO_{\{y\}}^{\{Person(y)\}}$ }}]>
 Content Quants < $NO_{\{x\}}^{\{Person(x)\}}$, $NO_{\{y\}}^{\{Person(y)\}}$ >
 Nucleus *Love(x,y)*
 Semantic interpretation: $NO(HUM, \{x|NO(HUM, \{y|x \text{ loves } y\})\})$
 In first-order logic: $\neg \exists x \neg \exists x \text{ Love}(x,y)$ [DN]
- (b) Arg-St<[Store { $NO_{\{x\}}^{\{Person(x)\}}$ }}, [Store { $NO_{\{y\}}^{\{Person(y)\}}$ }}]>
 Content Quants < $NO_{\{x,y\}}^{\{Person(x), Person(y)\}}$ >
 Nucleus *Love(x,y)*
 Semantic interpretation: $NO_{E^2}^{HUM \times HUM}(LOVE)$
 In first-order logic: $\neg \exists x \exists y \text{ Love}(x,y)$ [NC]

Note that (9a) and (9b) are identical as far as the argument structure, the storing mechanism, and the interpretation of the *love* relation is concerned. The difference resides in the interpretation of the polyadic quantifier: iteration in (9a), resumption in (9b). The main insights of this analysis are the following. The HPSG grammar assumes no lexical difference between negative quantifiers and n-words, so in the rest of this paper we use the term 'neg expression' to generalize over both. The analysis works for n-words in argument and adjunct position alike (so *nobody*, *nothing* as well as *never*, *nowhere*). Finally, it does not involve empty elements or 'hidden' negations in the syntactic structure. These are major advantages of this proposal.

The OT analysis comes in when we try to relate the HPSG analysis to languages that do not allow double negation and negative concord as freely as French does. In general, the combination of two negative quantifiers in English leads to a double negation reading, and resumption is only marginally available as an interpretive strategy. On the other hand, Spanish, Greek, Polish, and many other languages are typically negative concord languages, which hardly ever realize the iteration version of the polyadic quantifier analysis. In other words, the analysis proposed by de Swart and Sag (2002) does not predict cross-linguistic variation where it arises (Spanish vs. English, for example). The aim of this paper is extend the earlier analysis with a bi-directional OT component in order to define a typology of negation.

4 Marking and interpretation of negation in bi-directional OT

In this section, we develop a bi-directional OT analysis of negation. We will do so in two steps, first the OT syntax (section 4.1), then the combination with an interpretation mechanism (section 4.2). Section 4.3 discusses double negation readings in NC languages. For now, we focus on indefinites and neg expressions. The interaction with sentential negation is taken up in section 5 below.

4.1 Generation of double negation and negative concord in OT

According to Corblin and Tovenia (2003: 326), natural languages frequently have linguistic means to indicate that an argument must be interpreted within the scope of negation. They refer to this as marking of ‘negative variables’. Similarly, Haspelmath (1997: 231), building on Tanaka (1994), claims that the use of n-words is functionally motivated by the desire to mark the focus of negation, that is, the participants that are affected by the negation. In terms of OT syntax, the use of n-words constitutes a case of marking an input feature in the output: the ‘negative variable’ is formally marked as such. In our OT set-up, we express this by means of a Max constraint:

- ◆ MaxNeg
Mark ‘negative variables’
(i.e. mark arguments that are interpreted in the scope of negation)

The functional approach explains why the use of n-words is widespread among natural languages. However, we know from section 3.1 above that the use of n-words is not universal: languages like Dutch, English, Basque, etc. do not use n-words. This suggests that MaxNeg is not a hard constraint, and its position in the constraint ranking is not the same for every language. We can account for the difference between languages with and without n-words by changing the position of MaxNeg relative to *Neg. MaxNeg and *Neg are conflicting constraints: MaxNeg wants to reflect an input feature concerning negation in the form, whereas *Neg wants to avoid negation in the form. If *Neg is ranked higher than MaxNeg, the optimal way to express the meaning $\neg\exists x_1\exists x_2\dots\exists x_n$ is by means of indefinite pronouns. If MaxNeg is ranked higher than *Neg, n-words are used to express indefinites under negation. The following tableaux reflect this for the binding of two variables:

Tableau 3 (generation of indefinite)

Meaning	Form	FaithNeg	*Neg	MaxNeg
$\neg\exists x_1\exists x_2$	Indef+indef	*		
	☞ neg+indef		*	*
	☞ neg + neg		**	

Tableau 4: (generation of n-word)

Meaning	Form	FaithNeg	MaxNeg	*Neg
$\neg\exists x_1\exists x_2$	Indef+indef	*		
	neg+indef		*	*
	☞ neg + neg			**

The high ranking of FaithNeg (cf. section 1) makes it impossible to express indefinites under negation by indefinites exclusively (in the absence of a marker of sentential negation). In tableaux 3 and 4, the candidates that we need to compare are those that mark negation somehow in the output. This invariably leads to a violation of *Neg. Two neg expressions are ‘worse’ than one, so the combination of two neg expressions incurs two violations of *Neg.

As far as generation is concerned, we conclude that languages that allow indefinites under negation (e.g. Dutch), and languages that use n-words (e.g. Romance) differ in their ranking of the two constraints MaxNeg and *Neg. The question that immediately arises at this point concerns the interpretation of the expressions involved. A combination of a neg expression with a sequence of indefinites allows us to recover the meaning $\neg\exists x_1\exists x_2\dots\exists x_n$ by application of the standard rules of first-order logic. However, for languages that mark the arguments of a negative chain by means of n-words, the issue of the interpretation of these structures is less trivial. We address this question in section 4.2.

4.2 Interpretation of neg-expressions

In isolation, we cannot determine whether a particular expression is a negative quantifier or an n-word, because they both contribute the meaning $\neg\exists$ (cf. 8a, b). Following de Swart and Sag (2002), I assume that this question is decided in the grammar, not in the lexicon. This is why I use the term ‘neg expression’ to generalize over expressions that are formally marked for negation, but are interpreted either as negative quantifiers or as n-words. The use of neg expressions in a generative OT system means that we run into the recoverability problem: from the expressions generated, we can derive multiple interpretations, not only the intended one.

Recoverability is assured by the way the generation of negative sentences hangs together with their interpretation. In this section, we extend the OT syntax with an OT semantics. We need the familiar constraints FaithNeg and *Neg. These are ‘double-edged’ constraints in the sense that they work in the generation as well as in the interpretation perspective. In the OT semantics, FaithNeg requires a reflection of the negative form in a non-affirmative meaning. *Neg avoids a proliferation of negations in the semantics, preferring resumption over iteration. The third constraint we need is IntNeg:

- ◆ IntNeg
Force Iteration (i.e. interpret every neg expression in the input form as contributing a semantic negation at the first-order level in the output.)

MaxNeg and IntNeg both maximize the reflection of input features in the output, MaxNeg in the syntactic form, IntNeg in the semantic interpretation. As semantic constraints, both FaithNeg and IntNeg are instantiations of the general constraint FaithInt proposed by Zeevat (2000), and defined as a principle that forces the hearer to interpret all that the hearer has said. The three constraints together account for double negation and negative concord languages.

FaithNeg outranks all the other constraints as usual. MaxNeg is a purely syntactic constraint that does not play a role in interpretation. So the constraints that need to be ordered are *Neg and IntNeg. If *Neg is ranked higher than IntNeg in the OT semantics, a sequence of multiple Neg expressions leads to a single negation meaning by resumption. If IntNeg is ranked higher than *Neg, a series of Neg expressions is interpreted as multiple negation by forcing iteration. The following tableaux illustrate the two possible rankings and their optimal output:

Tableau 5: double negation (interpretation)

Form	Meaning	FaithNeg	IntNeg	*Neg
neg + neg	$\exists x_1 \exists x_2$	*	**	
	$\neg \exists x_1 \exists x_2$		*	*
☞	$\neg \exists x_1 \neg \exists x_2$			**

Tableau 6: negative concord (interpretation)

Form	Meaning	FaithNeg	*Neg	IntNeg
neg + neg	$\exists x_1 \exists x_2$	*		
☞	$\neg \exists x_1 \exists x_2$		*	*
	$\neg \exists x_1 \neg \exists x_2$		**	

We cannot interpret a statement involving two neg expressions without a reflection of the non-affirmative meaning, because of the top ranking of FaithNeg. As a result, the relevant candidates we compare have at least one negation in the output, and always incur a violation of *Neg. The combination of two neg expressions leads to a double negation reading in languages like Dutch and English, for the constraint IntNeg is ranked higher than *Neg in tableau 5. Because *Neg outranks IntNeg in tableau 6, single negation readings win over double negation readings in NC languages such as Spanish, Italian, Greek, Polish, etc.

Collapsing the generation and interpretation perspective, we derive the following two rankings for negative concord and double negation languages:

Bidirectional grammar

- Negative concord languages: FaithNeg >> MaxNeg >> *Neg >> IntNeg
- Double negation languages: FaithNeg >> IntNeg >> *Neg >> MaxNeg

Even if we assume that FaithNeg outranks the other constraints across all languages under consideration, we need to consider more rankings than the two orders given above. Aside from FaithNeg, we are working with three constraints, and obviously, 3 constraints permit 6 rankings, at least in principle:

MaxNeg >> *Neg >> IntNeg	NC
MaxNeg >> IntNeg >> *Neg	unstable
*Neg >> MaxNeg >> IntNeg	unstable
*Neg >> IntNeg >> MaxNeg	unstable
IntNeg >> MaxNeg >> *Neg	unstable
IntNeg >> *Neg >> MaxNeg	DN

So far, we have established the top ranking and the bottom one as reflections of a particular family of languages. What about the other four possibilities? I claim that the other four rankings cannot represent stable linguistic systems, because generation and production are not well-balanced. Consider the following examples:

Tableau 7 MaxNeg >> IntNeg >> *Neg (original meaning not recovered)

Meaning	Form	MaxNeg	IntNeg	*Neg
$\neg\exists x_1\exists x_2$	neg + indef	*		*
	☞ neg + neg			**
Form	Meaning	MaxNeg	IntNeg	*Neg
neg + neg	☞ $\neg\exists x_1\neg\exists x_2$			**
	$\neg\exists x_1\exists x_2$		*	*

This ranking generates two Neg expressions as the optimal output for the single negation input. But the interpretation of two Neg expressions leads to double, rather than single negation. This means that the original meaning is not recovered. The ranking IntNeg >> MaxNeg >> *Neg is equally unstable. Given that there is no direct interaction between IntNeg and MaxNeg, the argumentation is the same. We conclude that MaxNeg and IntNeg cannot both be higher than *Neg.

Tableau 8 *Neg >> IntNeg >> MaxNeg (form not motivated)

Meaning	Form	*Neg	IntNeg	MaxNeg
$\neg\exists x_1\exists x_2$	☞ neg+indef	*		*
	neg+neg	**		
Form	Meaning	*Neg	IntNeg	MaxNeg
neg+neg	$\neg\exists x_1\neg\exists x_2$	**		
	☞ $\neg\exists x_1\exists x_2$	*	*	

Here we get the reverse problem. Indefinites are the optimal form for expressing indefinites under negation, but a neg expression also leads to a negative concord reading. However, the use of the n-word is not functionally motivated by the low ranking of MaxNeg. The same problems arise with the ranking *Neg >> MaxNeg >> IntNeg, because MaxNeg and IntNeg do not interact directly. This shows that MaxNeg and IntNeg cannot both be lower than *Neg either.

The conclusion must be that only rankings where MaxNeg and IntNeg are distributed on each side of *Neg reflect viable options for a linguistic system that balances generation and interpretation of negative statements. In sum:

- **Negative Concord:** if you mark arguments of a negative chain (MaxNeg >> *Neg in syntax), then make sure you do not force Iteration (*Neg >> IntNeg in semantics).
- **Double Negation:** if you force Iteration, (IntNeg >> *Neg in semantics), then make sure you do not mark arguments of a negative chain (*Neg >> MaxNeg in syntax).

4.3 Double negation in concord languages

Although most languages clearly belong to either the DN class, or the NC class, there are some intermediate cases. Corblin (1996), Corblin and Tovenà (2003), and Corblin et al. (2004) argue that the French sentences in (10) and (11) are truly ambiguous:

- | | | |
|------|---|---------------------------------|
| (10) | Personne n'a rien payé.
<i>Nobody ne has nothing</i> paid.
= No one has paid anything.
= Everyone has paid something. | [ambiguous]

[NC]
[DN] |
| (11) | Personne n'est le fils de personne.
<i>Nobody ne is the son of nobody</i> .
= No one is the son of anyone.
= Everyone is the son of someone. | [ambiguous]

[NC]
[DN] |

For (10), the two readings are equally available. The DN reading of (11) conforms to our world knowledge in ways that the CN reading of this sentence does not. Corblin argues that pragmatic factors may block the NC reading of examples like (11).

We can account for this situation by moving the constraints *Neg and FaithNeg more closely together in a stochastic version of OT (cf. Boersma 1998, Boersma and Hayes 2001). In stochastic OT, constraints are ranked on a continuous scale. If adjacent constraints have an overlapping range, their order can be reversed in certain outputs. In modern French, we may assume that there is overlap between the range of *Neg and IntNeg in the interpretational system, so that in some contexts, the ranking can be reversed. Context plays an important role in disambiguation in general (de Hoop 2004), so cases like (10) and (11) would not be that unusual.

The stochastic view suggests that French occasionally switches to an unbalanced system in which both MaxNeg and IntNeg are ranked higher than *Neg. It is therefore quite likely that the ambiguities will be fairly restricted, unless the whole system is shifting towards a double negation language in which n-words are reinterpreted as negative quantifiers (and MaxNeg is reranked below *Neg). This would obviously be the next step in terms of the Jespersen cycle (cf. Jespersen 1917, de Swart and Sag 2002). French is assumed to be more advanced than other Romance languages in its stage of development in the Jespersen cycle (e.g. Haspelmath 1997), but there are some reports on similar ambiguities in Italian and Spanish. Zanuttini (1991: 144-5) claims that (12) exemplifies double negation in Italian:

- | | | |
|------|--|-----------|
| (12) | <i>Nessuno è rimasto con niente</i> in mano.
<i>Noone is left with nothing</i> in hand.
= Noone was left with nothing. | [Italian] |
|------|--|-----------|

And Herburger (2001) reports that the Spanish example in (13) is ambiguous:

- (13) *Nadie nunca* volvió a Cuba. [Spanish]
Nobody never returned to Cuba.
 = Nobody ever returned to Cuba [NC]
 = Nobody never returned to Cuba [DN]

MaxNeg is currently still high in the ranking of Spanish, Italian and even French, and there are no clear signs of it being demoted, so we are more on the side of a concord language than on the side of a double negation language as far as generation is concerned. Because of the tension between the functional motivation for MaxSN and the desire to respect IntNeg, it is impossible to predict if and when a complete rebalancing between form and meaning will take place in Romance. Possibly the system as it is (with just occasional outranking of *Neg by IntNeg in the interpretational system) is sufficiently stable to last.

5. Neg expressions and sentential negation

Haspelmath (1997) distinguishes three subtypes of negative indefinites, depending on their relation to the marker of sentential negation. His classification is presented in section 5.1. Sections 5.2 and 5.3 implement his two main classes of NC languages in our bi-directional OT analysis. Section 5.4 treats Catalan as a mixed type.

5.1 Empirical classification of co-occurrence restrictions

Haspelmath's classification serves as the starting point of our investigation, but cf. also the discussions in den Besten (1986), Hoeksema (1996), van der Wouden (1997), and Giannakidou (1998). Haspelmath (1997: 201) distinguishes three types of co-occurrence restrictions between neg expressions and markers of sentential negation.

Type I: SNV-NEG

Negative indefinites (NEG) always co-occur with verbal negation (SN), e.g. the Polish *ni*-series (*nikt* 'nobody', *nic* 'nothing', etc.). Similar examples are found in other Slavic languages, in Greek, Hungarian, Rumanian, etc. The examples in (14) are from Haspelmath (1997: 201); the examples in (15) from Corblin and Tovena (2003):

- (14) a. Nikt nie przyszedł. [Polish]
 nobody NEG came.
 'Nobody came.'
 b. Nie widziałam nikogo.
 NEG saw nobody
 'I saw nobody.'
- (15) a. Nimeni *(nu) a venit. [Rumanian]
 Nobody *(SN) has come.
 b. *(Nu) a venit nimeni.
 *(SN) has come nobody.

The type SNV-NEG is the most frequent type in Haspelmath's (1997) language sample. He refers to Tanaka (1994) for evidence that this type is functionally motivated, because both the scope and the focus of negation are marked. The close connection between the verb and sentence negation is expected if Aristotle's and Jespersen's view of negation as predicate denial is adopted, as argued extensively in Horn (1989). Den Besten (1986), Hoeksema (1997), van der Wouden (1997) and Giannakidou (1998) refer to this type as 'negative doubling', 'proper' or 'strict' negative concord.

Type II: V-NEG

Negative indefinites never co-occur with verbal negation, e.g. the English *no*-series.

- (16) a. Nobody came.
 b. I saw nobody.

According to Haspelmath (1997: 202) type II (V-NEG) is rare in cross-linguistic distribution. In his language sample, only European languages represent this type. He explains the relative rarity of type V-NEG as the result of a discrepancy between the semantics (which requires clausal scope of negation), and the surface expression of negation (which is on a participant, rather than on the verb in this type.)

Type III: (SN)V-NEG

Negative indefinites (NEG) that sometimes co-occur with verbal negation (SN) and sometimes do not, e.g. the Italian, Spanish and Portuguese *n*-series.

- (17) a. *Ninguém* veio. [E. Portuguese]
 Nobody came
 b. *Não* veio *ninguém*.
 SN came nobody
 'Nobody came.'

Type III ((SN)V-NEG) is strong in Romance, but rare elsewhere (Haspelmath 1997). According to Zanuttini (1991: 152-3) and Ladusaw (1992), the functional motivation for this type is that postverbal *n*-words are unable to take sentential scope. A preverbal expression of negation (*n*-word or SN) is thus motivated by the desire to express negation at the clausal (propositional) level.

In our terminology, type I and type III Neg expressions are *n*-words, and type II Neg expressions are negative quantifiers in double negation languages. Double negation languages are captured by the bi-directional analysis of section 4 above, and will not be discussed here. I propose two additional constraints for the class I and class III languages. These constraints are relevant for production only: the interpretation process is that of a concord language.

5.2 Class III languages: preverbal/postverbal asymmetry

Class III languages are characterized by the general constraint ranking of negative concord languages in combination with the additional constraint NegFirst:

- ◆ NegFirst
 Negation is preverbal

Variants of NegFirst are discussed in the literature, e.g. Jespersen (1917, 1933), Dahl (1979), Horn (1989), Haspelmath (1997), Corblin and Tovena (2003), Corblin et al. (2004). NegFirst is functionally motivated by the desire ‘to put the negative word or element as early as possible, so as to leave no doubt in the mind of the hearer as to the purport of what is said’ (Jespersen 1933: 297 as quoted by Horn 1989: 293, who dubs this principle ‘NegFirst’). Although NegFirst is found in many languages, Horn points out that it is not an absolute tendency. In OT, it works well as a violable constraint.

NegFirst is operative in several Romance languages, including Spanish, Italian, Sardinian Portuguese (compare Posner 1984), but also in New Testament Greek and older varieties of several Slavic languages (which are class I languages in their modern varieties, cf. Haspelmath 1997: 212). Since Zanuttini (1991) and Ladusaw (1992), it is well known that n-words in these languages can occur without negation in preverbal position, but need the support of a marker of sentential negation to mark clausal scope when they occur in postverbal position and there is no preverbal n-word:

- (18) a. Mario **(non)* ha parlato di *niente* con *nessuno*. [Italian]
 Mario **(SN)* has talked about *nothing* to *nobody*.
 b. *Nessuno* (**?non*) ha parlato con *nessuno*.
Nobody (**?SN*) has talked with *nobody*.

As these examples indicate, negation must be preverbal, but it does not matter whether it is expressed by a marker of sentential negation (18a), or by an n-word (18b). When the preverbal negation is expressed by a Neg expression, a marker of sentential negation is excluded. Insertion of a preverbal marker of sentential negation in combination with a preverbal n-word generally leads to ungrammaticality, and marginally to double negation readings (in certain dialects only, cf. Zanuttini 1991).

In the OT analysis, we need to establish a distinction between preverbal and postverbal n-words as the correlation of clausal/VP scope. If we complement the usual constraint ranking for concord languages with a highly ranked constraint NegFirst, we obtain as a result that the sentence without preverbal sentential negation is an optimal output in the production direction when the indefinite under negation is postverbal (18a, tableau 9). This ranking also leads to the desired (concord) interpretation.

Tableau 9 (generation/interpretation of class III with postverbal n-word)

Meaning	Form	MaxNeg	NegFirst	*Neg	IntNeg
$\neg V \exists x$	V neg		*	*	
\curvearrowright	sn V neg			**	
Form	Meaning				
sn V neg	$\neg V \neg \exists x$			**	
\curvearrowright	$\neg V \exists x$			*	*

Note that we left out of these tableaux all candidates that violate MaxNeg, so we only consider neg expressions. Note further that NegFirst and MaxNeg are not in direct competition, so their mutual order is irrelevant, as long as they are both ranked above *Neg. In all potential constraint rankings in which NegFirst is ranked below *Neg, the constraint is inactive. The interpretation doesn’t care how many negations there are in the form: the ranking *Neg >> IntNeg implies that resumption applies. In the resumption process, the marker of sentential negation is simply absorbed, because it does not contribute a binding variable (cf. de Swart and Sag 2002). So it is relevant to

add constraints like NegFirst to the OT syntax, but they do not affect the OT semantics. So from now on, we don't need to spell out the NC interpretation anymore.

For sentences in which the postverbal indefinite is in the scope of a preverbal Neg expression (18b), the optimal output on the production side is a sentence with a preverbal and a postverbal n-word, but without a preverbal sentential negation:

Tableau 10 (generation of class III with preverbal n-word)

Meaning	Form	MaxNeg	NegFirst	*Neg	IntNeg
$\neg\exists x_1 \forall \exists x_2$	☞ Neg V neg			**	
	☞ Neg sn V neg			***	

An additional preverbal SN incurs an extra violation of *Neg, which is not economical. In the semantics, there is no gain from an extra marker of sentential negation either, because the meanings of the sentences with and without a marker of sentential negation are the same under the ranking *Neg >> IntNeg. So class III languages do not insert a marker of sentential negation with preverbal n-words.

Note that the relevance of NegFirst is not restricted to NC languages. Horn (1989: 456, 7) relates English do-support to the preference for preverbal negation.

5.3 Class I languages: obligatory marker of sentential negation

Just like class III languages, class I languages require a marker of sentential negation with a postverbal n-word (14b, 15b). Unlike type III language, type I languages also require such a marker when the sentence contains a preverbal n-word (14a, 15a). NegFirst does not account for such a situation; the constraint that applies is MaxSN:

- ◆ MaxSN
A negative clause must bear a marker of sentential negation

Tableau 11 (generation of type I languages with preverbal n-word)

Meaning	Form	MaxNeg	MaxSN	*Neg	IntNeg
$\neg\exists x_1 \forall \exists x_2$	☞ neg V neg		*	**	
	☞ neg sn V neg			***	

MaxSN and MaxNeg are not in direct competition, so their mutual ranking is irrelevant. It suffices that they are both ranked higher than *Neg. The meaning of the sentence is not affected, for all n-words are absorbed into one resumptive negative quantifier thanks to the ranking of IntNeg below *Neg.

In class I languages that contain a preverbal marker of negation (e.g. Slavic, Greek), NegFirst is 'harmonically bound' by MaxSN. This means that NegFirst is automatically satisfied when MaxSN is. However, the constraints can be shown to be independent with a postverbal marker of SN. Afrikaans *nie* provides an example:

- (19) a. Jan het gehoop dat *niks* met hom sou gebeur *nie*. [Afrikaans]

- Jan has hoped that nothing with him would happen not.
 ‘Jan hoped that nothing would happen to him.’
- b. Sy hou *nooit* op met werk *nie*.
 She holds never up with work not.
 ‘She never stops working.’

Type I and type III languages thus support the view put forward by de Swart and Sag (2002) that sentential negation does not affect the semantics of negative concord. Whether or not we find a (pre)verbal marker of sentential negation in concord languages depends on syntactic constraints like NegFirst or MaxSN.

5.4 Catalan: a mixed case

The constraints NegFirst and MaxSN interact in a language like Catalan, which exemplifies a mix of class I and class III properties (Ladusaw 1992, Vallduví 1994):

- (20) a. En Pere **(no)* ha fet *res*. [Catalan]
 The Peter **(not)* has done *nothing*.
 b. *Ningú (no)* ha vist en Joan.
Nobody (not) has seen John.

The data in (19) are accounted for by the following ranking: MaxNeg >> NegFirst >> MaxSN <<>> *Neg. Suppose that MaxSN and *Neg are ranked equally high (i.e. <<>> in ordinal OT) or have a strongly overlapping range (in stochastic OT). Given that NegFirst is higher than either one, we generate a preverbal marker of sentential negation with postverbal n-words, just like in a type III language (19a, tableau 12). With preverbal n-words (19b), the equal position of MaxSN and *Neg generates two optimal outputs. This is illustrated in tableau (13):

Tableau 12 (generation of Catalan with postverbal n-word)

Meaning	Form	MaxNeg	NegFirst	MaxSN <	> *Neg	IntNeg
$\neg\forall\exists x$	V neg		*	*	*	
\rightarrow	sn V neg				**	

Tableau 13 (generation of Catalan with preverbal n-word)

Meaning	Form	MaxNeg	NegFirst	MaxSN <	> *Neg	IntNeg
$\neg\exists x_1\forall\exists x_2$ \rightarrow	neg V neg			*	**	
\rightarrow	neg sn V neg				***	

The main difference between preverbal and postverbal n-words is accounted for by the high ranking of NegFirst. However, Catalan is not a full type III language, because MaxSN is not ranked (strictly) below *Neg. It shares features with type I languages in allowing rankings in which MaxSN wins over *Neg. Thus a marker of sentential negation optionally shows up in outputs for the expression of preverbal n-words. As far as interpretation is concerned, we predict that the presence or absence of a marker of sentential negation is irrelevant. As long as *Neg is ranked above IntNeg, all

negative meanings will be collapsed into a single negation. As pointed out by Vallduví (1994), the optionality of a preverbal marker of sentential negation in combination with a preverbal n-word does not have a semantic effect,

Haspelmath (1997: 211, 213) observes that the pattern we find in Catalan is also found in Old Church Slavonic, and in several (mostly African-American) dialects of English. Haspelmath quotes the following examples from Labov (1972: 785-6):

- (20) a. *Nobody don't know where it's at.* [AAE]
b. *Nobody fights fair.*

We conclude that these are mixed cases, which nevertheless represent balanced systems that reflect the interaction of NegFirst and MaxSN.

6. Conclusion

The conclusion I draw from this investigation of the marking and interpretation of negation is that a bi-directional version of Optimality Theory offers new perspectives on the range of variation we find in natural language for the expression and meaning of negation and negative indefinites. Patterns that are frequently found in natural language, but do not display absolute tendencies can be fruitfully described in a framework that allows constraints to be violable. The bi-directionality is especially important to our analysis, because it relates the semantic compositionality problems raised by negative concord to the functional tendencies to formally mark the scope and focus of negation, in accordance with the view on compositionality advanced by Blutner, Hendriks and de Hoop (2003). Our OT analysis confirms the insight from de Swart and Sag (2002) that the position and distribution of the marker of sentential negation in negative concord is relevant for syntax, but does not affect the semantics.

References

- Bernini, G. and P. Ramat (1996). *Negative sentences in the languages of Europe*, Berlin: Mouton de Gruyter.
- Besten, J. den (1986). Double negation and the genesis of Afrikaans, in: P. Muysken and N. Smith (eds.). *Substrata versus universals in Creole languages*, Amsterdam: John Benjamins.
- Blutner, R. (1998). Lexical pragmatics, *Journal of Semantics* 15, 115-162.
- Blutner, R. (2000). Some aspects of optimality in natural language interpretation, *Journal of Semantics* 17: 189-216.
- Blutner, R., P. Hendriks and H. de Hoop (2003). A new hypothesis on compositionality, *Proceedings of ICCS 2003*, Sidney.
- Boersma P. (1998). *Functional phonology*, PhD diss. University of Amsterdam.
- Boersma, P. and B. Hayes (2001). Empirical tests of the gradual learning algorithm, *Linguistic Inquiry* 32: 45-86.
- Bresnan, J., S. Dingare and C. Manning (2001). Soft constraints mirror hard constraints: voice and person in English and Lummi, *Proceedings of the LFG 2001 conference, Hong Kong*, Stanford: CSLI publications.
- Corblin, F. (1996). Multiple negation processing in natural language, *Theoria* 17: 214-259.

- Corblin, F. and L. Tovena (2003). L'expression de la négation dans les langues romanes, in: D. Godard (ed). *Les langues romanes: problème de la phrase simple*, Paris: CNRS Editions, 279-342.
- Corblin, F., V. Déprez, H. de Swart and L. Tovena (2004). Negative concord, in: F. Corblin and H. de Swart (eds.). *Handbook of French Semantics*, Stanford: CSLI Publications.
- Dahl, Ö. (1979). Typology of sentence negation, *Linguistics* 17: 79—106.
- Déprez, V. (2000). Parallel (A)symmetries and the internal structure of negative expressions, *Natural Language and Linguistic Theory* 18: 253-342.
- Fauconnier, G. (1975). Pragmatic scales and logical structures, *Linguistic Inquiry* 6: 353-375.
- Fauconnier, G. (1979). Implication reversal in a natural language, in: F. Günther and S.J. Schmidt (eds.) *Formal semantics and pragmatics for natural languages*, Dordrecht: Reidel.
- Giannakidou, A. (1998). *Polarity sensitivity as (non)veridical dependency*, Amsterdam: John Benjamins.
- Giannakidou, A. (2000). Negative...concord, *Natural Language and Linguistic Theory* 18: 457-523.
- Haspelmath, M. (1997). *Indefinite pronouns*, Oxford: Clarendon Press.
- Herburger, E. (2001). The negative concord puzzle revisited, *Natural Language Semantics* 9, 289-333.
- Hoeksema, J. (1997). Negation and negative concord in middle Dutch, in: D. Forget, P. Hirschbühler, F. Martineau and Maria-Luisa Rivero (eds.). *Negation and polarity: syntax and semantics*, Amsterdam: John Benjamins, 139-158.
- Hoop, H. de (2004). The problem of unintelligibility, ms. Radboud University.
- Horn, L. (1989). *A natural history of negation*, Chicago: University of Chicago Press.
- Israel, M. (1996). Polarity sensitivity as lexical semantics, *Linguistics and Philosophy* 19: 619-666.
- Jespersen, O. (1917). *Negation in English and other languages*, Copenhagen: A.F. Høst. Reprinted in: *Selected writings of Otto Jespersen* (1962), London: George Allen and Unwin, 3-151.
- Jespersen, O. (1933). *Essentials of English grammar*, reprinted 1964, University of Alabama Press.
- Kadmon, N. and F. Landman (1993). Any, *Linguistics and Philosophy* 16: 353-422.
- Krifka, M. (1995). The semantics and pragmatics of polarity items, *Linguistic Analysis* 25: 209-257.
- Labov, W. (1972). Negative attraction and negative concord in English grammar, *Language* 48: 773-818.
- Ladusaw, W. (1979). *Polarity sensitivity as inherent scope relations*, PhD. Diss. University of Texas, also published: Garland Press (New York).
- Ladusaw, W. (1992). Expressing negation, *Proceedings of SALT 2*, Columbus: Ohio State University, 237-259.
- Ladusaw, W. (1996). Negation and polarity items, Shalom Lappin (ed.). *The handbook of contemporary semantic theory*, Oxford: Blackwell.
- Payne, J. (1985). Negation, in: T. Shopen (ed.) *Language typology and syntactic description I: clause structure*, Cambridge: Cambridge University Press.
- Portner, P. and R. Zanuttini (2003). Exclamative clauses: at the syntax-semantic interface, *Language* 79, 39-81.

- Posner, R. (1984). Double negatives, negative polarity and negative incorporation in Romance: a historical and comparative view, *Transactions of the Philological Society* 1984: 1-26.
- Swart, H. de (1998). Licensing of negative polarity items under inverse scope, *Lingua* 105: 175-200.
- Swart, H. de and I. Sag (2002). Negation and negative concord in Romance, *Linguistics and Philosophy* 25: 373-417.
- Tanaka, S. (1994). Die Mehrfachnegation: ein Sprachgut der Unraffinierten?, in: D. W. Halwachs and I. Stütz (eds.). *Sprache—Sprechen—Handeln: Akten des 28 Linguistischen Kolloquiums, Graz 1993*, Tübingen: Niemeyer, 191-198.
- Vallduví, E. (1994). Polarity items, n-words and minimizers in Catalan and Spanish, *Probus* 6: 263-294.
- Wouden, A. van der (1997). *Negative contexts: collocation, polarity and multiple negation*, London: Routledge.
- Zanuttini, R. (1991). *Syntactic properties of sentential negation*, PhD. Diss. University of Pennsylvania.
- Zeevat, H. (2000). The asymmetry of optimality theoretic syntax and semantics, *Journal of Semantics* 17: 243-262.
- Zwarts, F. (1986). *Categorial grammatica en algebraïsche semantiek: een studie naar negatie en polariteit in het Nederlands*, PhD diss. Groningen University.

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