Negative Concord and the Distribution of Quantifiers

António Branco and Berthold Crysmann*

1 Introduction

In some languages, when cooccurring in a suitable configuration, multiple negative items jointly express only one negation. This phenomenon, usually known as negative concord (NC), poses a clear challenge for the interface between Syntax and Semantics.

Within the recent literature, various proposals have been made towards resolving this puzzle, most of which fall into one of three categories: the first one assumes that N-words (i.e. the equivalents of English *nobody*, *no*, *nothing*, *never*) unambiguously express negation, syntactic derivation merging multiple negations into one (Zanuttini, 1991; Haegeman, 1995, among others). Under the second type of approach, N-words never directly express negation, negative force being added by some empty operator (e.g., Ladusaw, 1996; Suñer, 1995). The third type of approach regards N-words as lexically ambiguous between a positive existential and a negative reading, syntax restricting their respective distribution (van der Wouden and Zwarts, 1993; Dowty, 1994, among others).

The first two approaches necessarily have to assume a certain amount of covert machinery to cancel out or introduce negative force, thereby contradicting the basic tenets of lexicalist syntax. Ambiguity approaches, however, in order to perform the task of disambiguation, typically make use of syntactic diacritics which link the desired reading to a specific syntactic configuration, thus lending this type of approach only a limited explanatory appeal.

In this paper, we will try to enhance the interest in the ambiguity-driven approach to NC by uncovering an independently motivated constraint which avoids resorting to stipulative disambiguation.

Using NC in Portuguese as a case-study and adhering to the ambiguity approach rationale, we assume that N-words in this language are lexically ambiguous between strong negative polarity items (NPIs) and negative quantifiers. In Section 2, we will argue that the distribution of negative quantifiers and NPIs does not result from the effect of stipulated diacritics: rather, they can be derived from the interplay of independently motivated syntacto-semantic constraints. On the one hand, the occurrence of a strong NPI is subject to the usual licensing condition of it being preceded by a right anti-additive expression (Zwarts, 1996). On the other hand, there is a general constraint on linear precedence of quantifiers and negation targeting a subclass of quantifiers, including negative ones, which bans them to appear in a position linearly preceding negative expressions.

In Section 3, this analysis is formally developed in the framework of HPSG, a highly lexicalised surface-oriented framework which offers linear constraints on surface word order as a descriptive primitive. We will suggest a formalisation of monotonicity information, on the basis of which we will develop a formal account of the above distributional constraints, enabling us to derive the effect of negative concord in Portuguese.

* Authors' names are listed in alphabetical order.

2 Negative Concord: empirical observations

It has repeatedly been observed in the literature that negative concord in some Romance languages exhibits a strict asymmetry between preverbal and postverbal N-words (see van der Wouden and Zwarts, 1993; Dowty, 1994 for Italian; Suñer, 1995 for Spanish): whilst postverbal N-words require the presence of some negative element preceding the verb, preverbal N-words cannot cooccur with a marker of sentential negation, such as 'not'. Portuguese patterns with Italian and Spanish in this respect, giving rise to the basic distribution illustrated in (1) and (2) below:

(1) a. *Ninguém* viu o Rui.
nobody saw the Rui
'Nobody saw Rui.'
b. *Ninguém* viu ninguém.
nobody saw nobody
'Nobody saw anybody.'

(2) a. O Rui *não* viu ninguém.
the Rui not saw nobody
'Rui didn't see anybody.'
b. * Ninguém *não* viu o Rui.
nobody not saw the Rui

As it stands, the ungrammaticality of (2b) is quite a surprising phenomenon, given that multiple N-words can otherwise cooccur quite freely in this negative concord language.

If we extend the scope of our study and investigate the distribution of Portuguese quantifiers other than N-words, we find that the distributional restriction originally observed in the context of negative concord appears to be a far more general property of Portuguese syntax. Thus, whether a particular determiner may or may not appear to the left of the negative marker *não* 'not', is a property which divides the set of Portuguese determiners into two disjoint subsets. These, we will refer to as S1 and S2, respectively.

(3) {Muitos, Alguns, Vários, A maioria dos, Os, n} estudantes *não* viram o Rui.
{Many, some, several, the most of the, the, n} students not saw the Rui.
'{Many, some, several, most, the, n} students didn't see Rui.'

(4) a. * {Todos os, Nem todos, Poucos dos, Cada} estudante(s) *não* viram/viu o Rui.
{all the, not every, few of the, each} student(s) not saw the Rui
b. ?? {Menos de n, No máximo n} estudantes *não* viram o Rui.
{less than n, at most n} students not saw the Rui
c. ? Poucos estudantes *não* viram o Rui.
few students not saw the Rui

Although similar restrictions on combinations of quantifiers and negation can be observed in other languages as well — Hoeksema (1986, p. 38), for example, reports that not all English determiners can be preceded by *not* — the above pattern appears to be language-specific, because, in other languages, e.g. German, some of the combinations which are barred in Portuguese are easily attested:

(5)	{Alle,	Wenige}	Studenten	haben	Rui	*nicht*	gesehen.
	{all,	few}	students	have	Rui	not	seen

‘{All, Few} students have not seen Rui.’

Although the particular restriction we observe with Portuguese determiners is clearly language-specific, we will show that the exact partitioning of quantifiers into the sets S1 and S2 is rooted in general semantic properties, and we further claim that the phenomenon of negative concord in this language can be derived from the linearisation restrictions of quantifiers with respect to negation.

2.1 Downwards Monotonicity and Negation

If we investigate the semantic properties underlying the contrasts noted above, we can observe that the distinction between sets S1 and S2 does not correspond to the distinction between strong and weak determiners: Elements from both S1 and S2 behave as weak determiners, such as *alguns* ‘some’ and *menos de n* ‘less than n’ in (6), or as strong determiners, such as *a maioria dos* ‘most’ and *todos os* ‘every’ in (7):

(6)	Havia	{alguns,	menos de n}	estudantes	na	sala.
	there was	{some,	less than n}	students	in.the	room.

(7) *	Havia	{a maioria dos,	todos os}	estudantes	na	sala.
	there was	{most of the,	all the}	student(s)	in.the	room.

The partitioning of quantifiers into S1 and S2 does not align with the distinction between cardinal and proportional determiners either. The contrast below shows that not all proportional determiners fit into one of our sets S1 or S2:

(8)	a.	{Muitos dos,	Alguns dos,	*n* dos}	estudantes	*não*	viram	o	Rui.
		{many of the,	some of the,	*n* of the}	students	not	saw	the	Rui
	b. *	Poucos dos	estudantes	*não*	viram	o	Rui.		
		few of the	students	not	saw	the	Rui		

If we consider, however, the monotonicity properties of the determiners in the two sets, a natural grouping begins to emerge. A quantifier is said to be (right) upwards or downwards monotone, i.e. monotone with respect to the domain, if either of the following implications is valid:

MON↑: $D(A)(B) \wedge B \subseteq B' \rightarrow D(A)(B')$

MON↓: $D(A)(B) \wedge B' \subseteq B \rightarrow D(A)(B')$

With the exception of the universal quantifiers *cada* ‘every’ and *todos* ‘all’, the quantifiers in S2 are downwards monotone in their domain argument, while those in S1 are either non-monotone (e.g. definite descriptions) or monotone increasing. Taking a closer look at the right monotone increasing universal quantifiers in S2, we find, however, that they are downwards monotone with respect to their restrictor argument. Yet, determiners from S1, i.e. those which may precede negation, are either non-monotone or monotone increasing with respect to their left argument as well.

$$\uparrow\text{MON: } D(A)(B) \wedge A \subseteq A' \rightarrow D(A')(B)$$

$$\downarrow\text{MON: } D(A)(B) \wedge A' \subseteq A \rightarrow D(A')(B)$$

Thus, the property of downwards monotonicity in one of their arguments appears to be a valid characterisation of those determiners which cannot precede *não* 'not' in Portuguese:

		↓MON	MON↓	
a maioria	'most'	–	–	S1
muitos	'many'	–	–	S1
alguns	'some'	–	–	S1
n	'*n*'	–	–	S1
o/a	'the'	–	–	S1
todos	'all'	+	–	S2
cada	'every'	+	–	S2
nem todos	'not all'	–	+	S2
poucos	'few'	–	+	S2
menos de n	'less than *n*'	+	+	S2
no máximo n	'at most *n*'	+	+	S2

The hypothesis that (left or right) downwards monotonicity is the property at stake receives further empirical support from constructions where the occurrence of negation is also ruled out by monotone decreasing expressions other than determiners. This can be observed in the context of examples with the prepositional expression *sem* 'without' or the negative focus particle *nem* 'not even':

(9) a. O Rui saiu *sem* (*não) ter visto o Pedro.
the Rui left without (not) have seen the Pedro
'Rui left without having seen Pedro.'

b. *Nem* o Pedro (*não) viu o Rui.
not even the Pedro (not) saw the Rui
'Not even Pedro saw Rui.'

2.2 Quantifiers and Clitic Distribution

In recent work on Portuguese clitics (Crysmann, 1998, 1999), it has been shown that the set of left or right monotone decreasing quantifiers plays a central role in the syntax of clitic placement as well.

Pronominal clitics in the European variant of the language exhibit an alternation between a proclitic and an enclitic realisation which is subject to the presence of certain trigger elements to the left of the clitic-verb complex. If such a clause-local trigger is present, the clitic has to precede its host, otherwise, it will have to follow it. Apart from complementisers, prepositions, negation and focussed constituents, it is a subset of natural language quantifiers that triggers the preposing effect (cf. Madeira, 1992; Martins, 1994). Crysmann identifies the quantifiers triggering proclisis as the set of left or right monotone decreasing quantifiers (↓MON ∪ MON↓), arguing that proclisis licensing in Portuguese bears a significant resemblence to NPIs.

(10) {Todos os, Nem todos, Poucos, Menos de *n*, No máximo *n*} estudantes *o* viram.
all the, not all, few, less than *n*, at most *n* students CLITIC:him saw
'{Every, not every, few, less than n, at most n} students saw him.'

Similarly, those quantifiers which do not trigger proclisis, but rather have the clitic occur in its default position, are not downwards monotone in either of their arguments, corresponding to our S1.

(11) {Muitos, Alguns, Vários, A maioria dos, Os, *n*} estudantes viram *-no*.
{many, some, several, the most of the, the, *n*} students saw -CLITIC:him
'{Many, some, several, most, the, n} students saw him.'

Thus, the set of quantifiers compatible with the default realisation of the pronominal clitics is actually identical to the set of quantifiers (S1) which does not observe any distributional restrictions concerning negation.

Interestingly, the interaction of quantifiers with negation and with clitics display some further similarities.

First, the partitioning of quantifiers with respect to trigger status generalises from D- to A-quantifiers (Crysmann, 1998, 1999): while non-downward monotone A-quantifiers like *muitas vezes* 'many times' or *várias vezes* 'several times' do not trigger proclisis, the opposite is true for downward monotone A-quantifiers like *sempre* 'always' or *poucas vezes* 'seldom':

(12) {Muitas vezes, Várias vezes} elas viram-*no*.
{often, sometimes} they saw-CLITIC:him

(13) a. * {Sempre, Poucas vezes} elas viram-*no*.
{always, few times} they saw-CLITIC:him
b. {Sempre, Poucas vezes} elas *o* viram.
{always, few times} they CLITIC:him saw

In the context of negation, A-quantifiers display a distributional pattern strictly parallel to that of the corresponding determiners: while left or right monotone decreasing A-quantifiers (↓MON ∪ MON↓) cannot precede negation, no such restriction seems to hold for its complement set, consisting of quantifiers like *muitas vezes* 'sometimes', which are neither left nor right monotone decreasing.

(14) O Rui {muitas, algumas, a maioria das, n} vezes *não* viu o Pedro.
the Rui {many, some, the most of the, n} times not saw the Pedro
'Rui didn't see Pedro {many, some, most, n} times.'

(15) a. * O Rui {sempre, nem sempre, poucas das vezes} *não* viu o Pedro.
the Rui {always, not always, few of the times} not saw the Peter
b. ?? O Rui menos de *n* vezes não viu o Pedro.
the Rui less than n times not saw the Peter
c. ? O Rui {poucas, no máximo n} vezes não viu o Pedro.
the Rui {few, at most n} times not saw the Pedro

Second, Crysmann (1998, 1999) argues that triggering of proclisis is operative under linear precedence, irrespective of the scope properties of the quantifier. Constructions with subject extraposition, as in (16), or quantifier float, as in (17), lend empirical support to this claim: note, for example, that despite its postverbal surface position, the floating quantifier in (17) still unambiguously quantifies over the preverbal subject. Nevertheless, if the left or right monotone decreasing D-quantifier surfaces to the right of the clitic-verb complex, it loses its ability to trigger proclisis.

(16) a. Viram-no *todos os estudante*s.
saw-CLITIC:him all the students
'All students saw him.'
b. * O viram *todos os estudante*s.
CLITIC:him saw all the students
c. * *Todos os estudantes* viram-no.
all the students saw-CLITIC:him

(17) a. Os estudantes telefonaram-lhe *todo*s.
the students phoned-CLITIC:to.him all
'All students phoned him.'
b. * Os estudantes lhe telefonaram *todo*s.
the students CLITIC:to.him called all
c. * *Todos* os estudantes telefonaram-lhe.
all the students called-CLITIC:to.him

Constructions with A-quantifiers exhibit the same pattern as above, thereby reinforcing the empirical argument for the critical importance of linear precedence in the interaction of quantifiers with proclisis:

(18) a. Eles telefonaram-lhe *sempr*e.
they phoned-CLITIC:to.him always
'They always phoned him.'
b. * Eles lhe telefonaram *sempr*e.
they CLITIC:to.him phoned always
c. * Eles *sempre* telefonaram-lhe.
they always phoned-CLITIC:to.him

Surface linear precedence appears to be the relevant concept for the interaction between D-quantifiers and negation as well. In subject extraposition constructions, as in (19), or sentences with quantifier float, as in (20), no incompatibility between monotone decreasing D-quantifiers and negation can be attested if the former occurs in a position to the right of the negation adverb.

(19) a. * *Todos os estudantes* não viram o Rui.
all the students not saw the Rui
b. Não viram o Rui *todos os estudante*s.
not saw the Rui all the students
'No student saw Rui.'/'Not every student saw Rui.'

(20) Os estudantes não viram *todos* o Rui.
the students not saw all the Rui
'No student saw Rui.'/'Not every student saw Rui.'

Again, the parallelism between proclisis and negation can also be observed with respect to A-quantifiers. The adverbial *sempre* is lexically ambiguous between a temporal reading ('always') and an aspectual reading ('finally'). In a position preceding the negative marker *não*, the temporal reading becomes unavailable (cf. (21a)). If, however, *sempre* surfaces to the right of the negation marker, no such restriction applies:

(21) a. *Sempre* os estudantes não viram o Rui.
always the students not saw the Rui
%'The students didn't always see Rui.'/%'The students never saw Rui.'
b. Os estudantes não viram o Rui *sempr*e.
the students not saw theRui always
'The students didn't always see Rui.'/'The students never saw Rui.'

Note that both the postverbal subject NP in (19b), as well as the postverbal floating quantifier in (20) may take either wide or narrow scope with respect to negation. The same appears to hold for the postverbal temporal adverbial in (21b). We can therefore discard differences in scope properties as a potential source of explanation.

2.3 Quantifiers and Anti-additive Operators

In previous subsections, the incompatibility of D-quantifiers with negation has been shown to generalise to other sort of expressions that exhibit the same kind of incompatibility, namely prepositions such as *sem* 'without', focus particles such as *nem* 'not even' or A-quantifiers such as *sempre* 'always'. These expressions have in common that they are monotone decreasing in one of their arguments and that they cannot precede negation.

We will focus now on the other side of this distributional constraint and examine those expressions which cannot *follow* monotone decreasing operators.

The contrasts below illustrate that the distributional restriction observed above is not restricted to the negation marker *não* 'not'. It carries over to other negative expressions, such as *ninguém* 'no one', *nenhum* 'no', or *nunca* 'never':

(22) a. * {Sempre, Poucas vezes} *ninguém* viu o Rui.
{always, few times} nobody saw the Rui
b. *Ninguém* viu {sempre, poucas vezes} o Rui.
nobody saw {always, few times} the Rui
'Nobody saw Rui {always, seldom}.'

(23) a. * {Todos os, Poucos dos} estudantes *nunca* tinham visto o Rui.
{all the, few of the} students never had seen the Rui
b. *Nunca* {todos os, poucos dos} estudantes tinham visto o Rui.
never {all the, few of the} students had seen the Rui
'Never {all, few} students had seen Rui.'

Similar to our observations made in the preceding subsections regarding *não* 'not', the negative expressions presented in (22) and (23) can precede monotone decreasing items, but they cannot be preceded by them. Accordingly, this restriction cannot be assigned to the fact that these negative items are monotone decreasing expression. If this was sufficient, the examples (22b) and (23b) above would be equally ruled out as ungrammatical, contrary to fact.

What expressions like *not*, *no*, *nobody*, *never*, however, have in common is the fact that they all express a stronger form of negativity than mere downwards monotonicity. Looking at the hierarchy of negative expressions studied in Zwarts (1996), it turns out that their characteristic, unifying formal property is anti-additivity with respect to the scope argument:

Right anti-additivity: $D(A)(B \vee B') \leftrightarrow (D(A)(B) \wedge D(A)(B'))$

2.4 Negative Concord

Returning to the basic pattern of Portuguese negative concord (NC), we can now give a principled explanation for these data under an ambiguity approach, making crucial use of the independently motivated restrictions on the distribution of quantifiers.

(1) a. *Ninguém* viu o Rui.
nobody saw the Rui
'Nobody saw Rui.'
b. *Ninguém* viu ninguém.
nobody saw nobody
'Nobody saw anybody.'

(2) a. O Rui *não* viu ninguém.
the Rui not saw nobody
'Rui didn't see anybody.'
b. * Ninguém *não* viu o Rui.
nobody not saw the Rui

In (1) and (2b), the NPI lexical entry associated with the pre-verbal N-word *ninguém* 'nobody' is not licensed by any preceding licensor. Rather, in these constructions, N-words are restricted to express negation, as unequivocally shown by (1a). Accordingly, despite their ambiguity, only the negative quantifier reading can enter a grammatical representation.

Given the first occurring preverbal N-word is a negative quantifier, it is then a monotone decreasing expression. Accordingly, the ungrammaticality of (2b) can simply be traced to the general constraint on monotone decreasing quantifiers and negation.

Turning to the case of multiple concordant terms, as in (1b), we see that this distributional constraint precludes any N-word following the first one to express negative force. This means that their reading as negative quantifiers is blocked. Given that the first occurring N-word can only be a negative quantifiers there, and *a fortiori* a strong NPI licensor, all the following N-words will be licensed as (positive existential) NPIs.

Evidence that N-words *qua* NPIs are strong polarity items can be observed in examples like the one above, where a monotone decreasing but not anti-additive item is unable to act as licensor of N-words, although it acts as licensor of a weak NPI such as *o que quer que fosse* 'anything; lit:the what ever that was':

(24) a. * Poucos dos estudantes viram *nad*a.
few of the students saw nothing

b. Poucos dos estudantes viram *o que quer que fosse*.
few of the students saw the what ever that was
'Few students saw anything.'

Note that other examples with multiple concordant terms, such as (2a), receive a similar explanation. The negative adverb *não* is monotone decreasing, which triggers the application of the constraint on downwards monotone and right anti-additive expressions. Thus, the negative quantifier reading of the post-verbal N-word is eliminated from the grammatical representation. Its strong NPI reading, in turn, is licensed by the negative adverb.

Constructions with more than two concordant terms, like the one in (25), will receive an identical treatment.

(25) *Nem nunca ninguém nada* viu que pudesse incriminar o Rui.
not never nobody nothing saw that might incriminate the Rui
'It is not the case that anyone has ever seen anything that might incriminate Rui.'

Finally, (23a) illustrates the case where the negative quantifier reading of an N-word is banned, but its NPI reading is not licensed either. Given *todos* 'all' is left downwards monotone, it precludes the negative quantifier reading of *nunca* 'never' to figure in a grammatical representation; however, as *todos* is not anti-additive, it fails to qualify as a strong NPI licensor, thus precluding the NPI reading of *nunca* 'never' as well. The data in (22a) shows a similar effect with the only difference that the relative linear order of the D- and A-quantifiers is reversed.

3 A Constraint-based Account

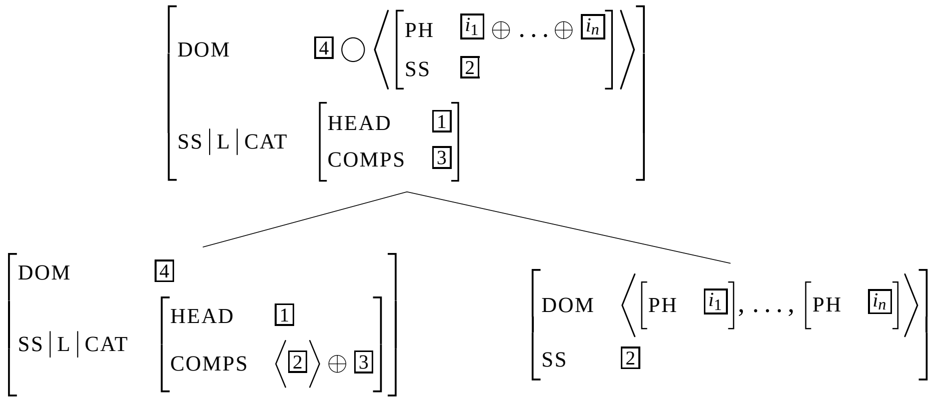
In this section we propose an account of the data under discussion in terms of linearisation constraints on quantifiers and strong negative polarity items (NPIs). The formal analysis is carried out in the framework of Head-driven Phrase Structure Grammar (HPSG; Pollard and Sag, 1987, 1994). After a brief introduction to linearisation on complex order domains (section 3.1), we will propose a formal integration of monotonicity information with Minimal Recursion Semantics (section 3.2). Finally, we will formulate two order constraints, as well as a licensing requirement for (strong) polarity items, on the basis of which the empirical pattern of Portuguese negative concord can be derived.

3.1 Linearisation in HPSG

Head-driven Phrase Structure Grammar (HPSG; Pollard and Sag, 1987, 1994) is a surface-oriented unification-based theory of grammar, which describes linguistic signs by means of typed feature structures. Building on rich and highly structured lexical information, organised in terms of multiple inheritance networks, HPSG recognises a set of highly general principles which specify how the feature structure of a syntactically complex sign is related to the feature structures of its parts. Among these principles, HPSG postulates a limited set of phrase immediate dominance (ID) schemata whose main purpose is to project phrase structure from the combinatorial potential of lexical signs.

Motivated by studies on "free word order" languages such as German (Reape, 1994; Kathol, 1995, 2000), current HPSG draws a fundamental distinction between the combinatorial aspects of phrase structure and its linearisation properties. In HPSG, phrasal signs must be licensed by one of several immediate dominance schemata, e.g. the HEAD-SUBJECT or the HEAD-COMPLEMENT schema, which regulate how signs can be combined into larger units and how the properties of the phrasal mother node relate to the properties of its daughters. Word order, however, operates on significantly larger domains, demanding a certain degree of independence from immediate constituency. To achieve this, it has been suggested by Reape (1994) and Kathol (1995, 2000), among others, that linear precedence statements do not operate on the phrase structure directly, but instead are formulated over a list of word order objects (DOM) which is derived from constituent structure by means of complex domain formation.

(26)



As illustrated above, ID-schemata, like the HEAD-COMPLEMENT schema in (26), specify, inter alia, how the the domain objects contributed by the head and non-head daughters are combined on the DOM list of the mother. The fundamental relation for complex domain formation is the "shuffle" operation (or sequence union), denoted by "○". The shuffle is an unordered concatenation of the DOM list of the head daughter with the domain object contributed by the non-head daughter (see Reape, 1994, p. 152–153, for a definition). In order to ensure that material from different major constituents cannot be interleaved, the DOM list of the non-head daughter is compacted into a single domain object, whose syntacto-semantic representation is token-identical with the syntacto-semantic representation of the non-head daughter and whose phonological contribution corresponds to the concatenation of the PH(ON) values on the non-head daughter's DOM list (see Kathol and Pollard, 1995, p. 175, for a formal definition of the compaction relation). Thus, the internal linear structure of the non-head is rendered opaque to ordering in higher domains.

With the other ID-schemata defined in an analogous way, a flat list representation of the entire sentential domain is built up which consists of domain objects corresponding to all major constituents plus the verbal head. The way in which complex domain formation is related to the ID-schemata also ensures the clause-boundedness of order phenomena: whenever a sentence is embedded as a subject, a modifier, or a complement, its DOM list is compacted into a single domain object, such that order constraints on the matrix clause can only target the embedded clause as a whole.

Although initially introduced in the context of Germanic languages, within HPSG, order domains are now adopted for the analysis of word order in a wide variety of languages, including other Romance languages, such as Italian (Przepiórkowski, 1999) and French (Bonami *et al.*, 1999). In Portuguese, the adoption of complex domain formation appears to be independently motivated (see Crysmann, 2000, for extensive discussion): Similar to other Romance languages, complements and modifiers can easily be interspersed, even separating the complements from the subcategorising verbal head. In the preverbal domain, modifiers can also be quite freely positioned, both before the subject and between the subject and the verb. Under a linearisation-based approach, both word order variation and the interleaving of arguments and modifiers can easily be accounted for.

Further evidence for a linearisation-based approach to Portuguese word order comes from the domain of clitic placement: whether or not the clitic cluster precedes its verbal hosts depends on the presence of some clause-local trigger element (e.g., complementiser, wh-expression, downward-entailing functor) to the left of the verbal cluster. As argued in Crysmann (1999, 2000, to appear), triggers are functionally, categorically, and configurationally quite heterogeneous, including heads, markers, modifiers, fillers, and subjects alike. The only distributional property shared by all these triggers is their linear position with respect to the verbal cluster.

3.2 Monotonicity in Minimal Recursion Semantics

As a first step towards a formal analysis, we will have to discuss how the semantic representation language (here: Minimal Recursion Semantics; Copestake *et al.* 1998) should best be enriched with monotonicity information.

MRS is not, in itself, a semantic theory, but a meta-level language for describing semantic structures in some underlying object language. In its formulation in Copestake *et al.* (1998), which we are adhering to here, the object language is the predicate calculus with generalised quantifiers. A major characteristic of MRS is its use of syntactically ‘flat’ semantic representations: The syntax of MRS is designed so that it can be straightforwardly expressed in terms of feature structures, and easily integrated into constraint-based grammars. According to its authors “the point of MRS is not that it contains any particular new insight into semantic representation, but that it integrates a range of techniques in a way that has proved to be very suitable for large general-purpose grammars for use in parsing, generation and semantic transfer” (p.2).

MRS is a semantic representation language with tools to accomodate an underspecified representation of meaning.[1] On the one hand, the semantic contribution of the subexpressions of a given expression *E* to the semantics of *E* are represented by feature structures of sort *mrs* (meaning representation structures) which are collected on a list. This list is the value of LISZT, a feature of the semantic representation of E. On the other hand, the hierarchical relations between the elements of sort *mrs* are expressed by means of indices and subordination constraints on these indices. To achieve this, each *mrs* specifies a HANDEL feature whose value is an index, which is the unique identifier of the corresponding *mr*s. As to the more complex semantic structures of quantifiers, they further include a SCOPE and a REST feature whose values are coindexed with the HANDEL of the domain and restrictor arguments. These feature-values are constrained to be of type *handl*e. The semantic representation of quantifiers also introduce a feature for binding the relevant variable (BV) of the noun’s predicate (INST). The semantic representation of an NP like *every man* will thus have the following representation:

[1] MRS shares a certain degree of similarity with other underspecified semantic representation languages, such as UDRT (Frank and Reyle, 1992, 1995) or UMRS (Egg, 1998).

(27)
$$\left[\text{SS}|\text{L}|\text{CONT}\ \left[\begin{array}{ll}\text{KEY} & \boxed{0}\\ \text{LISZT} & \left\langle \left[\begin{array}{ll}\textit{every-rel} & \\ \text{HANDEL} & \textit{handle}\\ \text{BV} & \boxed{2}\ \textit{ref-ind}\\ \text{REST} & \boxed{1}\ \textit{handle}\\ \text{SCOPE} & \textit{handle}\end{array}\right], \boxed{0}\left[\begin{array}{ll}\textit{man-rel} & \\ \text{HANDEL} & \boxed{1}\\ \text{INST} & \boxed{2}\end{array}\right]\right\rangle\end{array}\right]\right]$$

Apart from restricting the range of permissible coindexations, the sortal restriction on HANDEL, REST, and SCOPE values does not encode any useful linguistic information. Thus, we can safely augment the type *handle* with a sortal hierarchy to express the monotonicity context a quantifier creates for its arguments:

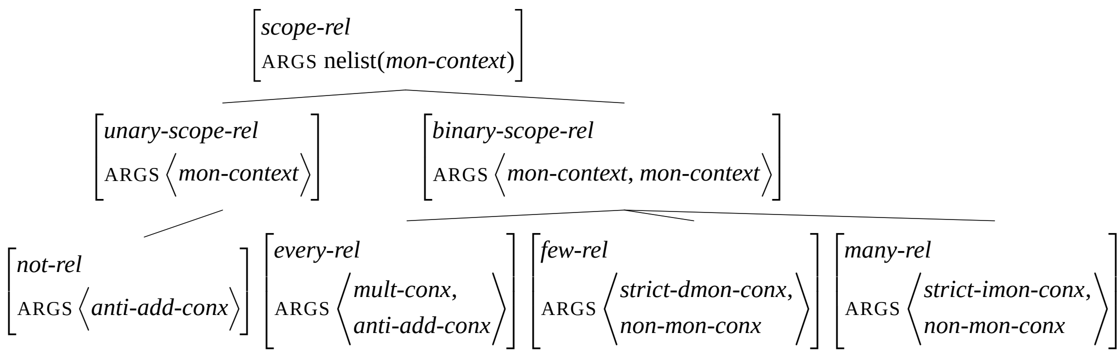
(28) *mon-context* ≡ *incr-mon-conx* ∨ *decr-mon-conx* ∨ *non-mon-conx*

As depicted in (28), a monotonicity context may either be upward entailing *(incr-mon-con*x), downward entailing *(decr-mon-con*x), or non-monotonic. This minimal hierarchy can further be expanded, if necessary, to encode the full hierarchy of negative (and positive) expressions identified by Zwarts (1996), where the sort *strict-dmon-conx* corresponds to items not observing any further parts of De Morgan laws except those minimaly characterising downwards monotone items. Similarly, the sort we label *strict-imon-conx* corresponds to upwards monotone contexts which are neither additive nor multiplicative (see Zwarts, 1996, for details).

(29) *decr-mon-conx* ≡ *anti-add-conx* ∨ *anti-mult-conx* ∨ *strict-dmon-conx*

(30) *incr-mon-conx* ≡ *add-conx* ∨ *mult-conx* ∨ *strict-imon-conx*

In order to facilitate generalisations across unary and binary functors, we suggest the following hierarchy of scope taking functors, where the scope and restrictor arguments are represented on a list-valued feature ARGS. By convention, the first element on this list will correspond to the functor's scope argument.

(31)


Consequently, the semantic contribution of an NP like *every man* will now be represented as in (32) below.

(32)

$$\left[\text{SS}\,|\,\text{L}\,|\,\text{CONT}\ \begin{bmatrix}\text{KEY} & \boxed{0} \\ \text{LISZT} & \left\langle \begin{bmatrix} \textit{every-rel} & \\ \text{HANDEL} & \textit{mon-cont} \\ \text{BV} & \boxed{2}\ \textit{ref-ind} \\ \text{ARGS} & \left\langle \textit{incr-mon-conx}, \boxed{1}\ \textit{decr-mon-conx} \right\rangle \end{bmatrix}, \boxed{0} \begin{bmatrix} \textit{man-rel} & \\ \text{HANDEL} & \boxed{1} \\ \text{INST} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix}\right]$$

For the purposes of semantic selection, MRS postulates a KEY feature which points to the semantic "core" of a sign, which is the head noun in the case of an NP. Thus, a subcategorising head can impose sortal restrictions on the kind of NPs or PPs it may combine with. The semantic contribution of the determiner can also be referenced straightforwardly by way of its variable-binding property: it is exactly that *mrs* whose BV value is token-identical with the INST value of the syntactic head.

(33) *d-mon-func* $\rightarrow$

$$\begin{bmatrix}\text{KEY}\ \boxed{0} \\ \text{LISZT} \left\langle \ldots \boxed{0} \left[\text{ARGS} \left\langle \ldots \textit{decr-mon-conx} \ldots \right\rangle\right] \ldots \right\rangle \end{bmatrix} \vee$$

$$\begin{bmatrix}\text{KEY}\ \boxed{0} \\ \text{LISZT} \left\langle \ldots \begin{bmatrix}\text{BV}\ \boxed{1} \\ \text{ARGS} \left\langle \ldots \textit{decr-mon-conx} \ldots \right\rangle\end{bmatrix} \ldots \boxed{0}\left[\text{INST}\ \boxed{1}\right] \right\rangle \end{bmatrix}$$

Having enriched the semantic representation language with monotonicity information, we can now give a formal definition of the class of ↓MON ∪ MON↓ functors: in essence, this class is defined in terms of the monotonicity contexts introduced by the determiner, in the case of NPs, or by the syntactic head itself, in the case of word-level quantifiers or the negative marker *não*. Similarly, strong NPI licensors can be defined on the basis of anti-additivity. Note that the description in (34) is properly subsumed by the description for downwards monotone functors, as given in (33) above.

(34) *neg-func* $\rightarrow$

$$\begin{bmatrix}\text{KEY}\ \boxed{0} \\ \text{LISZT} \left\langle \ldots \boxed{0} \left[\text{ARGS} \left\langle \textit{anti-add-conx}, \ldots \right\rangle\right] \ldots \right\rangle \end{bmatrix} \vee$$

$$\begin{bmatrix}\text{KEY}\ \boxed{0} \\ \text{LISZT} \left\langle \ldots \begin{bmatrix}\text{BV}\ \boxed{1} \\ \text{ARGS} \left\langle \textit{anti-add-conx}, \ldots \right\rangle\end{bmatrix} \ldots \boxed{0}\left[\text{INST}\ \boxed{1}\right] \right\rangle \end{bmatrix}$$

The last semantic type we are going to define relates to the NPI reading of N-words. Again, we suggest a disjunctive formulation, which describes both word-level functors, as well as phrases where a determiner combines with a content word.

(35) $$\textit{str-pol-item} \rightarrow \begin{bmatrix} \text{KEY} & \boxed{0} \\ \text{LISZT} & \left\langle \ldots, \boxed{0}\begin{bmatrix}\textit{exist-rel}\end{bmatrix}, \ldots \right\rangle \\ \text{H-STORE} & \{\} \end{bmatrix} \vee \begin{bmatrix} \text{KEY} & \boxed{0} \\ \text{LISZT} & \left\langle \ldots, \begin{bmatrix}\textit{exist-rel} \\ \text{BV} \quad \boxed{1}\end{bmatrix}, \ldots \boxed{0}\begin{bmatrix}\text{INST} & \boxed{1}\end{bmatrix} \ldots \right\rangle \\ \text{H-STORE} & \{\} \end{bmatrix}$$

MRS employs a Cooper-storage for the treatment of quantifier scope. To capture the fact that NPIs always take narrow scope, we further restrict the H-STORE to the empty list.

With all the basic semantic types in place, we can now characterise N-words as lexically ambiguous between a negative quantifier and a strong NPI reading:

(36) $$\textit{n-word} \rightarrow \begin{bmatrix}\text{CONT} & \textit{str-pol-item}\end{bmatrix} \vee \begin{bmatrix}\text{CONT} & \textit{neg-func}\end{bmatrix}$$

3.3 Deriving Negative Concord

As we have seen in the previous section, left or right downward entailing quantifiers observe a distributional restriction banning them from a position linearly preceding a negative expression. This placement restriction, which we regard as a word order phenomenon, can directly be captured by means of a linear precedence constraint (cf. (37)) which states that negative functors must precede left or right downward monotone functors.

(37) $$\begin{bmatrix}\text{CONT} & \textit{neg-func}\end{bmatrix} \prec \begin{bmatrix}\text{CONT} & \textit{d-mon-func}\end{bmatrix}$$

Put differently, under the standard interpretation of LP statements in HPSG (e.g. Pollard and Sag, 1987; Kathol, 1995), this constraint rules out any ordering under which a domain object that satisfies the description of a downward-monotone quantifier precedes a domain object corresponding to a negative functor.

Next, we will propose an implicational constraint requiring that every (strong) polarity item be licensed clause-locally. If, as stated in (38) below, a strong polarity item is present on the domain list of a sentential sign (a saturated verb), there must also be a local anti-additive licensor on the same domain list.

(38) $$\begin{bmatrix} \text{DOM} & \left\langle \ldots, \begin{bmatrix}\text{CONT} & \textit{str-pol-item}\end{bmatrix}, \ldots \right\rangle \\ \text{SS}|\text{L}|\text{CAT} & \begin{bmatrix}\text{HD} & \textit{verb} \\ \text{SUBJ} & \langle\rangle \\ \text{COMPS} & \langle\rangle\end{bmatrix} \end{bmatrix} \rightarrow \begin{bmatrix}\text{DOM} \left\langle \ldots, \begin{bmatrix}\text{CONT} & \textit{neg-func}\end{bmatrix}, \ldots \right\rangle\end{bmatrix}$$

Whenever a clause combines with some external head (either as a complement or as a modifier), its domain list is compacted into a single domain object on the mother's DOM list, thereby rendering the linear structure of the embedded clause opaque to ordering in the higher domain (see the discussion in 3.1 above). Thus, clause-locality is preserved by the very mechanism of complex domain formation, effectively blocking embedded licensors from licensing polarity items in the matrix clause.

Following Ladusaw (1992), we assume that linear precedence in a local domain provides the relevant generalisation. We can, therefore, formalise this further requirement on NPI licensors as a linear precedence statement, requiring a licensor to precede a licensee.

(39) $\left[\text{CONT} \quad \textit{neg-func}\right] \prec \left[\text{CONT} \quad \textit{str-pol-item}\right]$

On the basis of these three constraints, we can now give a formal account of the empirical pattern observed. The simplest case where a left or right downward monotone quantifier precedes the unambiguously negative *nã*o, will be directly ruled out on the basis of (37) above (cf. the example in (4a) repeated below).

(4)	a. *	{Todos os,	Nem todos,	Poucos dos,	Cada}	estudante(s)	*não*	viram/viu	o	Rui.
		{all the,	not every,	few of the,	each}	student(s)	not	saw	the	Rui

The first non-trivial case to be considered regards the placement of downward monotone quantifiers with respect to N-words. Under the ambiguity approach we assume here, these items can be interpreted either as negative quantifiers or as strong NPIs.

(40)	*	{Todos os,	Poucos dos}	estudantes	*nada*	viram
		{all the,	few of the}	students	nothing	saw

If the negative quantifier reading of *nada* is selected, (40) will be subject to the precedence constraint in (37), which demands that left or right monotone decreasing functors must follow any negative expression. If we consider the remaining option, interpreting this N-word as an NPI, we find that there is no strong NPI licensor, i.e. anti-additive functor to its left. Because no reading of the N-word in (40) may satisfy the LP constraints on quantifiers and NPIs, the sentence is ruled out as ungrammatical.

The same set of constraints will also prove capable of performing the task of disambiguation: in a sentence with two N-words, such as (41) below, each of the N-words is lexically ambiguous between a negative and an NPI reading, yielding up to 4 potential readings.

(41)	Ninguém	nunca	viu	o	Rui
	nobody	never	saw	the	Rui

‘Nobody ever saw Rui.’

The first reading (cf. (42)), which corresponds to double negation, can be ruled out on the basis of the constraint on downward monotone functors: as stated in (37), a left or right downward monotone functor may not precede an anti-additive functor on any domain list. Given that downward entailment subsumes anti-additivity (cf. (29)), this constraint thus disallows the cooccurence of any two negatives in the same sentential domain, as this would actually give rise to a configuration with a downward monotone functor preceding negation.

(42)
$$\begin{bmatrix} \text{S} \\ \text{DOM} \left\langle \begin{bmatrix}\text{NP}\\ \text{PHON } \textit{ninguém}\\ \text{CONT } \textit{neg-func}\end{bmatrix}, \begin{bmatrix}\text{ADV}\\ \text{PHON } \textit{nunca}\\ \text{CONT } \textit{neg-func}\end{bmatrix}, \ldots \right\rangle \end{bmatrix}$$

The reading where none of the two N-words carries negative force can also be discarded straightforwardly on the basis of the licensing requirement in (38).

(43)
$$\begin{bmatrix} \text{S} \\ \text{DOM} \left\langle \begin{bmatrix}\text{NP}\\ \text{PHON } \textit{ninguém}\\ \text{CONT } \textit{str-pol-item}\end{bmatrix}, \begin{bmatrix}\text{ADV}\\ \text{PHON } \textit{nunca}\\ \text{CONT } \textit{str-pol-item}\end{bmatrix}, \ldots \right\rangle \end{bmatrix}$$

Similarly, the precedence condition on NPI licensors will eliminate the spurious ambiguity between (44) and (45), leaving the latter as the only valid representation for a sentence like (41).

(44)
$$\begin{bmatrix} \text{S} \\ \text{DOM} \left\langle \begin{bmatrix}\text{NP}\\ \text{PHON } \textit{ninguém}\\ \text{CONT } \textit{str-pol-item}\end{bmatrix}, \begin{bmatrix}\text{ADV}\\ \text{PHON } \textit{nunca}\\ \text{CONT } \textit{neg-func}\end{bmatrix}, \ldots \right\rangle \end{bmatrix}$$

(45)
$$\begin{bmatrix} \text{S} \\ \text{DOM} \left\langle \begin{bmatrix}\text{NP}\\ \text{PHON } \textit{ninguém}\\ \text{CONT } \textit{neg-func}\end{bmatrix}, \begin{bmatrix}\text{ADV}\\ \text{PHON } \textit{nunca}\\ \text{CONT } \textit{str-pol-item}\end{bmatrix}, \ldots \right\rangle \end{bmatrix}$$

The last case we want to discuss concerns the incompatibility between preverbal N-words and the sentential negation marker *nã*o. If we assume that *não* unambiguously carries negative force, there are only two representations to be considered:

(46)
$$\begin{bmatrix} \text{S} \\ \text{DOM} \left\langle \begin{bmatrix}\text{NP}\\ \text{PHON } \textit{ninguém}\\ \text{CONT } \textit{str-pol-item}\end{bmatrix}, \begin{bmatrix}\text{ADV}\\ \text{PHON } \textit{não}\\ \text{CONT } \textit{neg-func}\end{bmatrix}, \ldots \right\rangle \end{bmatrix}$$

(47)
$$\begin{bmatrix} \text{S} \\ \text{DOM} \left\langle \begin{bmatrix}\text{NP}\\ \text{PHON } \textit{ninguém}\\ \text{CONT } \textit{neg-func}\end{bmatrix}, \begin{bmatrix}\text{ADV}\\ \text{PHON } \textit{não}\\ \text{CONT } \textit{neg-func}\end{bmatrix}, \ldots \right\rangle \end{bmatrix}$$

If the preverbal N-word is interpreted as an NPI, as in (46), the precedence requirement on licensing is not fulfilled, thus accounting for the unavailability of this particular reading. The negative quantifier reading of *ningué*m, however, is not available either, because the representation in (47) does not respect the LP constraint on downward monotone quantifiers.

To summarise, the effect of negative concord can be derived from independently motivated linear precedence constraints. The linearisation-based approach we have proposed here is further supported by the strict parallelism with clitic placement in the presence of left or right downwards monotone quantifiers, which has already been fruitfully analysed in terms of word order variation (Crysmann, 2000, to appear).

4 Conclusion

We have argued, heretofore, that the absence of double negation in Portuguese is the result of a linear constraint on ↓MON ∪ MON↓ and negation, which precludes downward monotone functors to precede negation. Under the ambiguity approach that we assume, the interplay of this constraint with the licensing requirement for (strong) NPIs enables us to derive the negative concord facts without any further stipulation. Furthermore, the surface-oriented, constraint-based approach we are adopting in this paper allows for a more strengthened view of N-words as NPIs (in one of their readings), as these expressions are assumed to be licensed by overt elements only.

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