BINDING SYMMETRIES AND NOMINAL DUALITIES

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1 Introduction

The grammatical constraints on anaphoric binding, known as binding principles, have been observed to form a classical square of logical oppositions. In this paper, we argue that this is the sign of the quantificational nature of binding constraints. More specifically, we show that these constraints are the effect of phase quantifiers over reference markers in grammatical obliqueness hierarchies.

We also discuss the impact of this result on our understanding of the semantics of nominals and, in particular, on the distinction between quantificational and referential nominals.

1.1 Anaphoric binding constraints

Since the so called integrative approach to anaphora resolution was set up in late eighties (Carbonell & Brown 1988; Rich & Luperfoy 1988; Asher & Wada 1988) and its practical viability extensively checked out (Lappin & Leass 1994; Mitkov 1997), it is common wisdom that factors determining the antecedents of anaphors divide into filters and preferences. The latter help to pick the most likely candidate, that will be proposed as the antecedent; the former exclude impossible antecedents and help to circumscribe the set of antecedent candidates.

Binding principles are a significant subset of such filters. They capture generalisations concerning the constraints on the relative positioning of anaphors with respect to their admissible antecedents in the grammatical geometry of sentences. From an empirical perspective, these constraints stem from what appear as quite cogent generalisations and exhibit a universal character, given the hypothesis of their parameterised validity across natural languages. From a conceptual point of view, in turn, the relations among the definitions of binding constraints involve non-trivial cross symmetry, which lends them a modular nature and provides further strength to the plausibility of their universal character. Binding principles have thus been considered one of the most significant modules of grammatical knowledge, usually termed as “binding theory” in generative linguistics.

We follow here the definition of these generalizations as it is proposed in Pollard & Sag (1994), and subsequent extension in Xue et al. (1994); Branco & Marrafa (1999), which is presented below, together with some examples. These constraints on the anaphoric capacity of nominals induce a partition of the set of anaphors into four classes. According to this partition, every anaphor is of one of the following anaphoric types: short-distance reflexive, long-distance reflexive, pronoun, and non-pronoun.

(1) **Principle A:** A locally o-commanded short-distance reflexive must be locally o-bound.

[Lee$_i$'s friend]$_j$ thinks [[Max$_k$'s neighbour]$_l$ likes himself$_{*i/*j/*k/l}$].

Principle Z: An o-commanded long-distance reflexive must be o-bound.

[O	*amigo*	*do*	*Lee$_i$]$_j$*	*acha*	*[que*	*[o*	*vizinho*	*do*	*Max$_k$]$_l$*	*gosta*
the	friend	of_the	Lee	thinks	that	the	neighbour	of_the	Max	likes

dele	*próprio$_{*i/j/*k/l}$].(Portuguese)*
of_him	self

'[Lee$_i$'s friend]$_j$ thinks [[Max$_k$'s neighbour]$_l$ likes him$_{*i/j/*k/}$/ himself$_l$].'

Principle B: A pronoun must be locally o-free.

[Lee$_i$'s friend]$_j$ thinks [[Max$_k$'s neighbour]$_l$ likes him$_{i/j/k/*l}$].

Principle C: A non-pronoun must be o-free.

[Lee$_i$'s friend]$_j$ thinks [[Max$_k$'s neighbour]$_l$ likes the boy$_{i/*j/k/*l}$].

The empirical generalizations above are captured with the help of a few auxiliary notions. The notion of *o-binding* is such that x o-binds y iff x o-commands y and x and y are coindexed, where coindexing is meant to represent anaphoric links.[1]

O-command is a partial order under which, in a clause, the Subject o-commands the Direct Object, the Direct Object o-commands the Indirect Object, and so on, following the usual obliqueness hierarchy of grammatical functions; in a multiclausal sentence, the upward arguments o-command the successively embedded arguments.[2]

The notion of *local domain* for an anaphoric nominal n concerns the partition of sentences and associated grammatical geometry into two zones of greater or less proximity with respect to n. Typically, the local domain of n coincides with the selectional domain of the predicator subcategorising n. In some cases, there may be additional requirements that the local domain is circumscribed by the first upward predicator that happens to be finite, bears tense or indicative features, etc.[3]

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[1] There are anaphors that appear as Subject-oriented, in the sense that they only take antecedents that have the grammatical function Subject. Some authors (e.g. Dalrymple 1993) assume that this should be seen as an intrinsic parameter of binding constraints and aim at integrating it into their definition. In this point, we follow previous results of ours reported in Branco (1996), where the apparent Subject-orientedness of anaphors is argued to be, not an intrinsic feature of binding constraints, but one of the surfacing effects resulting from the non linear obliqueness hierarchy associated with some predicators (or with all of them in some languages).

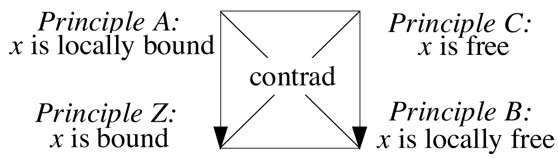
[2] The o-command relation is defined on the basis of obliqueness hierarchies successively embedded along the relation of subcategorization: "Y o-commands Z just in case either Y is less oblique than Z; or Y o-commands some X that subcategorizes for Z; or Y o-commands some X that is a projection of Z" (Pollard & Sag 1994:279). For a discussion of the empirical justification for obliqueness hierarchies as well as references on this topic, see Pollard & Sag (1987:Sec.5.2).

[3] See Dalrymple (1993) for details and examples.

1.2 Binding square of oppositions

With these introductory remarks on anaphoric binding constraints in place, the key observation to make with respect to the generalisations in (1) above is that, when stripped away from procedural phrasing and non-exemption requirements,[4] they instantiate the following square of oppositions (Branco & Marrafa 1999):

(2)



There are two pairs of *contradictory* constraints, which are formed by the two diagonals, (A, B) and (C, Z). One pair of *contrary* constraints (they can be both false but cannot be both true) is given by the upper horizontal edge (A, C). One pair of *compatible* constraints (they can be both true but cannot be both false) is given by the lower horizontal edge (Z, B). Finally two pairs of *subcontrary* constraints (the first coordinate implies the second, but not vice-versa) are obtained by the vertical edges, (A, Z) and (C, B).

Given this new square of oppositions, the natural question to ask is whether this is a sign that binding principles are the visible effect of some underlying quantificational structure. A major point of this paper is to argue that this question can be answered affirmatively.

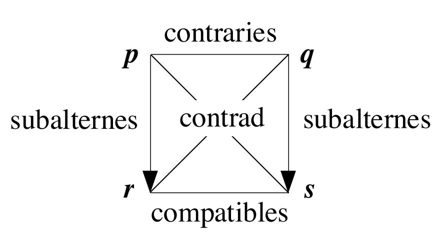
2 Quantification

2.1 Duality

Löbner (1987) suggested that the emergence of a notoriously non trivial square of logical duality between the semantic values of natural language expressions is a major empirical touchstone to ascertain their quantificational nature; and van Benthem (1991), while noting that the ubiquity of the square of duality may be the sign of a semantic invariant possibly rooted in some cognitive universal, highlighted its heuristic value for research on quantification inasmuch as "it suggests a systematic point of view from which to search for comparative facts" (p.23).

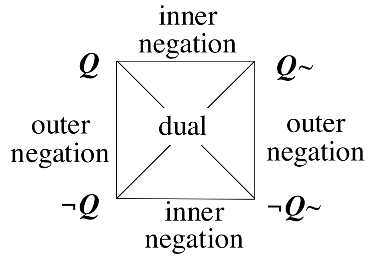
Given the working question raised above in the previous section, it is of note that a square of duality, in (4), is different and logically independent from a classical square of oppositions, in (3):

(3)



[4]Detailed discussion of exemption occurrences of reflexives is presented in footnote 7.

(4)



The difference lies in the fact that duality, inner negation and outer negation are third order concepts, while compatibility, contrariness and implication are second order concepts. As a consequence, it is possible to find instantiations of the square of oppositions without a corresponding square of duality, and vice-versa. [5]

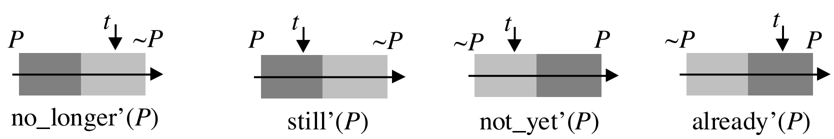
Although the two squares are logically independent, the empirical emergence of a square of oppositions for the semantic values of natural language expressions – like the one in (2) above – naturally raises the question about the possible existence of an associated square of duality, and about their quantificational nature.

In view of arguing towards the main point of this paper, we thus proceed by showing that there is a square of duality associated with the grammatical constraints on anaphoric binding.

2.2 Phase quantification

Before this result can be fully worked out, some analytical tools are to be introduced first. We resort to the notion of phase quantification, introduced in Löbner (1987) to study the semantics of aspectual adverbials and shown to be extended to characterise quantification in general. For the sake of concreteness, consider a diagrammatic display of the semantics of aspectual adverbials:

(5)



Very briefly, phase quantification requires the following ingredients: (i) an order over the domain of quantification; (ii) a parameter point t; (iii) a property P defining a positive semiphase in a sequence of two opposite semiphases; and (iv) the starting point of a given semiphase.

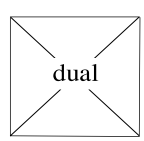
For the analysis of aspectual adverbials in terms of phase quantification, the order of (i) is the time axis; the parameter point t of (ii) is the reference time of the utterance; the relevant property P of (iii) denotes the instants where the proposition modified by the adverbial holds (with the adverbials *no longer* and *still* bearing the presupposition that semiphase P precedes semiphase $\sim P$, and *not yet* and *already* bearing the presupposition that $\sim P$ precedes P); and the starting point in (iv) is $I(R, t)$, the infimum of the set of the closest predecessors of t which form an uninterrupted sequence in phase R. [6]

Given these correspondences, the aspectual adverbials can be analysed as expressing the following quantifiers:

(6)

still':
$\lambda P.$every'$(\lambda x.(I(P,t) < x \leq t),P)$

no_longer':
$\lambda P.$not_every'$(\lambda x.(I(P,t) < x \leq t),P)$



not_yet':
$\lambda P.$no'$(\lambda x.(I(\sim P,t) < x \leq t),P)$

already':
$\lambda P.$some'$(\lambda x.(I(\sim P,t) < x \leq t),P)$

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[5] See Löbner (1987) for examples and discussion.

[6] See Löbner (1987, 1989) for a thorough definition.

3 Quantificational binding constraints

With this in place, the empirical generalisations captured in the definition of binding principles in (3) can be argued to be the visible effect of the phase quantificational nature of the corresponding nominals. In the present section, we will show how anaphoric nominals can be analysed as expressing one of four quantifiers acting on the domain of reference markers arranged in terms of the grammatical obliqueness order of their clauses.

3.1 Phase quantification ingredients

Phase quantification here is assumed to unfold not over entities of the extra-linguistic universe, but over entities in the universe of grammatical representations, vz. reference markers (Karttunen 1976; Kamp 1981; Heim 1982; Seuren 1985). Its ingredients are set up as follows:

(i) *Order:* reference markers are ordered according to the o-command relation;

(ii) *Parameter point:* t is set up as a, the reference marker of the antecedent of the anaphoric nominal at stake;

(iii) *Phase property:* P is set up as D, denoting the set of markers in what we term here the binding domain of the anaphor.

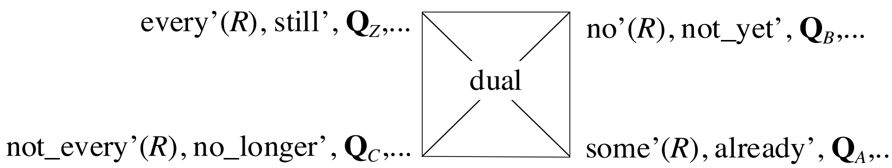
In terms of phase quantification, the binding domain is thus the positive semiphase in the sequence of two opposite semiphases. This positive semiphase D for binding is defined as follows: For an anaphoric nominal n (e.g. *himself*) in a given sentence s (e.g. *Kim said that Lee described Max to himself*), D is determined by the position of n in the obliqueness order which n enters in s (i.e. given the example above, that order is *Kim* < *Lee* < *Max* < *himself*). Given r, the reference marker of n, semiphase D_r is a stretch containing r and the markers that are less than or equal to r in the obliqueness order such that the closest D_r neighbour of semiphase $\sim D_r$ is local with respect to r (i.e. given the example above, *k* < *l* < *m* < *r*, with $\sim D_r$: *k* < *l* and D_r: *m* < *r*, where *m* is here the closest neighbour of $\sim D_r$ which is local with respect to r).

It is of note that the positive phase/binding domain D is not necessarily the local domain of the corresponding anaphor. In case $\sim D_r$ is presupposed to precede D_r, the first predecessor in D_r is local with respect to r. In this case, D_r contains in fact the local o-commanders of r (as in the example sentence in the paragraph above) thus becoming close to the notion of local domain.

But in the other case, that is in the case where semiphase D_r is presupposed to precede $\sim D_r$ (e.g. for long-distance reflexives – cf. discussion and examples in the Subsections below), D_r may not coincide with the local domain of r. Given the sequence $D_r.\sim D_r$ now, D_r is such that the last successor in it (r itself) is local with respect to r. Therefore, D_r contains all o-commanders of r, including those that are local and, in case they exist, also those that are not local with respect to r.

Given these ingredients for phase quantification and the appropriate replacements in the square in (6), one gets four phase quantifiers – we termed $\mathbf{Q}_Z$, $\mathbf{Q}_B$, $\mathbf{Q}_C$ and $\mathbf{Q}_A$ – entering the square of duality and aligning with other quantifiers of similar quantificational force at each of the corners:

(7)



As we are going to check in the Subsections below, these four phase quantifiers ensure the same empirical predictions as secured by the four binding constraints stated in (1).

3.2 Short-distance reflexives

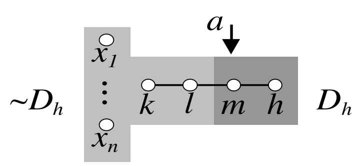
The quantifier expressed by short-distance reflexives is associated with the presupposition that $\sim D.D$. It receives the following definition:

$\mathbf{Q}_A$: $\lambda P.$some'$(\lambda x.(I(\sim P, a) < x \leq a), P)$

This is easily interpreted against the diagram corresponding to an example sentence like

Kim said Lee thinks [*Max*$_i$ *hit himself*$_i$].

In the diagram below, k, l, m and h stand, respectively, for the reference markers of *Kim*, *Lee*, *Max* and *himself*; and $x_1, \ldots, x_n$ stand for the markers not in the obliqueness relation of *h*, including those possibly introduced in other sentences of the discourse or available in the context (Hasse diagrams are displayed with a turn of 90 degrees right):



$\mathbf{Q}_A(D_h)$ is satisfied iff between the bottom of the uninterrupted sequence $\sim D_h$ most close to the admissible antecedent a and a inclusive, there is at least one reference marker in D_h. As $\sim D_h$ precedes D_h, this amounts to requiring that an admissible antecedent a be in D_h, the local domain of the short-distance reflexive marker h, and consequently that a be a local o-commander of h – in the example sentence above, this implies that only *Max* can be an admissible antecedent of *himself*, which matches the requirement of Principle A in (1).

Binding phase quantifier $\mathbf{Q}_A$ is thus analysed as having positive existential force and short-distance reflexives align in the square of duality in (7) with items like *some N*, *already*, *possibly*, etc.

3.3 Pronouns

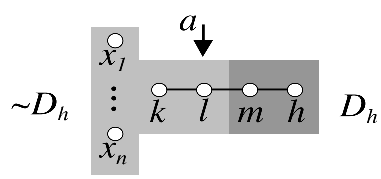
The phase quantifier expressed by pronouns, in turn, is analysed as lying at the same corner as the quantifiers no'(R) or not_yet' in (7):

$\mathbf{Q}_B$: $\lambda P.$no'$(\lambda x.(I(\sim P, a) < x \leq a), P)$

For the sake of the discussion, let us consider a prototypical working example like the sentence:

Kim said Lee$_i$ *thinks* [*Max hit him*$_i$],

The presupposition conveyed by these anaphors is also that $\sim D.D$, and $\mathbf{Q}_B$ is easily grasped when considering the diagrammatic description where h is the reference marker of *him*:



$\mathbf{Q}_B(D_h)$ is satisfied iff no reference marker between the bottom of $\sim D_h$ and the admissible antecedent a inclusive is in D_h, which implies that a is in $\sim D_h$. Henceforth, according to this analysis, admissible antecedents of a pronoun have to be outside the local domain of the pronoun (in the example above, *Max* is ruled out as an admissible antecedent of *him*), thus matching the generalisation captured by Principle B.

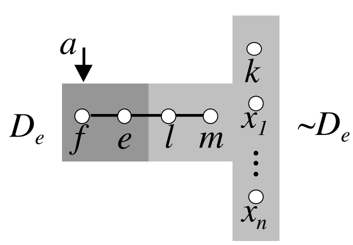
It is of note that, in the working example above, $\sim D_h$ includes not only the markers k and l of *Kim* and *Lee*, in the upwards clause, but also $x_1, \ldots, x_n$ thus allowing for non-sentential anaphoric links for the pronoun (including those that are discourse- or context-driven, deictic, etc.).

3.4 Long-distance reflexives

Turning to long-distance reflexives, we consider the following working example from Portuguese:

[*O amigo de Kim*]$_i$ *disse que ele próprio*$_i$ *acha* [*que Lee viu Max*](*Portuguese*)
[the friend of Kim]$_i$ said that ele próprio$_i$ thinks [that Lee saw Max].
'[*Kim's friend*]$_i$ *said "ele próprio"*$_i$ *thinks* [Lee saw Max].'

Its diagram can be displayed as follows, where e is the marker of the long-distance reflexive:



The phase quantifier expressed by long-distance reflexives is analysed as having positive universal force and can be found at the same corner of the square in (7) as the quantifiers every'(R) or still':

$\mathbf{Q}_Z$: $\lambda P.$every'$(\lambda x.(I(P,a) < x \leq a), P)$

As with short-distance reflexives, an admissible antecedent a is here required to occur in D_e though the presupposition conveyed now is that the positive semiphase D is followed by the negative semiphase $\sim D$. Taking into account the definition of positive phase D in Section 3.1, the antecedent a is thus required to be an o-commander – local or not – of the marker e of the anaphoric nominal.

The semantics of the phase quantifier corresponding to long-distance reflexives is such that, for $\mathbf{Q}_Z(D_e)$ to be satisfied, between the bottom of the uninterrupted sequence D_e closest to an admissible antecedent a and a inclusive, every reference marker is in D_e.

In terms of the working example above, this amounts to requiring that only *Kim's friend* can be taken as an admissible antecedent of the long-distance reflexive *ele próprio*. In general terms, this amounts to requiring the admissible antecedent a to be in D_e, i.e. to imposing that any admissible antecedent is an o-commander of the long-distance reflexive, as required in Principle Z.[7]

3.5 Non-pronouns

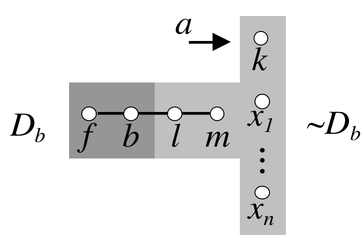
Non-pronouns are analysed as expressing a quantifier that appears at the same corner of the square in (7) as quantifiers like not_every'(R), no_longer', etc.:

$\mathbf{Q}_C$: λP.not_every'$(\lambda x.(I(P,a) < x \leq a), P)$

In order to support the justification of this analysis with a discussion of a prototypcal working example, we take the following sentence:

[*Kim*$_i$*'s friend*] *said the boy*$_i$ *thinks* [*Lee saw Max*].

Let us consider a first version of the diagram for this example, where b is the marker corresponding to *the boy*:



[7] When reflexives occur in a syntactic position where they have no possible antecedent o-commanding them in their binding domain, their anaphoric capacity is exempt from the usual binding "discipline" and they present a so-called logophoric behaviour. This is illustrated in the following example from Golde (1999:73), where *herself* picks an antecedent outside its (local) binding domain, the NP *the portrait of herself*: *Mary*$_i$ *thought the artist had done a bad job, and was sorry that her parents came all the way to Columbus just to see* [*the portrait of herself*$_i$].

Under the quantificational analysis of binding constraints we are presenting, to a reflexive m in an exempt position (i.e. in the bottom of the positive semiphase D), there corresponds the maximum "shrink" of D, as this is the singleton whose sole element is m. This maximum shrink has a disturbing impact only in the phase quantifiers for which the antecedent a is to be found in D, namely $\mathbf{Q}_A$ and $\mathbf{Q}_Z$. In these cases, for a to be in D and the relevant phase quantification to be satisfied, a can only be identified with m itself.

As m happens to be engaged in this anaphoric anchoring loop, its non vacuous interpretation remains to be accomplished. Admittedly, an overarching interpretability requirement is in force in natural languages ensuring the "meaningful" anchoring of anaphors: For an exempt reflexive to be non vacuously interpreted, an antecedent – inevitably one outside the binding domain of the reflexive in such cases – has to be fixed. Logophoricity appears thus as an exceptional anaphoric behaviour of reflexives that shows up when their interpretation has to be untied from anchoring loops formed by virtue of their markers occurring in the bottom of the positive semiphase D.

The presupposition here is that the positive semiphase precedes the negative semiphase. Furthermore, an admissible antecedent a of b should be required to occur in $\sim D_b$, which implies that a cannot be an o-commander of b, thus rendering the same constraint as expressed in Principle C.

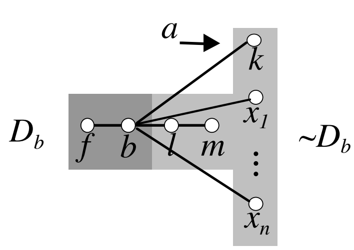
In terms of our example sentence, this means that *Kim's friend* is ruled out as an admissible antecedent of *the boy* by the non satisfaction of the phase quantifier exressed by *the boy*. The anaphoric links between *the boy* and *Lee* or *Mark*, in turn, are not ruled out by (the possible non satisfaction of) the quantifier expressed by *the boy*, but by the non satisfaction of the quantifiers that are expressed by *Lee* and *Mark*, respectively.

As in previous diagrams, the negative semiphase $\sim D$ is taken here as the complement set of the positive semiphase D. Fully correct empirical prediction requires however this assumption to be refined and a more accurate definition of $\sim D$ be provided for phase quantification in non-linear orders – as the one under consideration – where not all elements of the quantification domain are comparable.

Note that for $\mathbf{Q}_C(D_b)$ to be satisfied, between the bottom of D_b and the antecedent a inclusive, not every reference marker is in D_b. In examples as the one above, the denotation of $\lambda x.(I(D_b, a) < x \leq a)$, the restrictor of $\mathbf{Q}_C$, is always empty: It is not the case that $I(D_b, a) \leq a$ because when $a = k$ (or $a = x_i$, for any i), a is not comparable to any element of D_b, including its bottom, $I(D_b, a)$. Hence, not_every'$(\lambda x.(I(D_b, a) < x \leq a), D_b)$ is false whatever reference marker, k or x_i, happens to be taken as the antecedent for b. As a consequence, the specific anaphor resolution in the example above would be incorrectly ruled out.

This suggests that when phase quantification operates on non-linear orders, negation of the positive phase P may be slightly more sophisticated than simple Boolean negation rendering its complement set. We are taught that negation of P also involves the lifting of the complement set, $\overline{P}_\perp$, with $\perp$ equal to the top of P (b in the working example above) when there is the presupposition that $P. \sim P$.[8]

With this fine-tuned definition of the negative semiphase, the diagrammatic display for our working example becomes:



This specification of the negative semiphase correctly ensures that $\mathbf{Q}_C(D)$ is satisfied iff not every marker between the antecedent a and the bottom of D_b is in D_b; that is, iff a is not in D_b and, therefore, is not an o-commander of b, as stated in Principle C.

4 Discussion

The results reported in this paper may shed new light over a number of research issues, to whose discussion we turn now.

[8]For the sake of formal uniformity, when there is the presupposition that $\sim P.P$, the order-theoretic dual of this definition for $\sim P$ can also be assumed.

4.1 Binding symmetries

The intriguing symmetries between the definitions of binding constraints have been a source of puzzlement and challenge in the last decades for the research on nominal anaphora. These symmetries fostered the view that grammatical binding constraints belong to a coherent set or, as many have called it, to a binding "theory". They have inspired a number of accounts that try to justify them in terms of – and sometimes try to take them as the justification for – some underlying or general cognitive, functional, pragmatic, "economy"-driven, etc. foundations of language use or of the language faculty (see a.o. Levinson 1991; van Hoeck 1997; Reuland 2001; Piñango 2001).

The analysis presented in this paper provides for a notoriously elegant way of relating the different binding constraints with each other in a compact "theory". While presenting a formally precise account of the relations among binding constraints, this analysis offers a straightforward justification for the "symmetries" among them: the latter are the kind of "symmetries" that hold among the corners of squares of duality.

4.2 Natural language quantification

Many authors have stressed the view that there is no correspondence between surface and logical form of quantificational expressions of natural languages. Löbner emphasised this non-correspondence by pointing out that, while domain restrictor and quantified predicate are rendered by two different surface expressions in nominal quantification, in phase quantification expressed by aspectual adverbials, only the quantified predicate is available at the surface form.

With phase quantification expressed by anaphors, this gulf between surface and logical form widened further: There is no surface expression directly rendering either the domain restrictor of quantification or the quantified predicate.

Other important implications for our understanding of quantification in natural languages might have been uncovered as well by the results presented above. Quantification is extended to universes whose elements are not entities of the "extra-grammatical" universe, but entities of the "intra-grammatical" world itself: The models against which binding phase quantification is to be interpreted are not representations of the world, with everyday entities like donkeys, farmers, etc., but grammatical representations, with entities like reference markers, grammatical functions, etc. Hence, satisfaction of a formula made out of a binding phase quantifier, $\mathbf{Q}_A$, $\mathbf{Q}_Z$, $\mathbf{Q}_B$ or $\mathbf{Q}_C$, turns out to be a well-formedness constraint on the sentence where the corresponding anaphor occurs: For the meaning of "classic" quantification to be determined, one has to know how the world has to be for it to be true; for the meaning of binding phase quantification to be determined, one has to know how the corresponding grammatical representation has to be for it to be true.

4.3 Nominal dualities

It is also worth considering the implications of the results reported here for the overall semantic make up of nominals.

The shared wisdom is that nominals convey either quantificational or referential force, and a large bulk of the research on the semantics of nominals has been concerned with determining which side of this divide definite descriptions belong to (cf. a.o. Neale 1993; Larson & Segal

1995). For the sake of the argument, let us assume that definites are referential terms. Let us also take into account that proper names are ruled by binding Principle C.

Given these assumptions, the analysis developed in this paper implies that nominals with "primary" referential force (*he*, *the book*, *John*,...) have a certain "secondary" quantificational force: They express quantificational requirements – over reference markers in grammatical representations –, but cannot be used to directly quantify over extra-linguistic world entities, like the other "primarily" quantificational nominals (*every man*, *most students*,...) do.

This duality of semantic behaviour, however, turns out not to be that much surprising if one observes a symmetric duality with regards to quantificational nominals, apparent when they act as antecedents in e-type anaphora, as in the example *Most students*$_i$ *came to the party and they*$_i$ *had a wonderful time*. The analysis of e-type anaphora envisaged by some authors (e.g. Kamp & Reyle 1993:4.1.2) implies that nominals with "primary" quantificational force have a certain "secondary" referential force: These nominals have enough referential strength to evoke and introduce reference markers in the grammatical representation that can be picked as antecedents by anaphors – and thus support the referential force of the latter – but they cannot be used to directly refer to extra-linguistic entities, like the other "primarily" referential terms do.

If the results reported here are meaningful, the duality quantificational vs. referential nominals is less strict but more articulated than it has been assumed. Possibly taking indefinite descriptions aside, every nominal makes a contribution in both semantic dimensions of quantification and reference, but with respect to different universes. "Primarily" referential nominals have a dual semantic nature – they are "primarily" referential and "secondarily" quantificational – that is symmetric of the dual semantic nature of "primarily" quantificational ones – they are "primarily" quantificational and "secondarily" referential.

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Bibliography

Asher, N., Wada, H., 1988. A computational account of syntactic semantic and discourse principles for anaphora resolution. *Journal of Semantics* **6**, 309–344.

van Benthem, J., 1991. Linguistic universals in semantics. In: D. Zäfferrer (ed.), *Semantic universals and universal semantics*. Foris, Berlin, 17–36.

Branco, A., 1996. Branching split obliqueness. In: Proceedings of the 16th international conference on computational linguistics. 149–156.

Branco, A., Marrafa, P., 1999. Long-distance reflexives and the binding square of opposition. In: G. Webelhuth, J.-P. Koenig, A. Kathol (eds.), *Lexical and constructional aspects of linguistic explanation*. CSLI Publications, Stanford, 163–177.

Carbonell, J., Brown, R., 1988. Anaphora resolution: A multi-strategy approach. In: Proceedings of the 12th international conference on computational linguistics (COLING). 96–101.

Dalrymple, M., 1993. *The syntax of anaphoric binding*. CSLI Publications, Stanford.

Golde, K., 1999. *Binding theory and beyond*. Doctoral dissertation, The Ohio State University, Ohio.

Heim, I., 1982. *The semantics of definite and indefinite noun phrases*. Doctoral dissertation, University of Massachusetts, Amherst.

van Hoeck, K., 1997. *Anaphora and conceptual structure*. The University of Chicago Press, London.

Kamp, H., 1981. A theory of truth and discourse representation. In: J. Groenendijk, T. Janssen, M. Stokhof (eds.), *Formal methods in the study of language*. Mathematical Centre, Amsterdam, 277–322.

Kamp, H., Reyle, U., 1993. *From discourse to logic*. Kluwer, Dordrecht.

Karttunen, L., 1976. Discourse referents. In: J. McCawley (ed.), *Syntax and semantics 7: Notes from the linguistic underground*. Academic Press, New York, 363–385.

König, E., 1991. Concessive relations as the dual of causal relations. In: D. Zäfferrer (ed.), *Semantic universals and universal semantics*. Foris, Berlin, 190–209.

Lappin, S., Leass, H., 1994. A syntactically based algorithm for pronominal anaphora resolution. *Computational Linguistics* **20**, 535–561.

Larson, R., Segal, G., 1995. *Knowledge of meaning*. The MIT Press, London.

Levinson, S., 1991. Pragmatic reduction of the binding conditions revisited. *Journal of Linguistics* **27**, 107–161.

Löbner, S., 1987. Quantification as a major module of natural language semantics. In: J. Groenendijk, D. de Jongh, M. Stokhof (eds.), *Studies in DRT and the theory of generalized quantifiers*. Foris, Berlin.

Löbner, S., 1989. German schon-erst-noch: An integrated analysis. *Linguistics and Philosophy* **12**, 167–212.

Löbner, S., 1999. Why German *schon* and *noch* are still duals: A reply to van der Auwera. *Linguistics and Philosophy* **22**, 45–107.

ter Meulen, A., 1988. The semantic properties of English aspectual verbs. In: NELS 21. Amherst: University of Massachusetts, Amherst.

Mitkov, R., 1997. Factors in anaphora resolution: They are not the only things that matter. In: Proceedings of the ACL/EACL97 workshop on operational factors in practical, robust anaphora resolution. Association for Computational Linguistics.

Neale, S., 1993. Term limits. *Philosophical Perspectives* **7**, 89–123.

Piñango, M., 2001. *Cortical reflections of two pronominal relations*. Ms., Yale University, New Haven.

Pollard, C., Sag, I., 1987. *Information-based syntax and semantics*. CSLI Publications, Stanford.

Pollard, C., Sag, I., 1994. *Head-driven phrase structure grammar*. CSLI Publications, Stanford.

Reuland, E., 2001. Primitives of binding. *Linguistic Inquiry* **32**, 439–492.

Rich, E., Luperfoy, S., 1988. An architecture for anaphora resolution. In: Proceedings of the 2nd conference on applied natural language processing. 18–24.

Seuren, P., 1985. *Discourse semantics*. Blackwell, Oxford.

Smessaert, H., 1997. Aspectual duality regained. In: P. Dekker, et al. (eds.), *Proceedings of the 11th Amsterdam colloquium*. ILLC, Amsterdam, 271–276.

Xue, P., Pollard, C., Sag, I., 1994. A new perspective on Chinese *ziji*. In: Proceedings of the 13th West Coast conference on formal linguistics. CSLI Publications, Stanford.