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A Relational Account of the Spanish Noun Phrase

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I aim to show that the Spanish Noun Phrase is a network of relationships. More specifically, I aim to show that the structure and the function of the Spanish Noun Phrase can be described and explained by Lamb's relational networks. In fact, relational networks notation allow us not only to describe the Spanish Noun Phrase, but also to elucidate some features that are not elucidated by a description in words or in linear notation: they allow us to understand that the choice of a concrete grammatical structure is determined by the choice of the meanings that will be communicated. The Spanish Noun Phrase is a complex syntactic structure whose account in relational terms helps us to understand how the necessity of expressing certain meanings determines lexicogrammatical choices. Within the linguistic network, the nections at the lexicogrammatical level are connected to certain nections at the sememic level, and the activation of such sememic nections is what determines the activation of certain lexicogrammatical nections. Since relational networks show that grammatical structures are determined by meaning, the account developed in this paper reinforces the idea that Relational Network Theory is compatible with Systemic Functional Linguistics.

Keywords: Relational Networks; Grammar; Meanings; Spanish; Noun Phrase; Systemic Functional Linguistics

1. Introduction

> All linguistic structure is nothing but a network of relationships. (Sydney Lamb 2004: 426)

This article will be divided into four sections:

1. It will be maintained that Relational Network Theory (Lamb 1966a, 1974, 1999, 2001, 2002, 2004, 2004b, 2004c, 2005, 2006, 2013) is a prototypical representative of a prestigious and fruitful tradition that could be called 'Relational Linguistics'. According to this tradition, which includes the influential works of Saussure, Hjelmslev and Halliday, the linguistic system *is* a network of relationships.
2. It will be suggested that there is a good deal of linguistic (and even neurological) evidence which confirms the general hypothesis that language is a network of relationships.
3. The third section is the core of this work: it aims at developing a coherent relational explanation of the Spanish Noun Phrase. A series of relational networks, i.e. diagrams representing small parts of the linguistic system, will account not only for the syntagmatic relationships within the Spanish Noun Phrase, but also for the interaction between meaning and some potentially alternative syntactic structures. This last account involves paradigmatic relationships.
4. The term 'semantics' can be interpreted as the relationship between meanings and linguistic forms and, like most terms in common everyday use, it may be vague and therefore not very suitable as a technical term. Therefore I will use the earlier and still valuable term 'sememic' for a level (or stratum) of content form (Lamb 1966a). In these terms, 'semantics' can make reference to the relationship between sememic information and lexicogrammatical information, or to the (complex) relationship between the 'inner' sememic system and the outside world (see Lamb 1999: 145).
5. Some relevant conclusions will be presented. All the information corresponding to the figures of Section 3 (Figures 6–17) will be integrated in Figure 18. Finally, it will be suggested that every single relational network confirms three fundamental Hallidayan hypotheses: (i) language is a three-level system; (ii) linguistic meaning determines linguistic structure; and (iii) linguistic meaning appears simultaneously and necessarily with language use.

2. Relational Linguistics: From Saussure to Lamb (*via* Hjelmslev and Halliday)

There is an important and prestigious tradition in linguistics according to which 'language is a network of relationships' (Martin 2010). This tradition could be called 'relational linguistics' and it is represented by outstanding authors like the Swiss Ferdinand de Saussure, the Dane Louis Hjelmslev, the English (and Australian) Michael Halliday, and the American Sydney Lamb.

This tradition has sometimes been overlooked because of the powerful influence of Generative Linguistics, whose main hypotheses are incompatible with the relational approach. Many authors have pointed out this incompatibility. For instance, Lakoff (1991: 53–54) complains about the anti-empirical position of Chomskyan Linguistics, whose *a priori* 'Commitment' is to describe language (exclusively) in terms of the

mathematics of symbol manipulation systems: 'Meaning, communicative function, and general cognition *cannot by definition* enter into rules of formal grammars' (Lakoff 1991: 54). Fowler (1996: 5) notices that from the perspective of Generative Linguistics certain approaches are not considered linguistic approaches at all simply because they do not focus on 'autonomous' aspects of language. Lamb (2005: 156) observes that there are linguistic accounts which assume that symbols (for example, syntactic objects of any kind) are material constituents of the linguistic system—for instance Steven Pinker, who assumes that 'the representations that one posits in the mind have to be arrangements of symbols' (1994: 78). However, such accounts are incompatible with the relational conception, which assumes that in the linguistic system there is no space for symbols to be moved from one place to another.

It could be said that the modern science of language was mainly relational in its origins. In fact, one of the most important concepts developed by Saussure (1916) is the concept of value: every constituent of the linguistic system is determined by its environment. For example, it is not possible to fix the value of the word *sun* (which can be interpreted as signifying SUN) without first considering its surroundings. Saussure points out that in some languages it is impossible to say *sit in the sun*. Following Lamb (1999), *italic letters* will be used to represent lexicogrammatical information, whereas CAPITAL LETTERS will be used for sememic information.

In the case of grammatical relations, for example, the value of the English Noun plural does not match with the value of Sanskrit plural, even though their signification can be identical. Sanskrit has three numbers: reference to *my eyes*, *my arms*, *my legs*, is dual, not simply plural. Thus it is not right to attribute the same value to the plural in Sanskrit and in English because its value depends on the rest of the elements of the system. The notion of value helps us also to understand the relationships between 'words' and meanings. 'If words stood for pre-existing concepts, they would all have exact equivalents in meaning from one language to the next; but this is not true' (Saussure 1916: 116). For example, French uses *louer* (*une maison*) [*let* (*a house*)] to mean both PAY FOR and RECEIVE PAYMENT FOR, whereas German uses two words respectively: *mieten* and *vermieten*. It is clear that there is no exact correspondence of values.

In conclusion, there are no pre-existing ideas strictly assigned to words. On the contrary, values emanate from the system. Saussure does not use the word *relational*, but he does use the word *relations* many times. However, this is a mere terminological problem, and it is the case that his approach can be regarded as relational. Saussure states for example that concepts are purely differential and they are defined not by their positive content, but negatively, 'by their *relations* with the other terms of the system' (Saussure 1916: 117; italics are mine). In other words, every element of the linguistic system is just what the others are not.

In this sense, linguistic concepts are values determined by their relations with other values. In addition, those value relations are the ones which create signification, i.e. the connection between the 'signified' (concept) and the 'signifier' (sound-image). The linguistic fact in its essence and fullness is not just signification, (that is, the fact that the speaker has in mind the associating of a sound-image with a concept). The relations

determined by value are much more complex and constitutive within the linguistic system than isolated significations.

The relational conception maintained by Saussure also has consequences at the phonological level. The important thing in the word is not the sound alone but the phonic differences that make it possible to distinguish this word from all others, because 'differences carry signification' (Saussure 1916: 118). One vocal image is no better suited than the next one for what it is commissioned to express; consequently, a segment of speech can never in the final analysis be based on anything except its non-coincidence with the rest.

According to Saussure, relations are defined in terms of differences. Generally, differences imply positive terms between the differences that are established. However, in language, there are only differences without positive terms.

> Whether we take the signified or the signifier, language has neither ideas nor sounds that existed before the linguistic system, but only conceptual and phonic differences that have issued from the system. (Saussure 1916: 120)

Linguistics then works in the borderland where the sound and thought combine, and the combination of the two does not produce a substance, but rather a form. Saussure considers that the fact that language is form should be always emphasized because all the mistakes in our terminology and our conception stem from the assumption that the linguistic phenomena must have substance.

One of the most important followers of Saussure's work, Louis Hjelmslev, realized that there was an incompatibility between the claim that a language consists purely of relationships and the proposal that languages were to be described as systems of objects belonging to different levels (sentences, lexemes, morphemes, phonemes, phoneme features). Thus Hjelmslev suggests that language manifests two distinctions: (i) form vs. substance; and (ii) content vs. expression. The opposition content–expression refers to the one between meaning and sound.

These two distinctions intersect one another to produce four strata: content-substance, content-form, expression-form and expression-substance. The two forms (content-form, expression-form) belong to language proper, whereas the two substances (content-substance, expression-substance) are the external realities that are connected by language. On the one hand, there are 'external' relationships between elements in different strata; on the other hand, there are 'internal' relationships between the elements in one stratum. According to Hjelmslev, language consists purely of relationships.

> A totality does not consist of things but of relationships … The postulation of objects as something different from the terms of relationships is a superfluous axiom and consequently a metaphysical hypothesis from which linguistic science will have to be freed. (1943: 23)

The relational tradition from the continent exerted its influence on Great Britain. Systemic Functional Linguistics initiated by Michael Halliday is largely based on

Firth's system-structure theory, but it owes many ideas dealing with language functions to the Prague School, and also derives more abstract principles from Hjelmslev. Halliday formalizes paradigmatic relations in system networks, thereby foregrounding a theory of language as choice. A system network represents any part of the linguistic system as a resource for producing meaning by means of specific choices. Choice as a fundamental aspect of language structure and language use has not only been widely considered in the Hallidayan tradition but it is also one of the most important issues in play in current functional linguistics research (Fontaine *et al.* 2013).

The general hypothesis that language is a network of relationships is widely accepted within the theoretical framework of Systemic Functional Linguistics. For example, the 2013 anthology *Systemic Functional Linguistics: Exploring Choice* covers the fundamental notion of choice from different angles aiming at providing answers for the following five questions: (i) what is choice; (ii) how does choice contribute to linking language and cognition; (iii) how is choice constrained by language use; (iv) how does choice contribute to linking language and social context; and (v) how can we study choice in text? Thus, the notion of choice is considered from various perspectives, but in all these perspectives it is assumed that choice as an act is still a valid conception. In Halliday's words, 'choice is part of the overall account of the process of traversing a system network making selections along the way' (2010: 69).

In conclusion, system networks make manifest the conception according to which the linguistic system is a network of relationships. Systemic Functional Linguistics is essentially relational: a systemic grammar makes no difference between description and relationships, because 'describing something consists in relating it to everything else' (Halliday 1985: xxvii).

Geoffrey Sampson has considered that 'much more interesting than Hjelmslev's own work is the development it received at the hands of the American Sydney Lamb' (1980: 168). In fact, it could be said that Lamb aims at showing *how* and *why* the linguistic system is a network of relationships. If the relationships of linguistic units are fully analyzed, these 'units' turn out not to be objects at all, but just points of interconnection of relationships. We may conclude that the linguistic system (unlike its external manifestations) is *not in itself* a symbol system after all, but a network of relationships—a purely connectional system, in which all of the information is in its connectivity.

Since the information is in the connectivity, there is no such thing as a separate memory module, a place where things would be placed and from which they would later be retrieved. Rather, memory is the connections themselves and is therefore widely distributed. According to Lamb (1999: 53–65, 2005: 159–160), the linguistic system can be graphed with lines and nodes and nothing else, forming a network of relationships. Labels will be necessary for readability, but they are not part of the structure. In fact, the linguistic information resides entirely in the connectivity of the network. For the processing of information we would seem to have two kinds of operation available: the movement of activation through the network and changes in the lines and nodes, including the recruitment of new lines and nodes. Lines and

various node types can be interpreted as the elementary components of the network. Any point at which lines meet is a node, and we can stipulate as a rule of relational network modelling that at each such point the type of node must be identified.

In Lamb's relational networks there is a clear distinction between lexicogrammatical and sememic information, in relation to the connections between the nodes. The connectivity serves to illustrate that the linguistic system is, as Saussure and Halliday have explained, a three-level system in which meaning (concept/signified) is coded into wording (form), and then wording is coded into expression (signifier/sound-image).

In the next section I present relational networks which show how meanings and phonological information are connected by means of forms (lexicogrammatical information), and I will also try to justify the networks in terms of empirical evidence.

## 3. Relational Networks and Linguistic Evidence

It is not an exaggeration to suggest that the relational conception of language is supported by copious linguistic evidence (Lamb 1999: 186–203, 2005: 159–164). A first acceptable analysis of such linguistic evidence demonstrates that there are many relationships of different types among 'units', for example meanings, lexemes and phonemes; and once these relationships are deeply and fully represented, the 'units' disappear. For example, a lexeme that could be given symbolic representation, like *boy*, is connected on one side to phonological information and on to the other to sememic information. Figure 1 represents such relationships as connections in the network.

Relational networks exhibit patterns of organization of lines and nodes with hierarchical structure, and recurring modular structures can be identified. A basic module—which has a central line connecting to two nodes, of which one provides multiple downward connections, the other multiple connections upwards—may be called a *NECTION* (Lamb 1999: 72–73). When relationships are represented simply as connections in a network, there is no need for the symbol *boy*, which is not part of the network. In fact, the symbol *boy* is just a label that makes the network diagram easier to read, it identifies a location in the network. Alternatively, one can say that the label applies to the whole network fragment connecting above and below that central line. And this is one illustration of why relational networks actually convey a lot of precision that is lacking in ordinary description. When descriptive linguistics is not using networks, it is not possible even to make the distinction between the central line at the middle of the nection, the nection itself, and the additional connections extending above and below the nection. When we use a term 'boy' in ordinary parlance it refers (somewhat vaguely) to the whole sub-network, extending from phonological expression to meaning.

The five different kinds of nodes in Figure 1 represent syntagmatic and paradigmatic relationships: AND vs. OR relationships, respectively. These nodes correspond to 'compact' or 'abstract' notation in relational networks, and they are specified below under 'Nodes in relational networks'. They differ from one another not only in AND vs. OR relationships, but also in two other dimensions of contrast: UPWARD vs.

DOWNWARD orientation, and ORDERED vs. UNORDERED activation. Triangles represent AND relationships, whereas brackets are used to represent OR relationships. It should be of course acknowledged that the foundations of stratificational linguistics cannot only be found in the works published by Lamb during the second half of the 1960s (Lamb 1966a, 1966b, 1966c, 1966d, 1970), but also in the works of David Lockwood and Peter Reich (Lockwood 1969, 1972, 1973, 1978, 1981, 1986; Reich 1969, 1970a, 1970b, 1970c). Some seminal papers appeared in the anthology *Readings in Stratificational Linguistics*, published by Makkai and Lockwood (1973).

Nodes in relational networks are given below (examples taken from Figure 1):
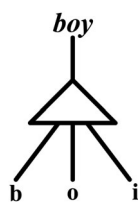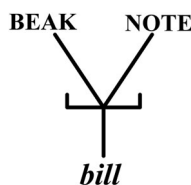
Downward ordered 'AND'

Downward activation from *boy* goes to b, and later to o, and later to i. Upward activation from b, and later from o, and later from i goes to *boy*.
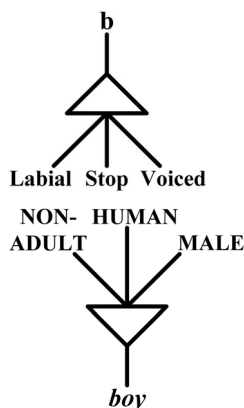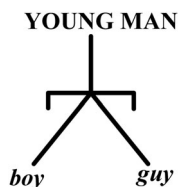
Downward unordered 'AND'

Downward activation from b, goes simultaneously (i.e. being unordered) to Labial, Stop **and** Voiced. Upward activation from Labial, Stop **and** Voiced goes simultaneously to b.

Upward unordered 'AND'

Upward activation from boy goes (simultaneously) to YOUNG, HUMAN *and* MALE. Downward activation from YOUNG, HUMAN *AND* male goes (simultaneously) to *boy*. The nection for *boy* does not have any meaning 'inside'. Lexemic nections are connected to certain sememic nectiones. Consequently, 'words' are used to evoke, communicate or understand certain meanings. They do not 'have' any meaning. This is in fact a very important essential property of relational networks (and of course not just of the nodes for 'boy', but any and all nodes). They have no content at all. They just receive and transmit activation.

Upward unordered 'OR'

Upward activation from *boy* goes to MALE/ADOLESCENT *and* [sic] MALE/CHILD. Downward activation from MALE/ADOLESCENT *or* [sic] MALE/KID goes to *boy*. This example helps us to represent the relationship of **polysemy,** which involves ambiguity (often resolved by context): there is one lexemic nection connected upwards to two (or more) sememic nections.

Downward unordered 'OR'

Downward activation from YOUNG MAN goes to *boy* and [sic] *guy*. Upward activation from *boy* or [sic] *guy* goes to YOUNG MAN. This example allows us to represent the relationship of **synonymy**, which involves one sememic nection connected downwards to two (or more) lexemic nections.
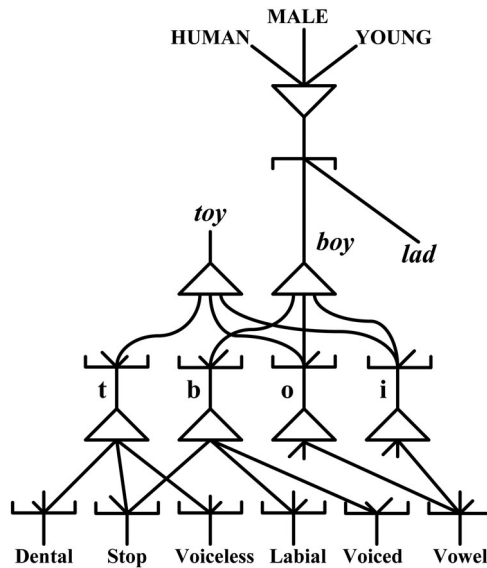
Figure 1 The relational network for the lexeme *boy* in the network of relationships

There is a sixth type of node in abstract notation: Downward Ordered 'OR', but this is not represented above because there are no such nodes in Figure 1. It will be introduced in Section 4 below.

Relational networks provide realistic means of explaining speaking and understanding in terms of the activation across the network pathways. Regarding the hearer, activation goes from expression to meanings. For the speaker, activation starts with meanings and then follows pathways to expression—although the actual process is much more complex. In recognition, activation first travels along connections from the cochlea to the brain stem (including the thalamus, which functions largely as a mechanism to control the timing of receipt of information in the cortex), and from the brain stem to the primary auditory cortex. It continues to the nections for the auditory features, and these nections will pass activation on up to nections corresponding to phonemes and syllables. Lamb remarks that since there are no symbols, no buffer is needed here, nor any workspace to hold such non-existent symbols (2005: 160). Each nection is its own processor: when it receives enough activation it passes activation on to higher-level nections to which it is connected. In summary, network connectivity is displayed both upwards (from expression to meaning) and downwards (from meaning to expression).

As represented in Figure 1, the relationship between 'words' and 'meanings' is a reciprocal connection, from the representation of the form to that of the meaning, and from that of the meaning to that of the form. Thanks to this relational conception of meaning, we may account not only for polysemy and synonymy (see Table 1), but also for ambiguity. For example, the intentional ambiguity of *earnest* in Oscar Wilde's

Table 1 Sememic information broadly represented by grammatical categories

Grammatical category	Corresponding meaning
Noun	CATEGORIES OF OBJECTS AND ENTITIES
Noun Phrase	OBJECTS AND ENTITIES
Determiner	SPECIFICATION OF REFERENCE
Adjective	CATEGORIES OF ATTRIBUTES
Adjective Phrase	ATTRIBUTES
Preposition	GENERAL LOCATORS
Prepositional Phrase	TIME, PLACE, CHARACTERISTICS
Clause	PROCESSES WITH PARTICIPANTS AND CIRCUMSTANCES
Adverb	CIRCUMSTANCES AND CHARACTERISTICS

famous comedy *The Importance of Being Earnest* can be clearly represented by two connections from the phonological word /ɜːnɪst/, one to the sememic nection corresponding to SERIOUS and the other one to the sememic nection corresponding to ERNEST-NAME (via the lexical nections for *earnest* and *Ernest*). Figure 2 represents how the recognition of this case of intentional ambiguity involves simultaneous activation of a double pathway.

In other contexts, disambiguation operates by means of activation from connected meanings representing linguistic and extralinguistic information. For example, the utterance *The duck caught a fish in its bill* will hardly be considered ambiguous, although the nection for *bill* is connected to BEAK and BANK NOTE. Figure 3 represents disambiguation by conceptual activation. Currently active connections are represented by heavier lines. In the given context, the concept BEAK receives more activation from other meanings than the concept BANK NOTE.

Ambiguity involves multiple pathways that represent alternative choices. There are many other examples which involve multiple pathways that are not alternative. In the case of complex lexemes, we have simultaneous parallel activations (Lamb 1999: 184–197, 2005: 162; Müller 2000). For instance, the Chinese compound *hong* 'fragrant' plus *kong* 'harbour' is the name for the territory of Hong Kong. Figure 4 shows that for Chinese speakers it is both (simultaneously and in parallel) a primary meaning, the name of a territory, and a 'shadow meaning' (Chafe 2000): 'fragrant harbour'.
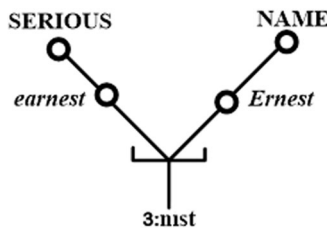

Figure 2 Intentional ambiguity. Simultaneous parallel activation of alternative interpretations
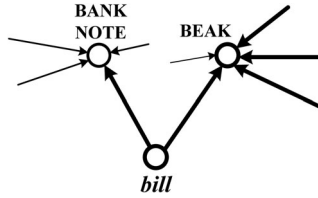
Figure 3 Disambiguation by means of meaning activation

Relational networks account for the fact that two meanings are activated simultaneously. Since *Hong Kong* has been learnt as a whole by Chinese speakers, it is likely that the primary meaning will be more strongly activated, whereas the shadow meanings will be activated more weakly. In Figure 4, thicker lines have been used for the connections and nodes involved in the activation of stronger primary meanings.

Similar to complex lexemes with shadow meanings are coexistent accounts of the same meaning but different shadow meanings. For instance, Lamb (1999: 233–236) demonstrates that *hamburger* as *ham-burger* (like fish-burger) and also as the diachronically earlier *hamburg-er* are both potential readings and operate in parallel in the networks.

The cases involving multiple possibilities of interpretation can be compared to the occurrences in everyday conversation of multiple possibilities for expressing different kinds of meanings. Lamb (1999: 190–194), Reich (1985), Dell (1979), and Dell and Reich (1977, 1980a, 1980b) have explored how meanings (and even phonological information) determine lexeme selection. For example, after hearing that the sixthgrade teacher was going to be absent for a three-month period, one of the fathers attending a meeting in a Spanish-speaking school said: *Necesitamos una maestra prostituta* [We need a prostitute teacher].

The speaker said *prostituta* [prostitute] instead of *sustituta* [substitute] because he was probably conditioned not only by the rhyme but also by other semiological
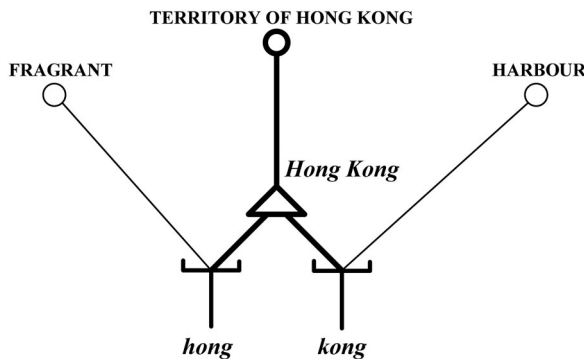

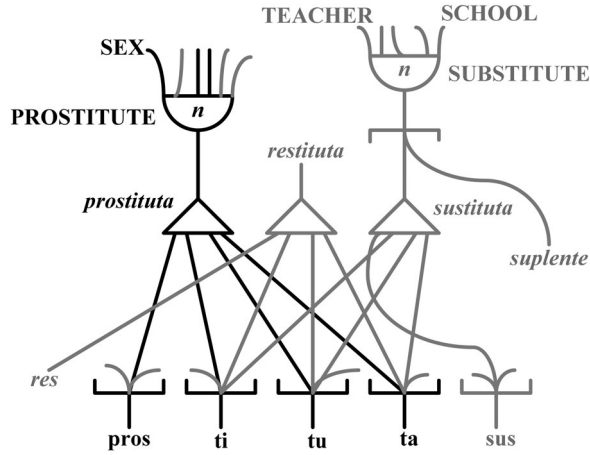**Figure 4** Simultaneous and parallel activation of meanings in a complex lexeme

Figure 5 Non-intended, but transmitted, linguistic information, in black. Intentional but not communicated information, in grey

associations. This 'Freudian slip' was produced spontaneously: the evidence for that is that the speaker was surprised both when his hearers laughed and when the slip was pointed out. The account of 'unintended' meanings also provides empirical support for the network model. Figure 5 represents by means of black lines how the nection corresponding to *prostituta* was more strongly activated than the one corresponding to *sustituta,* because the former received more activation than the latter from the sememic level. The nections and connections that received less activation are represented with grey lines.

The nections corresponding to *prostituta* and *sustituta* (as well as *restituta* and many others) are connected downwards to the phonological nections for the syllables /ti/, /tu/ and /ta/, which follow phonological nections /pros/ in *prostituta* and /sus/ in *sustituta.* The example can be clearly explained in terms of neurocognitive relational
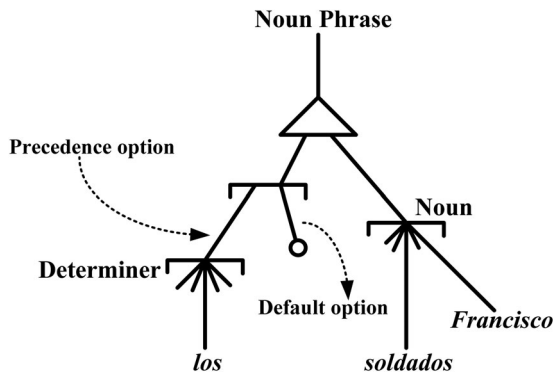

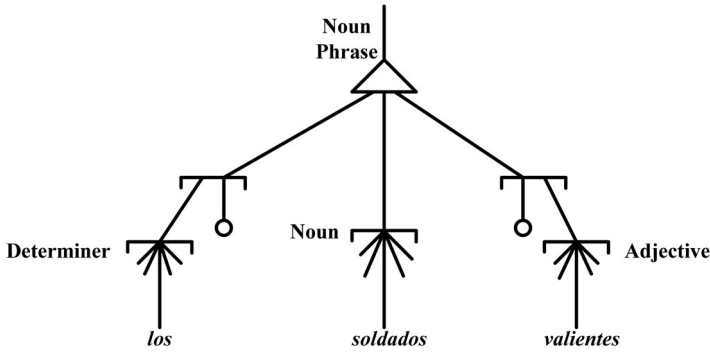**Figure 6** The Spanish Noun Phrase, *Determiner & Noun*

Figure 7 The Spanish Noun Phrase, *Determiner & Noun & Adjective*

networks, since excitatory connections not only can have varying strengths but are also bidirectional—they both feed-forward and feed-backward (Lamb 2005: 170).

In this case, the activation coming from sememic nections for SEX and PROSTI-TUTE was stronger than the one coming from SCHOOL, TEACHER and SUBSTI-TUTE, just because (at that moment) these representations were being more strongly activated in the sememic system of the speaker. In other words, certain meanings in the neurocognitive system of the speaker were stronger than the meanings expected in the conversation. This fact helps us to explain the selection of the lexeme *prostituta* instead of *sustituta*.

In Figure 5, semicircles represent **threshold nodes** at the level of sememics, i.e. nodes of an intermediate type between OR and AND nodes. The sememic threshold node can be activated by some but not necessarily all of its input lines in accordance with a threshold of activation. Lamb (1999: 152–156) explains that this threshold node is logically more basic than the 'and' and the 'or' in that they can be derived from it, as special cases. The 'and' is a special case of the threshold node for which the threshold is equal to
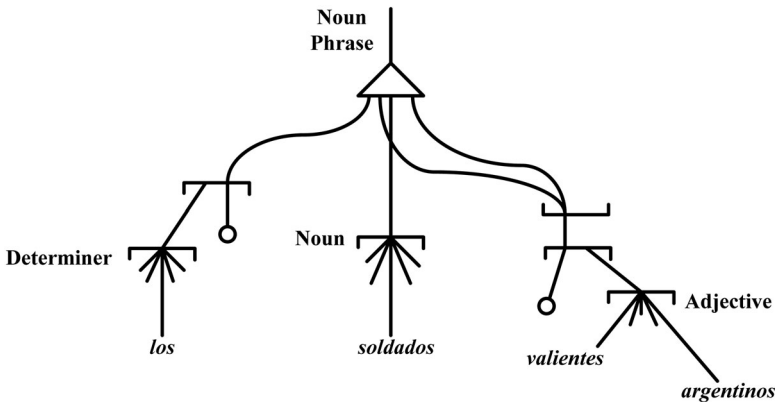

Figure 8 The Spanish Noun Phrase, *Determiner & Adjective & Noun & Adjective*
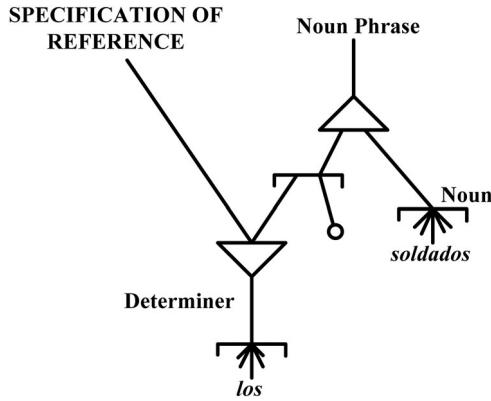
Figure 9 Sememic information determining the precedence of Determiners

the number of lines on the plural side, and the 'or' is a threshold node with a threshold of 1. The threshold node can be drawn with a number *n* inside indicating the threshold, i. e. the number of incoming lines that have to be activated in order to activate such a threshold. In fact, it may be unnecessary (or even impossible) to specify the exact number. Consider for example a relatively simple conceptual nection like the one for CAT. It must be connected to many other sememic nections, corresponding to nections for concepts (like ANIMAL or PET) as well as to nections corresponding to visual, auditory and somato-sensorial information. It is not likely, at least by now, that it can be found exactly which and how many sememic nections have been activated.
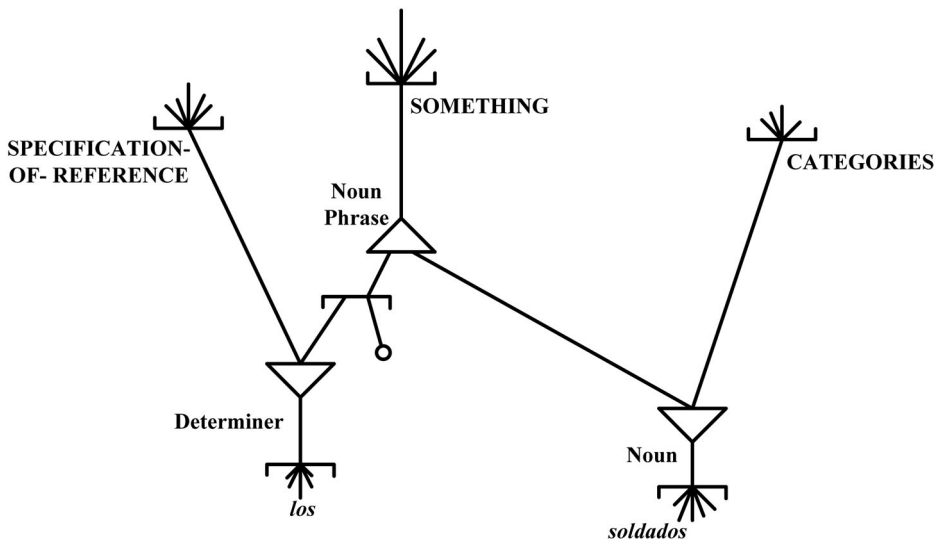
Figure 10 Sememic information represented by Determiners, Noun Phrases and Nouns
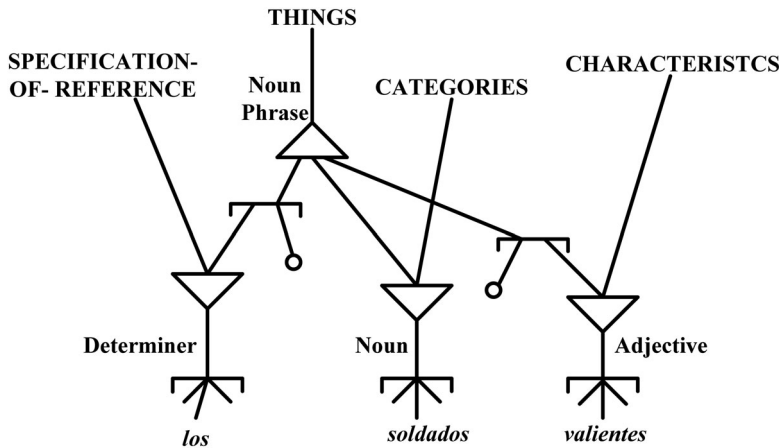
Figure 11 Sememic information represented by Determiners, NPs, Nouns and Adjectives

Lamb has suggested that Relational Network Theory is a realistic linguistic theory because it allows us to understand natural language processing by human beings. In the context of his neurocognitive research, Lamb (1999, 2006) proposes a definite meaning for the term 'realistic'. A 'realistic' theory of language should go beyond the analysis of the products of verbal behaviour (i.e. texts), and should account for the linguistic system in plausible neurolinguistic terms. With a view to doing that, a realistic linguistic theory will have to satisfy the following three requirements (Lamb, 1999: 293–294):

Operational plausibility: a realistic linguistic theory has to provide a plausible account of how the linguistic system can be put into operation in real time to produce and understand speech.

Developmental plausibility: a realistic linguistic theory needs to be amenable to a plausible account of how the linguistic system can be learned by children.

Neurological plausibility: a realistic linguistic theory has to be compatible with what is known about the brain from neurosciences.

Lamb has developed his ideas in connection with research in perceptual neuroscience, mainly the research carried out by Vernon Mountcastle and many other colleagues (Hubel & Wiesel 1962, 1968, 1977; Mountcastle 1957, 1997, 1998, 2005; Mountcastle *et al.* 1975; Martin 2015). This eminent neuroscientist, who characterized the columnar organization of the cerebral cortex, explains that the basic unit of the mature neocortex is the **cortical minicolumn**—a narrow chain of neurons that extends vertically across cellular layers II–VI. Each minicolumn contains about 80–100 neurons and all the major phenotypes of cortical neural cells. Mountcastle's general hypothesis is that the minicolumn is the smallest processing unit of the neocortex, and he also claims that 'every cellular study of the auditory cortex in cat and
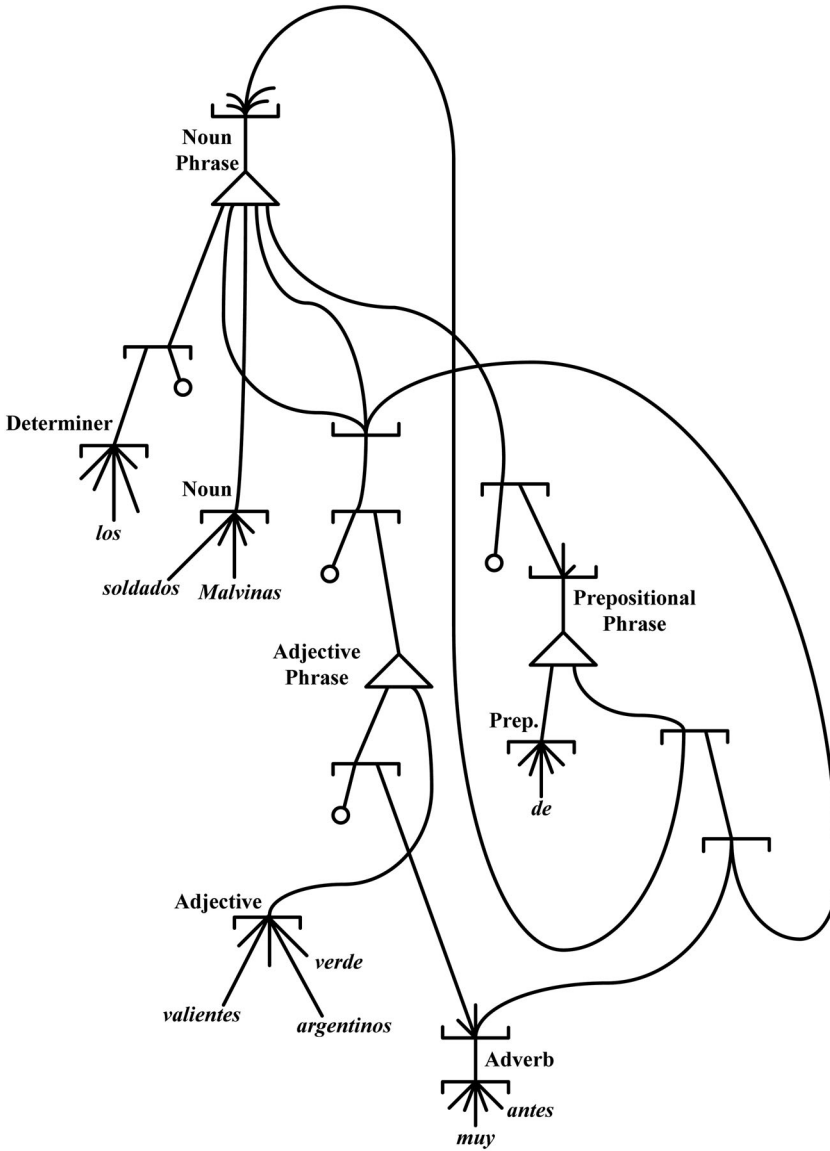
Figure 12 The Spanish Noun Phrase, Determiner & Adjective Phrase & Noun & Adjective Phrase & Prepositional Phrase

monkey has provided direct evidence for its columnar organization' (1998: 181). For example, a nerve-regeneration experiment in the monkey provides evidence for columnar organization of the somatic sensory cortex. In one experiment a recording microelectrode was passed nearly parallel to the pial surface of the cortex of the post-central somatic sensory cortex, through a region of neurons with the same modality properties. Neurons in adjacent minicolumns are related to adjoining and overlapping
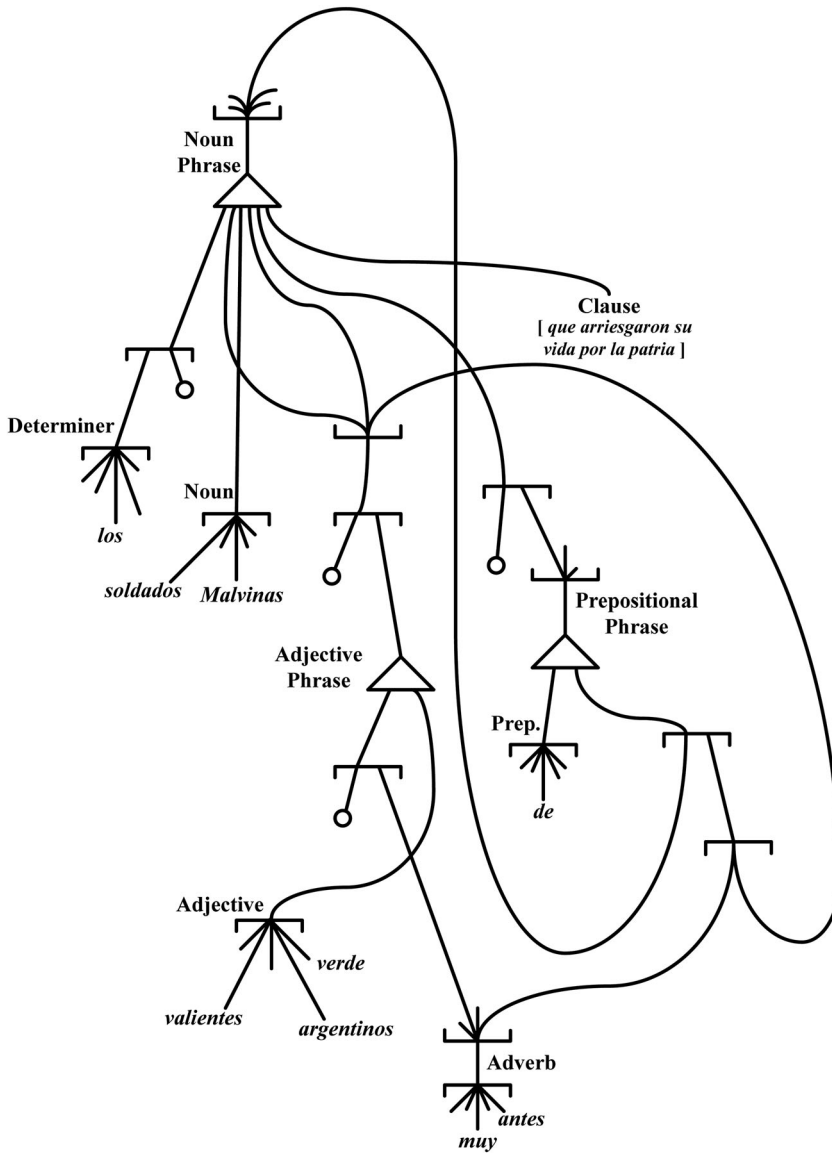
Figure 13 The Spanish NP, Determiner & Adjective Phrase & Noun & Adjective Phrase & Prepositional Phrase & **subordinate clause**

peripheral receptive fields, and the transitions between minicolumns pass unnoticed. Results obtained in the same animal in a similar experiment after section and resuture of the contralateral medial nerve showed a misdirection of the regenerating bundle of nerve fibres, innervating then the glabrous skin of the hand. Sudden displacements of receptive fields, which occur at intervals of 50–60 μm, reveal the minicolumns and their transverse size (Kaas *et al.* 1981, cited by Mountcastle 1997: 708, 1998: 173).

Figure 14 Sememic and lexicogrammatical information in the Spanish Noun Phrase

Figure 15 Number in Spanish
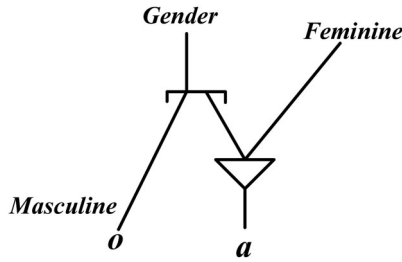
Figure 16 Gender in Spanish
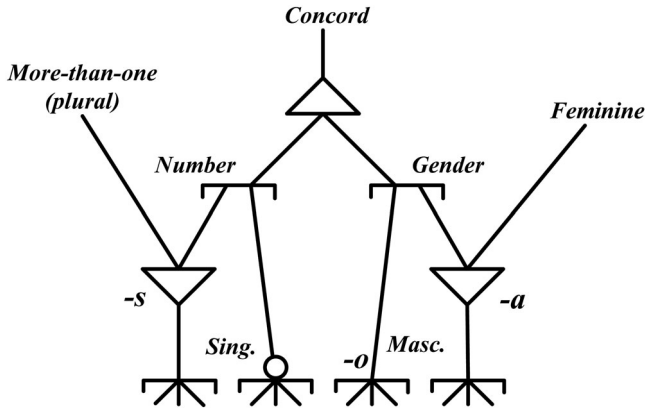
Figure 17 Concord in Spanish
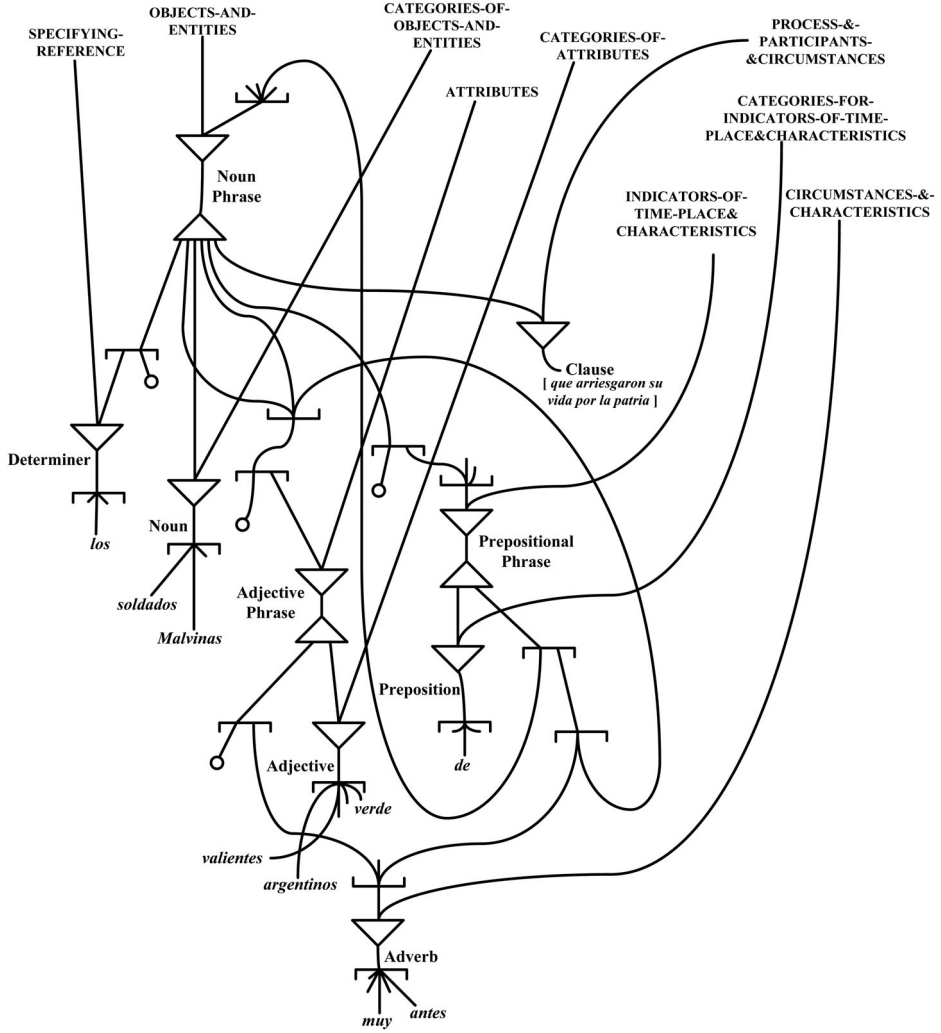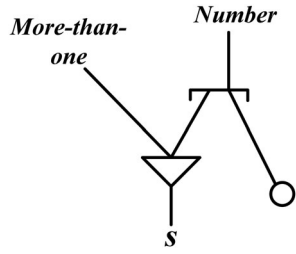
Since speech perception is a higher-level perception process, Lamb believes that it is permissible to suggest the following extrapolation: each nection in the neuro-cognitive system of an individual can be implemented as a cortical column. Within the linguistic system, every nection/cortical column has a highly specific function, just as in the perceptual systems studied by Mountcastle and others. For example, there may be a nection/cortical column corresponding to a single lexeme like *cat*. Consequently, on the basis of both neurological and linguistic research, Lamb has presented the following hypotheses, which altogether could be organized as a consistent argument for the **neurological plausibility of relational networks**:

1. Sets of neural fibres together with their synapses integrate real connections in the brain.
2. Linguistic nections and connections represented in relational networks are implemented as sets of neural fibres together with their synapses.
3. Therefore, relational networks represent real connections in the brain.
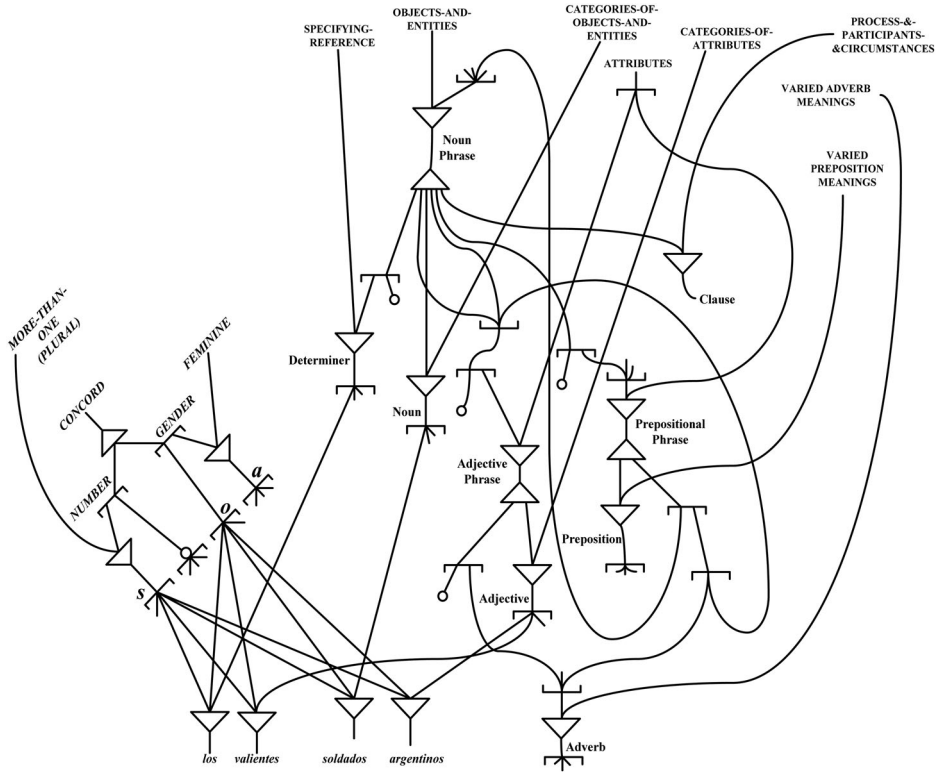
Figure 18 The Spanish Noun Phrase as a network of relationships

Of course, this argument is very general. Strictly speaking, it is not the nections of 'compact notation' (Lamb 1999: 78) that have been described, but the nections of 'narrow notation' (Lamb 1999: 81) that are implemented as cortical minicolumns. And it is often bundles of minicolumns. Also, narrow notation comes in degrees of narrowness, and we have to go to very narrow levels to approximate what is there in the columnar structures. Regarding neural fibres, the situation is far more complex because it is not only necessary to talk about this relationship in terms of narrow notation, but also to consider that for a connection of narrow notation we have, in general, many neural fibres. The main factor is that a column is connected to other columns by means of many fibres, not just one. Nevertheless, compact relational networks help to satisfy the requirement of neurological plausibility.

But even independently from the relevance and the importance of neurological plausibility of relational hypotheses, it can be concluded that a good amount and variety of linguistic evidence supports the hypothesis according to which the linguistic system is a network of relationships. In the next section, I will show that relational networks can account for another one of the innumerable phenomena of language, the structure of the Spanish Noun Phrase.

4. A Relational Account of the Spanish Noun Phrase

This section can be considered the core of this essay because it aims at developing a consistent relational explanation of the Spanish Noun Phrase. A series of relational networks, i.e. diagrams representing small parts of the linguistic system, will account not only for the syntagmatic relationships within the Spanish Noun Phrase, but also for the interaction between sememic information and some potential alternative syntactic structures. In other words, relational networks will account not only for syntagmatic but also for paradigmatic relationships.

Every syntactic construction can be represented by means of the downward ordered 'and' node: Downward activation goes first to the first node in the sequence, and then it goes later to another or other node/s—whereas upward activation comes from the first and, later, from the subsequent node/s. Figure 6 represents the fact that if chosen the Determiner comes first before the Noun.

Between the Noun Phrase and the Determiner nodes we have a representation of another type of ordering: the **downward ordered 'or'.** This type of disjunction involves **precedence ordering**; the line shown off to the left side of the 'or' node in Figure 6 takes precedence over the other line: if it can be taken, it is. The other line is the **default line** (so signalled with the small circle at its end point). By means of the downward ordered 'or' node it is shown that during linguistic production downward activation goes to the nection for Determiner if some other information has also been activated, namely the specification of the type of reference: This is the marked option. On the other hand, if there is no other information that has been activated, then downward activation goes to the node corresponding to 'nothing', which is represented with a small circle: this would be the case if the speaker opted for a 'proper noun', like *Francisco*.

Downward unordered 'or' nodes simply represent the fact that there are many context sensitive alternative options. For example, the nections corresponding to Determiner and Noun connect downwards to, respectively, *los* [the, masculine-plural] and *soldados* [soldiers], and of course many other nections corresponding to Determiners and Nouns.

Figure 7 incorporates the Adjective, which, along with the Determiner, is optional. Its optional nature is represented again by means of the downward ordered 'or' node, with nothing as the default option. Figure 8 accounts for the fact that the Spanish Adjectives can be placed before or after the Noun, for example in the phrase *los valientes soldados argentinos* [*the brave Argentinean soldiers*]. The word 'optional' simply means that the precedence line can be not chosen. On the other hand, if chosen, it is conditioned by the meanings the speaker or writer needs to communicate.

Relational networks are very useful for describing and explaining how linguistic meanings determine linguistic structure. Regarding the downward ordered 'or', sememic information determines precedence: in this case, if it is necessary to specify some kind of reference, then the line corresponding to Determiners will be activated (in systemic-functional terms we could say that this option will be

chosen). Figure 9 represents such information by means of the **upward unordered 'and' node**: downward activation from SPECIFICATION OF REFERENCE **and** Noun Phrase goes simultaneously to the nection for Determiner. The Downward unordered 'or' node for Determiner simply indicates that there are many other options available, whose activation depends on the type of reference that is being expressed—for example, definite reference by means of definite articles, like *el*, *la*, *lo*, etc. [*the*], or indefinite reference by means of indefinite articles, like *un*, *una*, etc. [*a*].

It should be noted that SPECIFICATION OF REFERENCE is just a description of a sememic representation. In fact, specifying what it is at any semantic instance is an extremely difficult undertaking; a whole book could be written on this topic, and still not tell the whole story. Thus I have to declare outright that what I am presenting here is just a sketchy beginning at a depiction of the structure that is actually present in the mind of a speaker. What is actually *there* is in fact so complex that it is impossible to describe completely: no framework of description can ever come close to accounting for all the structure that is actually there. But the same holds true for everything, not just for linguistic structure. We could never get a complete description, for example, of even a single tree, let alone a forest. To describe a single tree it would be necessary to include a description of every leaf, and of all the processes going on in every leaf, including what is going on in every cell of every leaf, and so on. In Lamb's words, 'no one could ever draw a network that would provide a complete account, even after a lifetime of work' (1999: 156).

Figure 10 incorporates sememic information connected to the Noun Phrase and Nouns. The Noun Phrase as a whole makes reference to a person, place or thing. In fact, the Noun Phrase may name multiple instances of a person, place or thing. On the other hand, Nouns simply make reference to categories of persons, places or things (unless it is a proper noun). In Lamb's words, 'the rest of the noun phrase is what narrows the specification down to one or more members of the named category' (Lamb 1999: 237). Compare, for example, phrases like *Argentina's flag, the beautiful triband flag, that flag* (said while pointing).

It could be suggested that it is a very general principle of semantics that increasing the scope of reference decreases the content. So the noun *flag* by itself designates the whole category; and further expression is added in order to narrow the category. For instance, in the case of *that flag* we add not only spoken expression but also extralinguistic information in relation to deixis. Thus, the Noun Phrase as a whole may refer to one or more specific flags. 'That's why languages have machinery like number and articles and modifiers—to designate selection of one or more members of the category indicated by the noun' (Lamb 1999: 237). Lines departing from upward unordered 'or' nodes simply stipulate that this node is connected to more specific meanings. For example, REFERENCE-TO-CATEGORIES is connected to a large series of CATEGORIES, like PERSONS, THINGS, PLACES, etc.

Figure 11 adds the representation of the sememic information connected to Adjectives to the picture, which opens up the possibility of reference to the huge set of characteristics that could be assigned to Nouns.

In summary, neurocognitive relational networks help us to realize that there is some kind of sememic information which determines the activation of certain lexicogrammatical information.

Figure 12 accounts for further complexity in the structure of the Spanish Noun Phrase. It depicts the following relevant information:

1. The Adjective is part of the Adjective Phrase, which can be put before or after the Noun.
2. The Determiner, the Adjective Phrase and the Prepositional Phrase (which has not been represented yet) are optional. The three nections corresponding to them receive activation from a precedence line belonging to a downward ordered 'or' node. (They are optional from the point of view of the lexicogrammatical stratum alone; since they are determined by meanings, it can be said that they are not optional from the point of view of the overall system, including sememic level).
3. When chosen, the Prepositional Phrase has to be put after the Noun and the Adjective Phrase. It is realized by Preposition & Noun Phrase syntagm, for example *de Malvinas* [*of the Falklands*]. This phenomenon is represented by means of the downward order 'or' node whose default line goes recursively to Noun Phrase.
4. The Prepositional Phrase can also be integrated by Preposition & Adjective, for example *de verde* [*in green*], and by Preposition & Adverb, for example *de entonces* [*at that time*]. These phenomena are represented by means of the downward unordered 'or' node whose incoming line is the precedence line departing from the downward ordered 'or' mentioned before, in item (3).
5. An Adverb can also modify an Adjective within and Adjective Phrase, for example *muy valientes* [*very brave*].
6. If we travel along the pathways of Figure 12, we confirm that an individual will be able to produce or understand, for example, the following Noun Phrases:
    soldados [soldiers]
    los soldados [the soldiers]
    los soldados de Malvinas [the Falklands soldiers]
    los soldados de antes [the soldiers at that time]
    los soldados de verde [the soldiers in green]
    los valientes soldados argentinos [the brave Argentinean soldiers]
    los valientes soldados argentinos de Malvinas [the brave Argentinean soldiers of the Falklands]
    los muy valientes soldados argentinos de Malvinas [the very brave Argentinean soldiers of the Falklands]

It should also be mentioned that the structure represented in Figure 12 does not only allow an individual to produce or understand *just* the sequences that have been exemplified in item (6). The strong hypothesis that is being supported here is

that the neurocognitive relational network of Figure 12 represents a part of the linguistic system of a Spanish speaker which allows an individual to produce and understand any Noun Phrase. The downward unordered 'or' nodes corresponding to Determiner, Noun, Adjective, Preposition and Adverb, connect downwards respectively with multiple nections that are not represented here.

Figure 13 simply adds the possibility of including a subordinate clause modifying the Noun, as in the Noun Phrase *los muy valientes soldados argentinos de Malvinas que arriesgaron la vida por su patria* [the very brave Argentinean soldiers who risked their lives for their country]. Of course, the account of the structure of the Spanish clause in relational terms would be much more complex than the account of the Noun Phrase and it is beyond the scope of our discussion here.

In concordance with the explanations provided for Figures 9–11, Table 1 and Figure 14 aim at accounting for the sememic information that, in general terms, can be represented by means of a Noun Phrase in Spanish.

Figure 14 represents how a single Spanish speaker can handle lexicogrammatical and sememic information in order to produce and understand any sequence that could be classified as a Noun Phrase. By means of upward unordered 'and' nodes, the nections corresponding to lexicogrammatical information (Noun, Determiner, Adjective Phrase, etc.) are linked both to the syntactic structure they integrate and to their sememic information.

It should also be admitted here that there is crucial information missing, namely the information dealing with concord between Nouns and their modifying: Determiners and Adjectives. For example, a Spanish user could normally say or hear *los soldados argentinos* [Det: masculine, plural & Noun: masculine, plural & Adj: masculine, plural], but certainly not *la soldados argentinas* [Det: feminine, singular & Noun: masculine, plural & Adj: feminine, plural].

Figure 15 represents, by means of the downward ordered 'or' node, that the morpheme *s* which corresponds to the meaning *Plural (More-than-one)* is the precedence option for *Number*. On the other hand, the default line connects to the circle that simply represents a null option, since singular is the unmarked option for number.

Similarly, Figure 16 represents the fact that the morpheme *o* which corresponds to the meaning *Masculine* is the precedence option for *Gender*, and that the default line is connected to the nection for the morpheme *a*, which is connected to the meaning *Feminine*.

The grammatical agreement between *Gender* and *Number* determines *Concord*. Thus Figure 17 combines the information represented in Figures 15 and 16. The downward unordered 'and' node stipulates that the information corresponding both to *Number* and *Gender* must be simultaneously activated. Downward unordered 'or' nodes connect to specific choices of Nouns, Adjectives and Determiners. Although *Number* and *Gender* are grammatical categories, and not concepts, it is apparent that they help to express sememic information about the participants involved in some process.

It should be emphasized that downward activation through a downward OR node goes to **all** of the connecting lines.

Figure 14 aims to account for the sememic and lexicogrammatical information in the Spanish Noun Phrase, whereas Figure 17 aims to account for Concord. The two of them would need to be integrated in order to provide a general framework that would enable us to understand why the Spanish Noun Phrase is a network of relationships.

5. Conclusions

In Sections 1 and 2 we have considered that the hypothesis that the internal linguistic system *is* a network of relationships has been reasonably supported by Saussure, Hjelmslev, Halliday and Lamb. It was thus necessary to provide a satisfactory notational system that enabled us to evaluate such a hypothesis. And it is the case that relational networks do enable us to represent and explain the sequential organization of a linguistic structure like the Spanish Noun Phrase. For example, Figure 14 represents the sememic and the lexicogrammatical information in the Spanish Noun Phrase. Downward ordered 'ands' allow us to account for sequential/syntagmatic information, whereas upward unordered 'ands' help us to show grammatical structures are connected with (and determined by) sememic information, i.e. the meanings that are communicated by linguistic structures. But relational networks can also be used to represent the not-sequential (unordered) information that is part of linguistic structures: By means of both downward and upward unordered 'ands', Figure 17 accounts for Concord.

Figure 18 combines the two cardinal figures that have been mentioned before: Figure 14 and Figure 17. It is not very conventional to present an additional diagram extending the analysis in the conclusion section, but this last and highly complex relational network does not only integrate the information displayed in previous schemes, but it should also explain the incidence of a not sequential ('unordered') factor like Concord in a sequential ('ordered') structure like the Spanish Noun Phrase.

If the figures and the accounts that have been presented in this article are correct, then the following conclusions could be reasonably sustained:

1. Since relational networks show *how* grammatical structures are determined by sememic choices, the account developed in this paper supports the idea that Relational Network Theory is compatible with Systemic Functional Linguistics (Halliday & Matthiessen 2004: 24; Lamb 2006: 208, 2013: 137–138). One of the most important proposals of Systemic Functional Linguistics is that the nature of language is closely related to the demands that we make on it. In other words, the functions that language has to serve determine language structure. This assumption implies that language cannot be explained by only listing its many

uses, but it also implies that an account of linguistic structure that overlooks the demands we make of language is incomplete. In other words, language structure is considered in terms of language use (Halliday 1970, 1978, 1985, 1994; Halliday & Matthiessen 2004). The peculiar form adopted by the vocabulary and the grammar of language (i.e. the lexicogrammatical nections of the internal linguistic system) is closely related to the social and personal meanings that individuals need to express in everyday life. It is necessary to take into account the system of language and its functions at the same time in order to build a general linguistic theory. Systemic Functional Linguistics emphasizes that every act of speech involves simultaneous selections from among a large amount of interrelated choices. These choices represent the meaning potential of language. The system of available options is represented in the vocabulary and the grammar of the language, and speakers (or writers) select within this system 'not *in vacuo*, but in the context of a speech situation' (Halliday 1970: 142). A person produces or interprets a text in a situational context which is included in a cultural context. And every text (a concrete set of choices in a certain context of situation) is always built on the basis of resources provided by the lexicogrammatical system. Since Systemic Functional Linguistics considers both system and text, it enables us to analyze the latter on the grounds of the former. 'Both system and text have to be in focus of attention … only by starting from the system can we see the text in its aspect as a process' (Halliday 1994: xxii).

By means of the relational account of the Spanish Noun Phrase it has been illustrated *how* certain meanings determine certain options at the lexicogrammatical level. For example, Figure 18 shows (among many other things) that the necessity of specifying reference determines the activation (the choice!) of the nection for Determiners.

2. It has been stated that the main objective of this paper was to show that the Spanish Noun Phrase is a network of relationships. In this sense, Figures 6–18 provide a general account of the structure and the function of the Spanish Noun Phrase. Such figures, together with the explanations that have been offered, shed light on a fundamental linguistic phenomenon—it is the necessity of expressing certain meanings which determine lexicogrammatical choices. Within the linguistic network, the nections at the lexicogrammatical level are connected to specific nections at the sememic level, and the activation of such sememic nections is what determines the activation of certain lexicogrammatical nections. In other words, it can be suggested that relational networks represent *how* the choice of some concrete grammatical structure is determined by the choice of the meanings that will be communicated. In this sense, the choice of a particular concept leads to the choice of a particular lexeme. For example, Lamb (1999: 188) considers the differing connotations of these alternative statements describing the same event:

    I. The acid corroded the pipe.
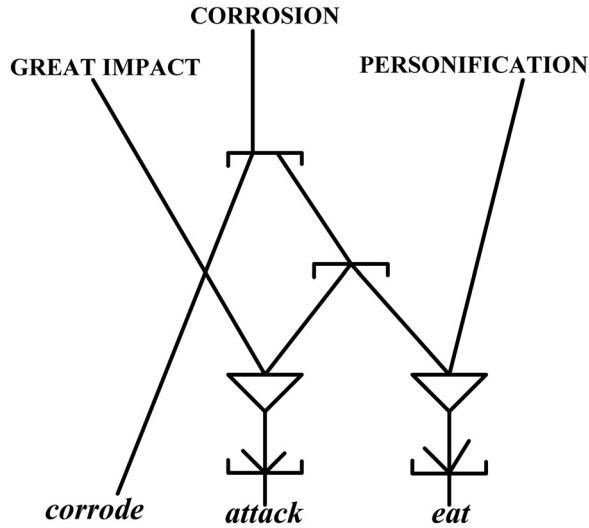   II. The acid ate the pipe.

Figure 19 Conceptual information determining choices at the lexical level

    III.   The acid attacked the pipe.

The verbs *corroded*, *ate* and *attacked* have the same denotation within the context of the above examples (although they would not in most other contexts). However, they differ widely in connotation as alternative ways of describing the event: (i) presents the event as a rather dull and prosaic one, (ii) seems to treat the acid as a person, and (iii) suggests a greater impact. Figure 19 represents how in the linguistic system of the speaker some concepts are differentially connected to the three lexemes.

This relatively simple example seems to support the hypothesis that relational networks help us to show *how* meanings determine options at the lexical level:

> If the speaker needs to produce a 'normal', 'unmarked', message, downward activation from CORROSION goes to *corrode* along the default connection.

> But if, for example, the speaker needs to communicate some additional meanings dealing with the impact of the process, downward activation from CORROSION **and** downward activation from GREAT IMPACT go to the lexical node for *eat*, which will be activated.

3. The account is realistic because it is operationally plausible, i.e. it provides a plausible account of how the linguistic system can be put into operation in real time to produce and understand speech. Regarding the hearer, activation goes from expression to meanings. Considering the speaker, activation starts

with meanings and then follows pathways to expression. Of course, since language is a three-level system, phonology is also included in this framework, although it was not necessary to represent phonological information in Figures 6–18. The representation of phonology information has been exemplified in Figure 2 and Figure 5. Lockwood has provided many examples about the connections among the different strata in his *Introduction to Stratificational Linguistics* (1972) and other publications (Lockwood 1973, 1978, 1981, 1986). This description (downward through the network for speaking, upward for comprehension) is of course a rough first approximation. Actual processes are much more complex. For example, upward activation may occur during the process of forming a statement, while the speaker tests his planned output for clarity, and perhaps does some editing before actually speaking.

4. Relational networks representing the Spanish Noun Phrase account both for paradigmatic and syntagmatic relationships, which are represented respectively by means of 'or' and 'and' nodes. One of the beauties of this notational system is that paradigmatic information and syntagmatic information are represented together at the same time. It is the case that meaning determines language structure, and that linguistic meaning is a necessary result of language use and language structure. There is no linguistic meaning without an instance of linguistic structure and, vice versa, every linguistic structure evokes some meaning. Consequently, there is no need to distinguish between semantics and pragmatics, i.e. between the meanings within the system, before language use and the meanings activated in specific contexts: every meaning is part of the system AND it also is (or can be) activated in some specific situation.

5. Different kinds of linguistics have different functions, as pointed out by Halliday in his 'Syntax and the consumer' (1964). Relational Network Theory differs from mainstream linguistic theories in that it is not an easy vehicle for linguistic description. But Relational Network Theory is not primarily about describing languages, it is about understanding. While its development was influenced by Hjelmslev, it arose out of American structural linguistics, and its concern was mainly with linguistic structure as a reality. This concern is what leads to the requirements of operational, developmental and neurological plausibility—requirements that are not considered important in other kinds of linguistics. On the one hand, many linguistic theories are interested in linguistics for description, because it will help in second language teaching or in translation studies or other practical endeavours. And for such applications we want a description that is easy to read. On the other hand, relational networks are not easy to read. But they are not therefore useless, since they have an important, but different, function. By means of relational network notation we have not only been able to describe the Spanish Noun Phrase, but we also elucidated some interesting features that are not elucidated by a description in words or in some kind of linear notation, namely the incidence of meaning in lexicogrammatical structure. In Nicholas Rescher's words, 'scientific realism is the doctrine that science describes the real world' (2003:

363). If we want to be realistic when doing linguistics, we need to describe complex phenomena. And because of the complexity of these phenomena, it is necessary to count with a consistently complex descriptive device like the one that has been developed by Relational Network Theory.

One day, Professor Lamb was asked about the extreme complexity of relational networks. He admitted that they were very complex and hard to understand. 'So is language', he answered. And then he added: 'But if it's too complex, don't blame me. Blame reality!'.

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