

# Catalan morphology and low-level patterns in a network model

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The fact that more specific or *low-level* morphological patterns may coexist with the most general or abstract ones is a characteristic insight of cognitive morphology. According to the bottom-up approach of the model, it is even to be expected that low-level patterns may have a more relevant role than the most inclusive and abstract ones. On the basis of the analysis of an aspect of Catalan inflection (velar verbs of the second conjugation) and one aspect of Catalan word-formation (complex words with the prefixoid *radio-*), we will show the advantages of incorporating to the model salient low-level patterns and the local paradigmatic relations in which they are based.

Un tret característic de la morfologia cognitiva és que els patrons morfològics més generals o abstractes poden conviure amb els més específics o *de baix nivell*. D'acord amb l'orientació *de baix a dalt* del model, cal esperar fins i tot que els patrons de baix nivell tinguin un paper més rellevant que els més inclusius i abstractes. A partir de l'anàlisi d'un aspecte de la flexió del català (els verbs velaritzats de la segona conjugació) i un de la formació de mots (els mots complexos formats amb el prefixoide *radio-*), ens proposem mostrar els avantatges d'incorporar al model morfològic els patrons de baix nivell prominents i les relacions paradigmàtiques de caràcter local en què es basen.

key words: network model, cognitive morphology, low-level patterns, paradigmatic relations

## 1. The network model

The nature and function of morphological patterns is a central and distinctive aspect of morphological theory and therefore an issue reflecting the basic assumptions adopted by each model. The divergence of these assumptions is the basis of the well-known

differences between the conception of patterns characteristic of generative morphology and that of the cognitive and functionalist morphology of Langacker and Bybee.

Thus, the generative proposal on morphological patterns is founded on the purpose of formulating a model that expresses the morphological competence of the speaker in a most *economical* and least redundant manner. Along these lines, morphological rules represent the most inclusive generalization possible, express the paradigmatic relation between the base and one of its derivatives not found in the lexicon, and have the primary function of generating possible words (which, because they are regular, are not included in the lexicon). From this point of view, general rules allow for the *elimination* of redundancies from the lexicon. On the other hand, the subpatterns observable in the data are considered unnecessary and grammatically insignificant.

For their part, the morphological patterns of cognitive models represent regularities of different levels of generalization (the most inclusive patterns may coexist with the most specific ones), emerge from the paradigmatic relations between real words in the lexicon (they are *product-oriented patterns*), and have the function of serving, on the one hand, for the formation and categorization of new words and, on the other, for the analysis and organization of words stored in the lexicon. In this way, morphological patterns do not simplify the lexicon by eliminating redundant information but instead express generalizations regarding the lexicon (Derwing 1990, 252).

From this perspective, subpatterns or low-level patterns can be grammatically significant and can even have a more important role than more general and/or abstract ones. According to Langacker (1988: 288), we do not have any certainty that speakers invariably arrive at high-level patterns, which, given their abstract nature, could be of little use in forming and evaluating new expressions. Our purpose is to show the advantages of incorporating salient, low-level patterns and their local paradigmatic relations into the morphological model.

Our approach is based on the network model proposed by Bybee (1985, 1988, 1995, 1999, 2001). Bybee, like Langacker, maintain that morphology is not a *component* or *module* of a grammar containing morphological rules and acting independently from the lexicon. Grammar constitutes one single component formed by both the lexicon and rules or patterns. From this standpoint, the lexicon, morphology, and syntax form a

continuum of symbolic units that serve to structure conceptual content for purposes of expression (Cifuentes 1994, 331). The basic characteristics of the network model are (Bybee 1996a: 249-250):

- a) Words that form part of the lexicon have several grades of lexical strength, which is largely due to the token frequency of words. Words with a high degree of lexical strength are of easier activation, serve as the foundation for morphological relations, and have an autonomy that makes them more resistant to change and predisposed towards independence from a semantic point of view.
- b) Words in the lexicon are interrelated through groups of lexical connections between either identical or similar phonological or semantic traits. The parallel phonological or semantic connections define the morphological structure of words.
- c) Sets of words that have similar semantic or phonological patterns are mutually reinforced and create emerging generalizations that can be described as schemes or patterns. The productivity of schemes is a direct consequence of type frequency.

Characteristics a) and c) relate language usage to properties of lexical representation. Thus, the level of lexical strength of words and the degree of productivity of their patterns relate to a property of these units (their salience or ease of activation) that depends in part on their frequency of use (token frequency and type frequency). Unlike structuralist models, in which the impact of usage is not taken into account in the structure of language, in the network model the frequency of use of the units has an important role in the establishment and maintenance of representations of the linguistic system (Bybee 1995: 428).<sup>1</sup>

## 2. Paradigmatic relations between real words in the lexicon

In the network model, the lexicon contains real words that, given their frequency of use, have been consolidated as units of the linguistic system. One well-known fact favoring this hypothesis is that complex words, whether they are commonly used or not,

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<sup>1</sup> The interaction between the use and the mentally constructed grammar of a language by its speakers is an undeniable fact. Language is not confined to a mental prison, and isolated from use. This is why paradigms that do not dissociate language and use are interested in dealing with how and to what measure use affects the linguistic system.

are activated more easily and with a smaller margin of error. In this model, each lexical unit is the union of a set of semantic traits with a group of phonological traits (Bybee 1988: 126). The paradigmatic relations between words in the lexicon are based on their identical or similar semantic and phonological traits. Figure 1 illustrates these kinds of semantic and phonological relations between the Catalan nouns *gat* ‘cat’, *gatet* ‘kitten’, *gos* ‘dog’ and *cadell* ‘puppy’.

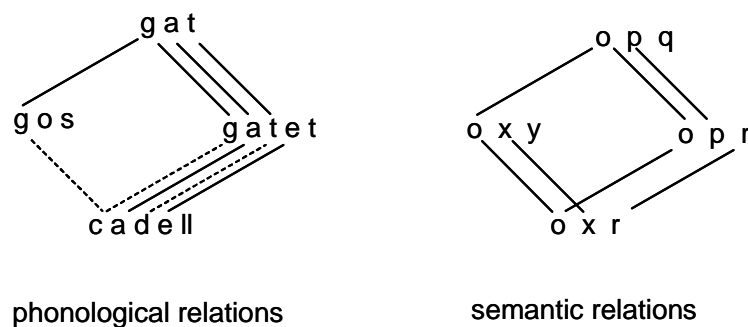


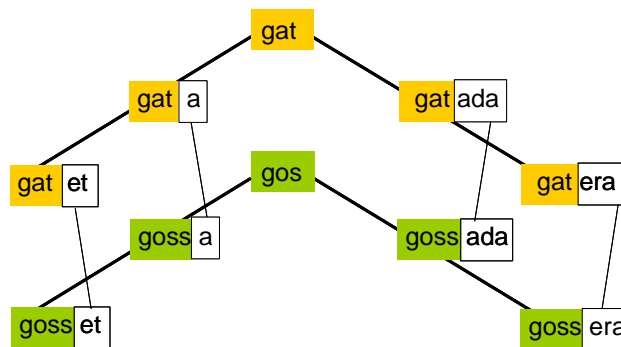
Fig. 1. Semantic and phonological relations (based on Bybee 1988: 126)

The nouns *gat* and *gatet* are related through phonological connections (the three phonemes they share, as seen on the left of Fig. 1) and through semantic connections (because they have common semantic traits, conventionally represented by letters, as on the right of Fig. 1: “o” and “p”). In contrast, the phonological relationship between the nouns *gos* and *cadell* is limited to a partial similarity (represented by a dotted line) between the initial phonemes: the voiced and voiceless stops, respectively. Moreover, these words have largely common semantic traits, since they only differ in that *cadell* specifically denotes a young animal. This semantic similarity is expressed through the relationship between “o” and “x”: the common semantic traits. For their part, *gat* and *gos* have the same initial phoneme and a similar structure (CVC), and they are also related from a semantic viewpoint, inasmuch as they designate pets. Likewise, *cadell* and *gatet* have a certain similarity at the phonological level: the last syllable is stressed in both, they share the structure CaCeC, and their first two consonants are stops in both cases. Finally, they are semantically related, as both *cadell* and *gatet* designate young varieties of pets.

### 2.1. Morphemes in the network model

Parallel phonological and semantic relations allow for the definition of morphological constituents of words, that is, the morphemes that make them up. These morphemes are, in fact, identified by the narrow correlation between form and meaning, such as the existing association in the previous example between the sequence *gat* and the traits “o” and “p”.

The representation of semantic relations as exemplified in Fig. 1 presents an inconvenience in that it does not take into account that the smallest units of meaning are morphemes. The semantic relationship between words with common morphemes is a connection between the smallest units of significance, which are not semantic traits but rather the morphemes themselves. Moreover, this way of representation could imply that the meaning of words (and of morphemes) is the sum of a series of separable semantic traits.<sup>2</sup> For these reasons, we will explicitly represent<sup>3</sup> the paradigmatic relations between words with common morphemes—both the affixal elements as well as the roots—whenever they are transparent and productive morphemes (see Fig. 2). Following this line of thought, these connections could be of two different types: the paradigmatic relationship between words with one or more common affixal elements (inflectional or derivational categories) and the paradigmatic relationship between words with the same root (word families) (Vallès 2003, 2004).



<sup>2</sup> Traits identifiable by way of a componential analysis can have different grades of salience or prototypicality (Geeraerts 1992: 222-223; 1995: 33). Moreover, the meaning can be metaphorical or metonymical and of an encyclopedic nature.

<sup>3</sup> As shown in Fig. 1, Bybee’s connections are not morpheme to morpheme but phoneme to phoneme in such a way that the border between morphemes is not expressed explicitly but implicitly—deduced from the comparison of the base and the derivative—in the representation of the derivative series. Regarding the disadvantages that Bybee alleges against explicit morphological segmentation and ways to avoid them, see Vallès (2003: 145-148).

Fig. 2. Morphological relationships<sup>4</sup>

Psycholinguistic studies contribute an important argument regarding the morphological relationships among words. For instance, research in word recognition has provided evidence for the existence of a morphological parser, that is “an automatic and obligatory component of the word recognition process for both existing words and novel multimorphemic forms” (Libben and Almeida 2002: 223). This parser “is responsible for the isolation and identification of morphological constituents of multimorphemic words” and “makes it possible for language users to understand novel or infrequent multimorphemic words by breaking such words into their morphological constituents so that an interpretation of the novel form can be constructed on the basis of those constituents” (Libben and Almeida 2002: 213).

In order to perform this morphological analysis of words in the lexicon and of neologisms, speakers must compare words and search for similarities between their morphemes. In other words, they must establish paradigmatic relations between words with common morphemes, such as we propose to express explicitly through the network model. For example, in order to interpret a Catalan neologism like *bicultural*, one must compare this complex word with other Catalan words formed with *bi-* (*bimotor*, *bidireccional*, and *bidimensional*) and with members of its own family of words (*cultura*, *cultural*, *multicultural*, *intercultural*, *transcultural*...). Without this comparison, the neologism would be unparsable.

## 2.2. Other paradigmatic relations

The model not only allows for the recognition of morphemes that constitute complex words, but it also allows for the definition of other relations that extend beyond morpheme boundaries or do not identify with any concrete morpheme. Regarding the first possibility, let us imagine hypothetical data like the following (upper-case letters represent roots and lower-case letters represent affixes) (Vallès 2004: 97-102):

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<sup>4</sup> *Gat* ‘cat’ and *gos* ‘dog’ are accompanied by *gata* and *gossa* (referring to their respective female counterparts), *gatet* and *gosset* (referring to their young), *gatada* ‘colony’ and *gossada* ‘pack’, and *gatera* (flap door for cats) and *gossera* (doghouse).

- (1)
- a. B, C, D, E, F...
  - b. aB, aC, aD, aE...
  - c. aBg, aCg...
  - d. aCgh, aDgh, aEgh...

Starting with these data, from a top-down perspective, linguists could formulate a general rule for the prefix *a-*, and general rules for the suffixes *-g* and *-h*. In contrast, with a bottom-up approach such as the one adopted by the network model, the same data could suggest not just the general patterns of the affixes *a-*, *-g*, *-h*, but also the subpatterns *-gh* (such as the Catalan forms *-ització* ‘-ization’, *-alment* ‘-ally’: *periodització*, *setmanalment*...), *a\_g* (*des\_ció* ‘un\_ tion’: *desinformació*, *desmotivació*...) and *a\_gh* (*anti\_ització* ‘anti\_ ization’: *antiglobalització*, *antimilitarització*...). What changes from one to another is not just the inclusion of subpatterns as a relevant factor. The true difference is that, from a top-down perspective, the general rules are *a priori* considered significant, whereas the subpatterns are not. In contrast, from the perspective adopted by a usage-based model, the existence of patterns and subpatterns in grammar becomes an empirical question.

We have shown that the model can define morphological relations, not just at a level greater than morphemes but also at a lesser level. This second possibility can be exemplified in the participles of Catalan verbs of the third conjugation. The regular participles of this conjugation follow a very general pattern that can be formulated in (2):

- (2) [root [íd]]

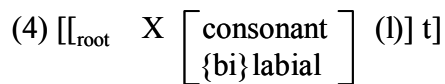
Within Catalan irregular verbs, there is a group of the third conjugation that takes on a distinctive participle ending in *-ert*. The group is rather small since this characteristic of the participle is determined in part by the final consonants of the root. As evidenced in (3) with the infinitive forms, in all cases the final consonant of the lexical root is a liquid and the preceding consonant is labial:

- (3)
- a. *-br-*: obrir, cobrir
  - b. *-bl-*: establir, reblir
  - c. *-pl-*: omplir, complir
  - d. *-f(e)r-*: oferir, sofrir

In the participle the liquid disappears if it is an *r* (and also disappears the preceding *e* of *oferir*), but remains if it is an *l*:

- (4) a. *-bert*: obert, cobert  
 e. *-blert*: establert, reblert  
 f. *-plert*: omplert, complert  
 g. *-fert*: ofert, sofert

The pattern that accounts for this irregular participle can be formulated as in diagram (4), where X refers to unspecified phonological content, the curved brackets to preferred but non-obligatory traits or segments, and the parentheses to optional traits or segments.<sup>5</sup>



As the diagram shows, the bilabial consonant and the liquid intervene in the morphological relation involving the irregular participles ending in *-ert*, in which the boundary between the lexical root and the flective ending become fuzzy. We observe that, while this morphological relation is local, it is at the same time also very strong because the participles share a high number of common traits, which is precisely what gives cohesion and stability to the group. As Bybee (1996b) has pointed out, language shows a clear parallelism to memory in this sense. We normally remember habitual, recurring, and repeated events, but we also remember unconnected details, redundancies, and generalizations of a very local nature. In the same way, speakers are capable of formulating very general and abstract diagrams like the one in (3) but also very local ones like the one in (4). Low-level patterns can therefore be of grammatical significance and even have as important a role as the most general or abstract patterns.

Having presented the general characteristics of the model, in the following sections we will analyze an aspect of inflection and one of derivation. Specifically, we focus on

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<sup>5</sup> In the pattern in (2), the final alveolar consonant is voiced but becomes voiceless when positioned at the very end, as seen by contrasting the masculine form (*dormit*) and the feminine form (*dormida*) of the participle, ‘slept’. However, in (4), the consonant remains voiceless, demonstrated by the fact that there is



the Catalan velar verbs of the second conjugation and on complex words using the prefix form *radio-*.

### 3. Catalan velar verbs of the second conjugation

The second conjugation is the most irregular and least productive Catalan verbal inflection, but some of the most frequent verbs follow this pattern. Among the verbs traditionally considered irregular, the so-called “velar” verbs are of special importance. Certain forms of the paradigm display a velar consonant between the root and the inflectional ending. Table 1 shows the paradigm of the verb *molldre* ‘to grind’, with the velar forms marked in italics.

INDICATIVE					
	Present	Imperfect	Simple past	Future	Conditional
1 <sup>st</sup> sg	<i>Molc</i>	Molia	<i>Molguí</i>	Moldré	Moldria
2 <sup>nd</sup> sg	Mols	Molies	<i>Molgueres</i>	Moldràs	Moldries
3 <sup>rd</sup> sg	Mol	Molia	<i>Molgué</i>	Moldrà	Moldria
1 <sup>st</sup> pl	Molem	Molíem	<i>Molguérem</i>	Moldrem	Moldriem
2 <sup>nd</sup> pl	Moleu	Molíeu	<i>Molguéreu</i>	Moldreu	Moldrieu
3 <sup>rd</sup> pl	Molen	Molien	<i>Molgueren</i>	Moldran	Moldrien
SUBJUNCTIVE			IMPERATIVE	NONPERSONAL FORMS	
	Present	Imperfect		Infinitive	Participle
1 <sup>st</sup> sg	<i>Molgui</i>	<i>Molgués</i>		Moldre	Mòlt
2 <sup>nd</sup> sg	<i>Molguis</i>	<i>Molguéssis</i>	Mol		Mòlta
3 <sup>rd</sup> sg	<i>Molgui</i>	<i>Molgués</i>	<i>Molgui</i>	Gerund	Mòlts
1 <sup>st</sup> pl	<i>Molguem</i>	<i>Molguéssim</i>	<i>Molguem</i>		Mòltes
2 <sup>nd</sup> pl	<i>Molgueu</i>	<i>Molguéssiu</i>	Moleu	Molent	
3 <sup>rd</sup> pl	<i>Molguin</i>	<i>Molguéssin</i>	<i>Molguin</i>		

Table 1: Paradigm of the verb *molldre* ‘to grind’

As can be observed, inflected forms with the velar consonant include the first-person in the present indicative, the simple past, the present subjunctive, the imperfect subjunctive, and the 3<sup>rd</sup> singular, 1<sup>st</sup> plural, and 3<sup>rd</sup> plural persons in the imperative, but not in any other forms. In addition, verbs like *beure* ‘to drink’ also acquire a velar in the participle (*begut*, ‘drunk’) and others show certain peculiarities in their distribution of velar forms. Moreover, the velar is unvoiced in the 1<sup>st</sup> singular person of the present indicative but voiced in all other cases. Keeping in mind that this distinction is prompted

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no variation between the masculine form (*obert*) and the feminine form (*oberta*) of the participle, ‘opened’. A similar phonetic variation will be explored in greater detail in section 3.

by the phonic context -namely, all word-final obstruents are voiceless- it can be argued that there is no morphological difference between these voiced and voiceless velars and that both cases deal with the phoneme /g/ (Bonet & Lloret 1998: 103-105).

### 3.1 *The status of the velar consonant*

The status of the velar consonant becomes problematic for models based on the segmentation of morphological constituents. Due to this difficulty, the velar segment has been characterized in different ways in Catalan linguistic studies. For some researchers, the velar consonant is identified with the final segment of one of the allomorphs of the verbal roots (Roca Pons 1968: 231; Mascaró 1983: 155-194; Badia 1994: 574-578). Other researchers, however, have argued that the velar segment is a constituent independent of the root and the inflectional affixes (Malkiel 1974, Viaplana 1984; Wheeler 1993: 196; Pérez Saldanya 1998: 73-75; Perea 2002: 597-601). Finally, it has also been argued that the velar segment is an empty morph (DeCesaris 1988) or a lexically-conditioned epenthetic consonant (Hualde 1992: 410).

The diversity of these linguistic arguments is due, in large measure, to the fact that arguments supporting one theory or another readily exist. From an etymological perspective, the answer cannot be unitary since in some cases the velar consonant goes back to the final consonant of the root of the Latin equivalent of the present, as in (5a), whereas in other cases it derives from a consonant replacing the inflectional marker U (/w/), which appeared in some strong perfects (5b).

- (5) a. DIC > dic; DICAM > diga (*later* digui)...  
b. VALUI > valc (*later* valgui)...; VALUISSEM > valgués...

From a synchronic standpoint, the answer is not unitary either. For a verb like *beure* 'to drink', it might seem that the velar is part of the root (or the velar allomorph of the root), since the constituent *beg-* follows the canonical structure (CVC) of verb roots in Catalan and the velar consonant and others that clearly are part of the root are in a

complementary position, like *v* or the consonant *u* (in *bevia* or *beus*, for example)<sup>6</sup>. As for verbs like *molldre* ‘to grind’, on the other hand, it seems that it is an independent element added onto the canonically structured root *mol-*. Finally, from a functional point of view, if it is true that the velar has no particular meaning, then it is also true that its presence or absence allows us to distinguish between the 1<sup>st</sup> and 3<sup>rd</sup> singular persons in the present indicative (*molc* and *mol*, respectively) and the present indicative and present subjunctive in the fourth and fifth persons (*molem* and *moleu*, contrasted with *molguem* and *molgueu*, respectively). In summary, the velar segment finds itself at the intersection between the root and the endings since it exhibits properties of one or the other without belonging itself to either one or the other.

As has been indicated, a network model is not based on the segmentation of morphological constituents but on the relationships of form and meaning (or function). In addition, these relationships of forms and meaning may exactly coincide with morpheme boundaries but could also surpass or fail to reach these boundaries. In the case analyzed here, the model demonstrates this equidistance in the sense that it connects the velar of different verbs with inflectional forms (i.e., the endings) and also with different forms of the same verb (i.e., the root):

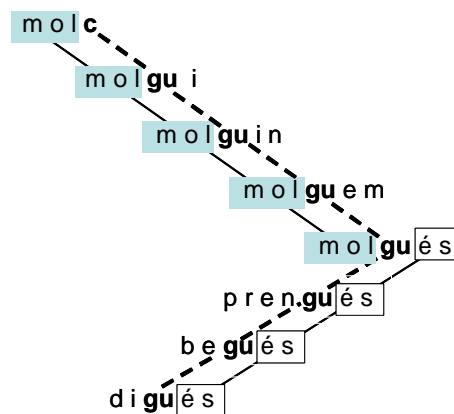


Fig. 3. Paradigmatic relations between velar forms

Based on the evidence of the position and function of the velar segment, we can conclude that the velar acts as a marker for verbal class and, specifically, as a thematic

<sup>6</sup> In the Catalan varieties in which *v* maintains its labiodental pronunciation, the semivowel *u* can be derived from *v* since it appears only in a position of syllabic coda. In the Catalan varieties in which *b* and *v* are confused and both bilabial, two different phonemes must be considered.

extension, parallel to the thematic vowel (Viaplana 1984; Wheeler 1993b: 196; Pérez Saldanya 1998: 73-75; Perea 2002: 597-601).

### 3.2. *Patterns in velar verbs*

Morphological patterns arise from paradigmatic connections, as the previous section has illustrated. In the case of velar verbs, the pattern could be described as the velar followed by the endings, which appear in all forms except the 1<sup>st</sup> singular person of the present indicative, which does not have any affix. Another aspect of the pattern is that it could also indicate that the velar is preceded by a very specific group of segments, as can be seen in (6).

- (6)
- a. stressed vowel + n: *prenc, estenc, tinc, vinc, ponc, fonc...*
  - b. stressed vowel + l: *molc, dolc, solc, tolc...*
  - c. stressed vowel + j: *caic*
  - d. stressed vowel: *bec, moc, dic, duc, plac, conec...*

Finally, the pattern could also indicate that the stressed vowel is usually preceded by a consonant at the beginning of the word, even though there also are cases of two consonants together (like *prenc*), cases of a single vowel alone (like *hagués*), or cases in which the stressed vowel is preceded by an unstressed vowel (*escric, conec*). The formula in (7) illustrates the aforementioned pattern.

- (7) [ { ##C } + V<sub>stressed vowel</sub> + (n/l/j) + g + { endings } ### ]

The lexical connections also highlight how irregular verbs follow certain patterns that minimize irregularities and favor learning. Not all forms of a paradigm are equally representative. The most frequent forms are usually the most morphologically simple, and both the frequency and simplicity of their forms reinforce their accessibility to the speaker and the degree to which they are representative of the paradigm. In fact, this difference in how well different forms represent an entire paradigm establishes the distinction between basic and derivative forms.

As the data indicate, the most basic forms of the paradigm are the 3<sup>rd</sup> and 1<sup>st</sup> singular persons of the present indicative. For a verb like *conèixer* ‘to know’, the two forms allow for the derivation of the rest of the paradigm by adding the appropriate endings:<sup>7</sup>

- (8) a. *conec* → PS: *conegui, coneguis...*  
 SPas *coneguí, conegueres...*  
 IS: *conegués, coneguessis...*  
 3<sup>rd</sup> sing, 1<sup>st</sup> pl, 3<sup>rd</sup> Imp: *conegui, coneguem, coneguin*  
 Part: *conegut*
- b. *coneix* → 2<sup>nd</sup> sing, 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> pl PI: *coneixes, coneixem...*  
 II: *coneixia, coneixies...*  
 2<sup>nd</sup> sing, 2<sup>nd</sup> pl Imp: *coneix, coneixeu*  
 Inf: *conèixer*  
 F: *coneixeré, coneixeràs...*  
 C: *coneixeria, coneixeries...*  
 G: *coneixent*

In this case, the organization of the paradigm is as iconic and compositional as possible in the sense that all forms can be derived by adding the appropriate endings to the two basic forms. In other cases, in addition to the two basic forms, there is a third, which corresponds to the forms adopted by the 1<sup>st</sup> and 2<sup>nd</sup> plural person conjugations of the present indicative. The verb *coure* ‘to cook’, for example, follows this model:

- (9) a. *coc* → PS: *cogui*  
 PasS *coguí, cogueres...*  
 IS: *cogués, coguessis...*  
 3<sup>rd</sup> sing, 1<sup>st</sup> pl, 3<sup>rd</sup> pl Imp: *cogui, coguem, coguin*  
 Part: *cogut*
- b. *cou* → 2<sup>nd</sup> sing, 3<sup>rd</sup> pl PI: *cous, couen*  
 2<sup>nd</sup> sing Imp: *cou*  
 Inf: *coure*  
 F: *couré, couràs...*  
 C: *couria, couries...*
- c. *coem, coeu* → II: *coïa, coïes...*  
 2<sup>nd</sup> pl Imp: *coeu*  
 G: *coent*

<sup>7</sup> The following abbreviations are used: present indicative (PI), simple past (SPas), imperfect indicative (II), future (F), conditional (C), present subjunctive (PS), imperfect subjunctive (IS), imperative (Imp), infinitive

In this case, the level of iconicity of the paradigm is not as high, given that, in the case of the third basic form, the derivative forms are not recovered by adding on endings but by changing them.

There are even more specific cases, but the two examples offered serve to demonstrate how paradigms and relationships are established. In dealing with more recurring patterns, it is also possible to define them by way of more general and abstract patterns.<sup>8</sup> Verbs like *conèixer* ‘to know’, for example, would follow the formula in (10a), where it would be necessary to specify the forms adopted by each one of the patterns. Verbs like *coure* ‘to cook’, for their part, would follow the formula in (10b). Finally, verbs like *molldre* ‘to grind’ or *vendre* ‘to sell’ follow the formula in (10c); like *conèixer*, they have two basic forms but are different in that the velar does not alternate with any other consonant.<sup>9</sup>

- (10) a. [Xg {endings}] – [XC {endings}]  
b. [Xg {endings}] – [XC {endings}] – [X endings]  
c. [Xg {endings}] – [X {endings}]

### 3.3 *The velar verb and analogical processes*

Velar verbs have undergone a set of changes through analogy, which can be described in a simple way using the network model. In the next section, we provide evidence for two changes through analogy in velar verbs: the first dealing with interparadigmatic changes, which convert an originally non-velar verb into a velar one, and the second dealing with intraparadigmatic changes, which convert originally non-velar, inflectional forms into velar ones.

#### 3.3.1. *The velarization of the verb donar*

Analogy often occurs through a process of paradigmatic leveling, which adds uniformity and transparency to inflectional paradigms. In some cases, nevertheless, the change seems to go in the opposite direction, as regular forms are replaced with irregular

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(Inf), gerund (G), and participle (Part).

<sup>8</sup> See Mascaró (1983: 181-185) for a more detailed analysis of these kinds of patterns.

<sup>9</sup> In this model, the consonant *d* appearing in the infinitive (*molldre*), the future (*moldré*), and the conditional (*molldria*) is omitted, as it is motivated by the phonetic context so as to prevent contact between

forms. A rather indicative example of these “irregular” changes can be found in the verb *donar* ‘to give’. This verb has a relatively high frequency of use and, moreover, belongs to the most regular and productive conjugation class in Catalan. These characteristics give it qualities of stability and resistance to change. Nevertheless, the verb *donar* has colloquial forms in some Catalan varieties and has adopted a mixed form of conjugation, regular in (11a) and velar in (11b).

- (11) a. donés, dóna...; donava, donaves...; donaré...; etc.  
 b. donc; dongui, donguis...; dongués, donguessis...

The velarization of this verb through analogy can be explained in simple terms using the network model, as this model takes into account lexical connections based on phonological and semantic similarities, localized yet quite strong. In fact, the verb *donar* ‘to give’ establishes a very powerful yet narrow relationship with another velar verb: the verb *prendre* ‘to take from’. The relationship is narrow because it depends on meaning as well as form. In terms of meaning, *donar* and *prendre* refer to reciprocal actions in which the same two participants intervene: one who gives and one who receives. In terms of form, in both cases the root ends in a high-mid stressed vowel followed by *n*. The following formula in (12) illustrates the interrelationship between these two verbs:

- (12) a. Meaning: if A gives X to B, then B takes X from A  
 b. Form: [<sub>root</sub> C(C) [high-mid vowel] n]: *pren-*, *don-*

The connection is local, but at the same time it is very intense; and this intensity motivates the adoption by *donar* of the pattern of velar verbs, abandoning the regular pattern of the verbs of the first conjugation.

### 3.3.2. Relationships within paradigms: the velar and the thematic vowel

Analogical changes also result within the same paradigms with velar forms. As can be seen in Table 1, in many of the velar forms, the velar consonant is followed by a stressed *e*: *molguem*, *molgueu*, *molgué*... The presence of both constituents in many forms makes up a subpattern that is reinforced because the two constituents behave

functionally as markers of verbal categories. Thus, the *e* is associated with the thematic vowel and is therefore a marker of the second conjugation, whereas the velar consonant identifies with the velar extension and is therefore a marker of the subcategory within the verbs of the second conjugation.

This narrow relationship, in fact, explains the tendency of the velar consonant to become widespread in all colloquial registers in all contexts in which the thematic vowel is used. The further innovation of velars, all in all, has neither the same intensity nor the same geographical extension in all Catalan varieties. It is quite generalized in the gerund (*molguent* instead of the standard *molent*), but it has a more limited and dialectal character in other cases. The velarization of infinitives with a stressed *e* is very frequent in the Catalonia dialect (*sapiguer*, *capiguer*, and, to a lesser degree, *volguer*, instead of the standard *saber*, *cabre*, and *voler*), whereas the velarization of the fourth and fifth person forms in the present indicative is quite habitual in central Valencian speech (*coguem* and *cogueu* in place of the standard *coem* and *coeu*).

#### 4. The prefixoid *radio-*

The importance of paradigmatic relations is not exclusive to inflection. They are also highly relevant in the formation of new words, as previous research has pointed out.<sup>10</sup> An important advantage of the network model is precisely its ability to express all kinds of paradigmatic relations existing among the various units that make up grammar. We illustrate these kinds of relationships through the study of the word formation processes with the combining form *radio-*.

##### 4.1. *The morphological pattern radio-*

A conventional description of the word formation pattern with the combining form *radio-* would specify only its phonological form /*rádio*/, the semantic content of ‘radio’, and the grammatical category of the base and the derivative (it creates nouns using nouns). This description, however, would not take into account that the pattern is not an

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93).

<sup>10</sup>Among those that emphasize the role of paradigmatic relations in word formation are: Bauer (1997, 2001), Becker (1993), Booij (1997, to appear), Camus (1996, 1997, 1998a, 1998b), Camus and Miranda



isolated element of the Catalan morphological system and that it exhibits a series of paradigmatically determined traits.

The so-called *prefixoids* (*radio-*, *euro-*, *eco-*, *narco-*, *tele-*, *petro-*, etc.) are initial combining forms of recent creation that have been introduced through the imitation of neoclassical combining forms and often disseminated through the mass media (Vallès 2004, 174-186). They result from the truncation of a word (*radioreceptor* ‘radio receiver’, *europèu* ‘European’, *ecològic* ‘ecological’ ...) and follow the tendency of colloquial registers to shorten complex words to the first two syllables (although, for this reason, the prefixoid sometimes is identical to the truncated word: *radio-* and *ràdio*).

In general, the morphological patterns of prefixoids share the following characteristics:

(13a) The phonological content of the pattern:

- Generally has two syllables, of which the first one is stressed. If it has three, it follows the syllabic structure CVC(C)VV (*radio-*, *biblio-*).
- Usually ends in the vowel *-o*.
- Is identical to a fragment of the original complex word.

(13b) The semantic content:

- Creates a relationship of modifier-head with the base.<sup>11</sup>
- Keeps the semantic content of the original noun or adjective.

Prefixoids are different from the rest of combining forms for various reasons. Unlike other combining forms of Greek or Latin origin, such as *cron(o)* (*cronòmetre* ‘chronometer’, *sincronia* ‘synchrony’), prefixoids only appear in the initial position of a word. Whereas prefixoids ending in *-o* require this vowel, other initial combining forms display a vowel or not, depending on the context (*fonema* ‘phoneme’, *fonòmetre* ‘phonometer’). The final vowel of a prefixoid is part of the original complex word,

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(1996), Geeraerts (1995, 2002), Haspelmath (2002), Pounder (2000), Rifón (2001, 2002), Rubba (1993, 1998), Vallès (2003, 2004) and Van Marle (1985, 1994). See also Bybee (2001: 117).

<sup>11</sup> In line with this, it is necessary to distinguish between the prefixoid *radio-* (*radionovel·la* ‘radio serial’, where *radio-* has the function of modifier) from the truncated word *radio* (as in the copulative compound

whereas in other combining forms, the vowel *-o* appears only in this initial element (*electro-* vs. *elèctric*, *socio-* vs. *social*). Since in prefixoids no phoneme is added to the truncated word fragment, and since they do not have allomorphs, they are completely transparent. Thus, from a phonological perspective, they are invariable and identical to the truncated word fragment of the corresponding complex word, and, from a semantic viewpoint, they carry the semantic value of the original complex word.

Prefixoids constitute a subcategory of combining forms that is homogenous and relatively open. In the network model, the great similarity among various prefixoids can be expressed as a paradigmatic relation of a local nature among the morphological patterns of *radio-*, *eco-*, *euro-*..., which may have given way to a more abstract pattern with the common traits mentioned in (13). In this way, the model provides an understanding of the narrow similarity among the morphological patterns of these prefixoids, as well as the formation of new members within the category (such as the Catalan prefixoids *publi-* ‘advertising’ in *publireportatge* ‘advertoarial, infomercial’, *publitramesa* ‘mailing’, *publiinformació* ‘publicity’, and *petro-* ‘petroliferous’ in *petrodòlar* and *petroeconomia*).

#### 4.2. The semantic content of radio-

We have argued that the morphological conclusions provided by subpatterns in theoretical models vary depending on whether a top-down or bottom-up approach is adopted. As an example, we analyze the different meanings of *radio-* in a corpus of Catalan articles from the press.<sup>12</sup>

Semantic value	Examples in Catalan	
	Conventional words	Neologisms
a. ‘radio’, ‘radio communications’	<i>radionovel·la</i> ‘radio serial’, <i>radiooient</i> ‘radio listener’, <i>radioaficionat</i> ‘radio-amateur’, <i>radiotaxi</i> , <i>radioenllaç</i> ‘radio link’, <i>radiodifusió</i> ‘broadcasting’,	<i>radiofórmula</i> , <i>radiodrama</i> , <i>radioteatre</i> , <i>radiotertúlia</i> ‘radio discussion group’, <i>radioafecció</i> ‘radio affinity’, <i>radioescolta</i> ‘listener’, <i>radiopirata</i> ‘pirate or illegal radio-amateur’,

*radiodespertador* ‘alarm clock-radio’). In the latter, the first constituent is not a prefixoid but instead a noun; *radiodespertador* is a compound formed by two nouns, that is, two autonomous roots.

<sup>12</sup> See Pérez Lagos (1985) for an analysis of the entries in the *Diccionario de la Real Academia Española* in which the Spanish equivalent of this formation appears.

	<i>radiotelèfon, radiotelègraf</i>	<i>radiopredicador</i> ‘radio preacher’, <i>radiopatrulla</i> ‘radio patrol car’, <i>radioemissor</i> ‘radio transmitter’, <i>radiocontrol...</i>
b. ‘radioactivity’	<i>radiodiàgnostic,</i> <i>radioteràpia, radioisòtop</i>	<i>radiocirurgia</i> ‘radio surgery’
c. ‘X rays’	<i>radiografia, radiologia</i>	
d. ‘radius bone of the forearm’	<i>radiohumeral</i>	

Table 2: The meanings of *radio-*

The meanings of *radio-* as compiled in Table 2 express the lowest common denominator in semantic terms for each group of complex words. This search for patterns in data often performed by linguists is also conducted by speakers, albeit in a more spontaneous manner. However, the patterns detected by one or the other are not necessarily the same (Bybee 1985: 131). The reason for this discrepancy is that linguists have traditionally adopted a *top-down* approach in order to form rules as general as possible (something that speakers do not always do). From a top-down perspective, subpatterns—at best—hold merely a marginal interest because they are considered *unnecessary*.

From a top-down approach, the first three meanings of *radio-* (Table 2.a-c) are irrelevant, as they could be included in a single hyperonym. The semantic value of ‘radiation’ could be attributed to *radio-* since all three cases deal with the emission and propagation of waves, either of a high frequency (radioactivity, X rays) or a low frequency (radio transmission). In a top-down approach, only two different meanings of *radio-* would need to be differentiated:<sup>13</sup>

- (14) a. *radio-* ‘radiation’ (meanings a-c in Table 2)  
b. *radio-* ‘radius bone of the forearm’ (meaning d in Table 2)

From this perspective, these two rules or patterns would be sufficient to account for all complex words formed with *radio-*. However, this simplicity or *economy* also has its

disadvantages. The description of data is very imprecise as it fails to account for the various semantic *subpatterns* corresponding to meanings (a-c). The information provided by these subpatterns would have to be individually attributed to each lexical entry as idiosyncratic information, and this rule would fail to reflect a subpattern easily observed by speakers, such as the one shared by the sample words in Table 2.a: *radionovel·la*, *radiooient*, *radiopirata*, etc. Thus, there would be no way of explaining why only one of the three meanings of *radio-* in (14.a) is productive: ‘radio, radio communications’ (Table 2.a). A final disadvantage of a top-down approach is the lack of plausibility of a rule with the meaning of ‘radiation’, as the cohyponymic relation between the meaning of *radio-* in *radiografia* ‘X rays’ and in *radionovel·la* ‘radio’ is fuzzy for many speakers.

Cognitive grammar adopts a bottom-up orientation because it is a usage-based approach. Thus, patterns of all levels are admitted, from the most general to the most specific. In this case, the pattern in the complex words with meanings (b-d) in Table 2 is probably not widespread enough in language for speakers to be able to analyze these words and recognize their meanings in the new formations. Moreover, only specialists would be able to relate the meaning of ‘radio’ with that of ‘radioactivity’ and ‘X rays’ by way of the hyperonym, or their common meaning, ‘radiation.’ Thus, it must be the case that the hyperonymic connection is absent from the mental grammar of speakers. The productive morphological pattern *radio-* shows only one meaning: the semantic value of ‘radio’, ‘radio communications’ (Table 2.a).

#### 4.3. Paradigmatic relations and neology

Traditionally, the formation of a neologism in Catalan like *radiopirata* ‘illegal radioamateur’ has been explained through morphological rules, such as the rule governing the prefixoid *radio-*. From this point of view, only one rule is needed to account for the neologism. The monorelational rule [ [*radio-*] [...]<sub>N</sub> ]<sub>N</sub> expresses the relationship between the prefixoid *radio-* and the base *pirata*, but does not take into

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<sup>13</sup> In addition to the semantic value of *radio-*, these two groups of complex words exhibit another important difference. The internal structure of words corresponding to meanings (a-c) in Table 2 is that of modifier-head; in contrast, words carrying the meaning (d) have a relationship of coordination. In the latter, *radio-* has an adjective function ‘related to radius’ that maintains a relationship of coordination with the other constituent, also an adjective (*humeral*, *carpal*, etc.), in such a way that *radiohumeral* means ‘related to radius and to the humerus’.

account all the paradigmatic relations that, together with contextual information, allow the speaker to encode and decode *radiopirata*.

Let us imagine that a reader of the following Catalan newspaper article encounters this neologism for the first time<sup>14</sup> (the underlined segments contribute to the understanding of the new word):

Un **radiopirata** crea el pànic en el trànsit aeri de Brussel·les. Un home ha aconseguit desencadenar el pànic entre els aviadors i els controladors aeris amb missatges que fa arribar als pilots que es dirigeixen a l'aeroport de Brussel·les. La policia està buscant intensament aquest fals controlador aeri, que domina perfectament el llenguatge internacional de l'aviació —en anglès—, aconsegueix arribar a les freqüències dels avions i els envia ordres que poden confondre els pilots. La policia sospita que el **radiopirata**, que actua des de finals de novembre, podria ser un antic pilot o controlador amb la intenció de provocar un accident. Encara que se'l busca per diferents indrets, els investigadors creuen que fa les seves transmissions des de la província de Limburg, a la frontera amb Holanda, i que podria fer-ho des d'un vehicle per evitar ser localitzat. (Avui 23/01/97)<sup>15</sup>

Given the contextual information, the reader of this news article will have a clear enough idea of what *radiopirata* means. The reader will not think, for example, that a *radiopirata* is a comical character—a sailor with a wooden leg and an eye patch—who enjoys listening to the radio. Nor will (s)he think that it is someone who makes pirate copies of songs or programs transmitted over the radio. In other words, (s)he will discard more than one *possible* meaning based on the meanings of the constituents of the neologism (a technique that evidently could not make any word formation rule for *generating* the neologism).

The contextual information could lead to an erroneous hypothesis regarding the meaning of the neologism. It could lead one to believe that *radiopirata* means 'fake air-

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<sup>14</sup> For expository purposes, we adopt the point of view of the reader who attempts to decode the neologism. For the inverse process of encoding, the speaker has the same linguistic resources at his or her disposal.

<sup>15</sup> 'A *radiopirate* created a state of panic in the air traffic surrounding Brussels. He succeeded in sowing panic in both aviators and controllers by transmitting messages relayed to pilots heading in the direction of the Brussels airport. Police are hunting the fake air-traffic controller, who is thoroughly familiar with international aviation terminology in English, able to reach the aircraft frequencies, and capable of sending messages that may confuse pilots. Police suspect that the *radiopirate*, active since late November, could be a former pilot or controller intending to provoke provoking an accident. Although the search is being conducted in various areas, the investigators believe that the pirate transmits his signals from the province

traffic controller' ("Police are hunting the fake air-traffic controller..."). The presence of the word in other contexts, together with the morphological analysis, is what allows the reader to extract the appropriate definition. In this example, the newspaper article published the next day provided more information: a *radiopirata* is a *radioaficionat* 'radio amateur' who has committed an illegal act.

Detingut el menor que alarmava l'aeroport de Brussel·les. El **radioaficionat** que, amb missatges falsos als pilots i controladors aeris, feia tres mesos que estava causant alarma a l'aeroport de Zaventem, a Brussel·les, és un menor d'edat, segons van informar ahir fonts oficials. El jove, apassionat de l'aviació i de les seves formes de transmissió, va ser detingut ahir i interrogat. Amb un perfecte domini de l'anglès i de les normes de transmissió, el jove **radioaficionat** donava ordres falses als pilots. (*Avui* 24/01/97)<sup>16</sup>

From a morphological point of view, neologisms are often characterized by their transparency and by their regularity. Thus, whenever a complex word is involved, in addition to the information contributed by the natural context in which the neologism appears, information provided by the morphological structure of the two words must also be considered. This structure emerges from the comparison of the neologism with other linguistic expressions that the speaker already knows. In our example, to get an idea of the meaning of *radiopirata*, the reader could relate this word to:

- a) other words that begin with the same morpheme *radio-* (*radionovel·la*, etc.), in particular those that refer to people (*radioaficionat*, *radiooient*, etc.),
- b) the noun *pirata* and the expressions *pirata aeri* 'hijacker', *pirata informàtic* 'hacker', in which *pirata* means 'person who performs an illegal, delinquent act'; the adjective *pirata* and the noun *radio*, and other expressions such as *còpia pirata* or *vídeo pirata*, in which *pirata* means 'illegal, delinquent.'

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of Limburg, on the border with Holland, and that he might be operating from a vehicle to avoid being tracked down.' (*Avui* 23/01/97)

<sup>16</sup> 'A minor who threatened the airport in Brussels has been arrested. The radio-amateur who, by transmitting false messages to pilots and air-traffic controllers, had been causing alarm at Zaventem Airport in Brussels for three months, is a minor, official sources said yesterday. The youth, passionate about aviation and its transmission systems, was arrested and questioned yesterday. Completely fluent in English and in transmission conventions, the young radio-amateur gave false instructions to pilots.' (*Avui* 24/01/97)

In summary, in order to encode and decode *radiopirata*, all other words with the prefixoid *radio-* are just as important as the members of the word family *pirata*. This is relevant because, in the expressions *pirata aeri* ‘hijacker’, and *pirata informàtic* ‘hacker’, the noun *pirata* no longer means ‘a sailor who robs and hijacks ships for plunder’ (see Fig. 4.a)<sup>17</sup> but ‘a person who commits an illegal, delinquent act’ (Fig. 4.a), and this is precisely what *pirata* means in *radiopirata*. In fact, the neologism *radiopirata* could be considered an exocentric compound (in contrast to *radioaficionat* ‘radio-amateur’). It is endocentric, however, if we consider the newly accepted semantic value of the noun *pirata* as ‘a person who commits an illegal act’, by which a *radiopirata* is a ‘person who illegally transmits messages by radio’.

The bottom of Figure 4 reveals two patterns. The first (e) is syntactic [[N] [ADJ]], and it includes a semantic relation of nucleus-modifier (as in *pirata aeri*). The second (f) is morphological because it is found in complex words formed with *radio-*, with an inverse semantic relation between its modifier and nucleus constituents (*radiopirata*).

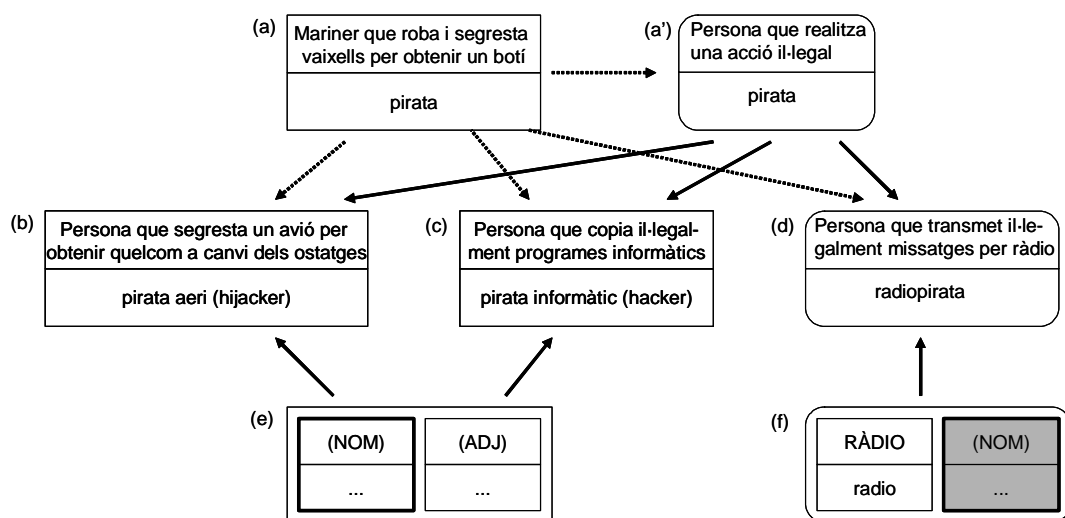


Fig. 4. Relation between *radiopirata* and the noun *pirata*<sup>18</sup>

<sup>17</sup> In line with Langacker’s work, we have represented the semantic pole for each grammatical unit (in the upper portion) and the phonological pole (in the lower portion); categorized relations are indicated by solid arrows (an established relation) or dotted arrows (an extended relation).

<sup>18</sup> (a) ‘Sailor who robs and hijacks ships for plunder’, (a’) ‘Person who commits an illegal act’, (b) ‘Person who hijacks a plane to gain something from hostages’, (c) ‘Person who illegally copies computer programs’, (d) ‘Person who illegally transmits messages by radio’.

Finally, speakers can also observe the relation between *radiopirata* ‘illegal radio-amateur’ and *ràdio pirata* ‘pirate radio station’, and other expressions in which the adjective *pirata* means ‘illegal, delinquent’: *còpia pirata*, *vídeo pirata*. This adjective has suffered a semantic evolution parallel to that of the homonymous noun. Whereas its original meaning was ‘related to pirates’ (see Fig 5.a), in the sense of ‘sailors...’ (e.g. *vaixell pirata*, or ‘pirate ship’), its latest use indicates ‘illegal, pirate’ (Fig. 5.a’) (e.g. *ràdio pirata* ‘pirate radio station’, *vídeo pirata* ‘pirate video’).

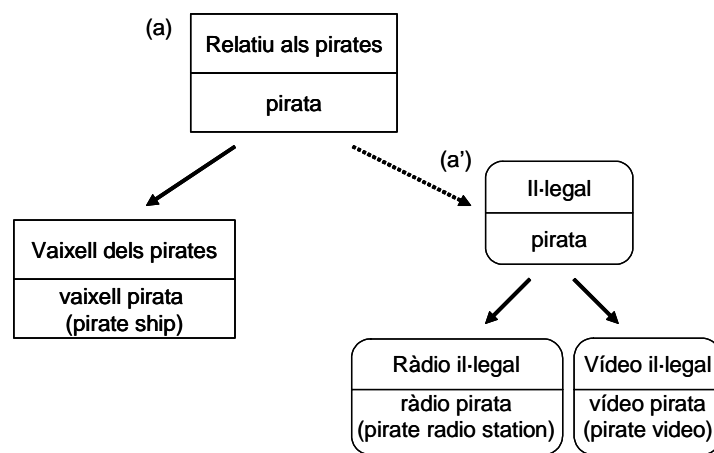


Fig. 5. *Ràdio pirata* and the adjective *pirata*

The categorized relations we have represented in these figures following Langacker’s morphological connections are equivalent to the Bybee’s lexical connections. Speakers may establish the following network of lexical connections for encoding and decoding *radiopirata*:



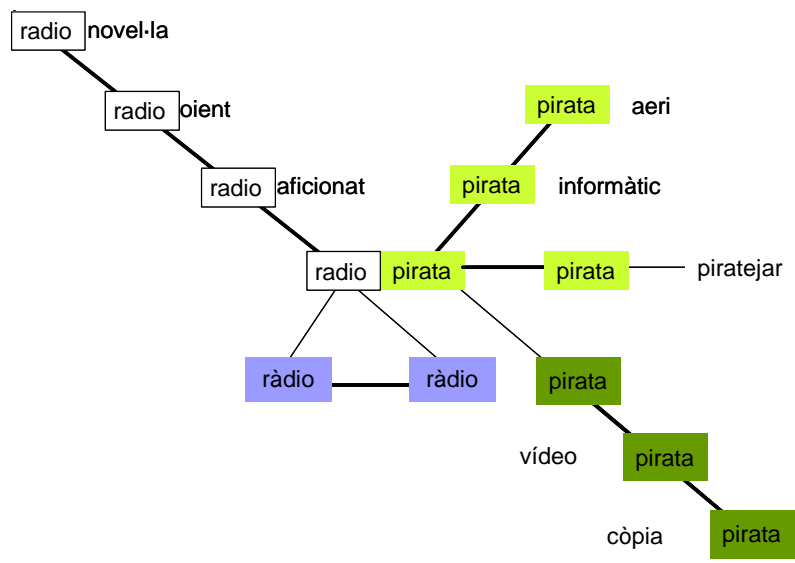


Fig. 6. Network of paradigmatic relations in *radiopirata*

This network of paradigmatic relations is composed of connections between words with identical or similar morphemes, and it provides relevant information to the speaker for the purpose of encoding and decoding the neologism *radiopirata*. Therefore, the formation of this word must be explained not just with regard to the prefixoid *radio-* but also with regard to all the paradigmatic relations that it maintains with other lexical units sharing common morphemes.

**5. Conclusions**

In this paper we have analyzed a topic in inflection (velar verbs of the second conjugation) and a topic in word formation (the prefixoid *radio-*) in the framework of Bybee’s network model. We have shown that the model can explain all possible paradigmatic relations between units of the lexicon, both in morphological relations and in those that go beyond morpheme boundaries or are not associated with any particular morpheme.

We have shown that low-level patterns and the paradigmatic relations of a local nature cannot be considered unnecessary *a priori* or grammatically insignificant. Following a bottom-up approach in cognitive morphology, we have illustrated that low-level patterns offer the advantage of specificity; that is, the great number of common traits that they represent can make them more *visible* and easier to recognize. The role of

low-level patterns can be explained by what some experimental studies call *perceptive salience*, or the ease of perception and recognition of a unit of the linguistic system by speakers (Chapman 1995; Goldschneider and Dekeyser 2001, Langman and Bayley 2002). In conclusion, linguistic analysis and psycholinguistic research point to the importance of incorporating low-level patterns into the morphological model.

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