

On the encyclopedic knowledge of gender

João Paulo Lazzarini
Cyrino
*Universidade de
São Paulo*
jpcyrino@usp.br

Paula Roberta Gabbai
Armelin
*Universidade de
São Paulo*
paula.armelin@usp.br

Rafael Dias Minussi
*Universidade Federal
de São Paulo*
rafael.minussi@unifesp.br

1. Introduction

In the Distributed Morphology framework (Halle and Marantz 1993, Marantz 1997 and much subsequent work), henceforth DM, it is assumed that two kinds of entities are present in the syntactic derivation: formal features and roots. An important difference between these syntactic primitives is that while features may undergo decomposition in operations like impoverishment, fission and fusion, roots, on the other hand, are not subject to this kind of decomposition.¹ In this scenario, a central question that has been discussed in the literature is how the root is licensed with regard to gender features.

Given the idiosyncratic relation that seems to hold between nouns and their gender in many languages, a common solution in the literature is to equip the root or the stem with a gender diacritic, which should determine the gender of the formations in which the relevant root appears. This strategy can be found in approaches developed both outside DM (Alexiadou and Müller 2008) and inside the DM framework (Alcântara 2003, 2010). Empirically, however, treating gender as a root property is very problematic, since cases in which the very same root surfaces with more than one gender are not hard to find and this is unexpected if gender is a characteristic of the root itself.

(1) Brazilian Portuguese

- a. *o poeta/ a poeta*
the.M poet/ the.F poet
'the poet'
- b. *o chefe/ a chefe*
the.M boss/ the.F boss
'the boss'

(2) Brazilian Portuguese

- a. $\sqrt{\text{menin}}$ – *a menina/ o menino*
 $\sqrt{\text{girl}}$ the.F girl/ the.M boy
'the girl' / 'the boy'
- b. $\sqrt{\text{gat}}$ – *a gata/ o gato*
 $\sqrt{\text{cat}}$ the.F cat(M)/ the.M cat(M)
'the female cat' 'the male cat'

¹ Arad (2005) claims that roots are not atomic concepts. The non-decompositionality of roots is relevant to the theoretical model as a distinctive factor between roots and formal features. It may be possible that the roots are, in some sense, decomposed, provided that the relevant processes take place in different domains than those decomposing formal features. Otherwise, there would be no distinction between roots and formal features. In other words, roots are atomic elements for the system, which manipulates atoms, but this does not prevent them from being constituted by protons and electrons and there might be a subsystem that manipulates these ontologies.

In the DM framework, assuming that roots have gender features also raises theoretical complications. As pointed out by Acquaviva (2009), equipping the root with a feature that gives clues about the categorial formations in which the relevant root may appear ultimately means that these roots are not completely devoid of category, contrary to what is proposed by DM.

In the face of this impasse, some authors have been proposing that gender information is not on the root itself, but on the element that turns this root into a noun, namely the categorizer *n*. In this view, the relation between the root and the flavors of *n* is responsible for licensing the roots with respect to the gender features (Acquaviva 2009, Kramer 2012). In this kind of approach, post-syntactic licensing conditions specify which roots may occur with which gender features. The prediction of approaches that rely on licensing conditions is that any incompatibility between what the relevant condition states and the gender that surfaces in the syntactic structure would result in a non-convergent morphosyntactic structure. However, this prediction is not empirically supported by Brazilian Portuguese data, henceforth BP.

In BP it is possible that the expected gender is incompatible with the gender feature present in the syntactic structure and this does not lead to ungrammaticality.

(3)

- a. *A garrafa está na minha casa.*
 the.F bottle(F) is in my.F house(F).
 ‘The bottle is in my house.’ or ‘A girl whose nickname is ‘bottle’ is in my house.’
- b. *O garrafa está na minha casa.*
 the.M bottle(F) is in my.F house(F).
 ‘*The bottle is in my house.’
 ‘A guy whose nickname is ‘bottle’ is in my house.’

(4)

- a. *A bola está na minha casa.*
 the.F ball(F) is in my.F house(F).
 ‘The ball is in my house.’ or ‘A girl whose nickname is ‘ball’ is in my house.’
- b. *O bola está na minha casa.*
 the.M ball(F) is in my.F house(F).
 ‘*The ball is in my house.’
 ‘A guy whose nickname is ‘ball’ is in my house.’

In (3b) and (4b) there is a clear mismatch between the gender of the determiner and the gender of the noun. However, (3b) and (4b) are perfectly interpretable in a context in which ‘bottle’ and ‘ball’ are related to animate entities in the world. The grammaticality of these sentences is totally unexpected under approaches that either equip the root/stem with gender features or rely on licensing conditions.

Once there actually is the possibility that the computational system generates structures with gender incompatibility, it makes sense to assume that the value of the gender feature on the noun is irrelevant to syntax and to morphology. In this sense, we claim that gender licensing should be treated as an epiphenomenon of the Encyclopedic interpretation.

In our approach, gender information is interpreted as sets in the Encyclopedia, the list that stores the speaker’s non-linguistic knowledge. In BP, for example, the Encyclopedia may be composed by two different sets: one with feminine entities and another one with masculine entities. Whenever a structural association between the root and the gender features is sent to the Encyclopedia, there is a checking operation which verifies if the relevant entity is

included in the correspondent gender set. If the inclusion is not verified, that is, once there is incompatibility between the gender features generated in the syntactic structure and the gender features expected at the Encyclopedia, this association is considered to be false, leading to a violation of the Grice's Maxim of Quality (Grice 1989). This violation triggers a semantic rescue operation similar to, for example, the one triggered in the interpretation of metaphors or idiomatic expressions. A common consequence linked to gender mismatch in BP is to confer animacy to the relevant noun, which, by its turn, shares some properties with the semantics of the root.

An important point to highlight is that our analysis does not rely on other mechanisms than the ones traditionally assumed in the DM framework. Our proposal offers a simple and uniform explanation for gender mismatch, metaphors and idiomatic expressions. Besides, our proposal provides a straightforward answer for the expected association between roots and gender features. These associations are the result of the proper Encyclopedic organization that results from the speaker's world knowledge.

2. On gender and the feature checking approach

In this section we discuss some proposals which treat gender as a feature that has to be submitted to a checking system. This checking operation was proposed to occur through Agree (Alexiadou 2004) or through licensing conditions (Kramer 2012).

Alexiadou (2004) claims that the gender feature is independent from inflection class, presented by some languages, as Spanish and Greek, for example. The proposal is that the class feature is an inherent property of noun stems. When it comes to gender, however, some noun stems are inherently specified for gender, while others acquire gender by rule. In the same sense, Alexiadou (2004) does not consider gender to be a functional projection, in opposition to number inflection.

Kramer (2012), analyzing data from Amharic, a Semitic language, develops an analysis of gender based on two central elements: (i) the division between natural gender and grammatical gender and (ii) the licensing conditions. The hypothesis is that gender is an *n* feature and that the feature specification of the categorizer varies in type (interpretable vs. non-interpretable) and value (feminine vs. masculine). In this sense, natural gender is considered to be interpretable, whereas grammatical gender is considered to be uninterpretable. The inventory of *n* is the following:

(5) Types of <i>n</i>		
a. <i>n</i> i [+FEM]	female natural gender	Interpretable
b. <i>n</i> i [-FEM]	male natural gender	
c. <i>n</i>	no natural gender or natural gender unknown	
d. <i>n</i> u [+FEM]	feminine grammatical gender	Uninterpretable

(Adapted from Kramer 2012: 10)

The categorizers in (5a-b) present a correlation between gender and sex and are interpretable. The categorizer in (4d) expresses grammatical gender and it is considered to be uninterpretable. The *n* in (4c) is the *default*, and since the masculine gender is the default in Amharic whenever the other categorizers to be inserted are not specified enough, the masculine is going to surface. In this sense, there is no necessity to specify an *n* with masculine grammatical gender (u [-FEM]), the masculine being the *default*.

The central question is then how to make the right *n* surface with the right root. To solve this problem, Kramer (2012) relies on Acquaviva (2009) and proposes that licensing conditions are necessary to effect the pairing between roots and the different kinds of *n*. The licensing conditions are post-syntactic indications that determine which roots are compatible with which gender values. It is important to remark that the association between the roots and the insertion contexts leads to the problem that the very same root may appear with more than one gender in the languages. This is almost the same problem which is found in approaches that specify the root with a gender diacritic. Besides that, the central problem with the licensing conditions approach is an empirical one: it predicts that the incompatibility between the gender specified by the relevant condition and the gender generated by the syntactic structure should result in an ungrammatical morphosyntactic structure. BP data show, however, that no gender value might be à priori specified in the formal linguistic component, since any noun in BP may be paired with either feminine or masculine. This gender switching has semantic consequences, but what we want to emphasize is that the result is definitely grammatical.

(6)

- a. *A bola chegou.*
the.F ball(F) arrived.
'The ball arrived' or 'A girl whose nickname is 'ball' arrived.'
- b. *O bola chegou.*
the.M ball(F) arrived.
'A guy whose nickname is 'ball' arrived.'
- c. *A garrafa chegou.*
the.F bottle(F) arrived
'The bottle arrived.' or 'A girl whose nickname is 'bottle' arrived.'
- d. *O garrafa chegou.*
the.M bottle(F) arrived
'A guy whose nickname is 'bottle' arrived.'

In the sentences (6b) and (6d) there is a mismatch between the gender that is expected to be specified in a possible licensing condition and the gender of the determiner. However, these sentences are easily interpreted and the noun is related to animate entities in the world. In this sense *a bola* - with the feminine determiner - and *o bola* - with the masculine determiner - share properties like 'being round', for example. In this sense, the interpretation that 'somebody fat has arrived' is easily associated with the sentence (6b). The same applies to *a garrafa* - with the feminine determiner - and *o garrafa* - with the masculine determiner. They also share properties, like 'being related to drink', and the interpretation that 'somebody who drinks a lot has arrived' is easily linked to (6d). It is important to emphasize that the relevant nouns in the sentences (6a) and (6c) may also have the interpretation of animate entities. This means that the process that turns non-animate into animate nouns is not exclusive to the cases of gender mismatch.

The gender incompatibility above discussed is a general one in BP: any noun of the language may have its expected gender switched, provided that the relevant noun is interpreted as an animate entity. This phenomenon, however, is unexpected under the approach that relies on licensing conditions.

Interestingly the grammaticality of the data in (6b) and (6d) contrasts with the ungrammaticality in (7c-d) below, where there is an incompatibility of gender agreement between the determiner and the adjective.

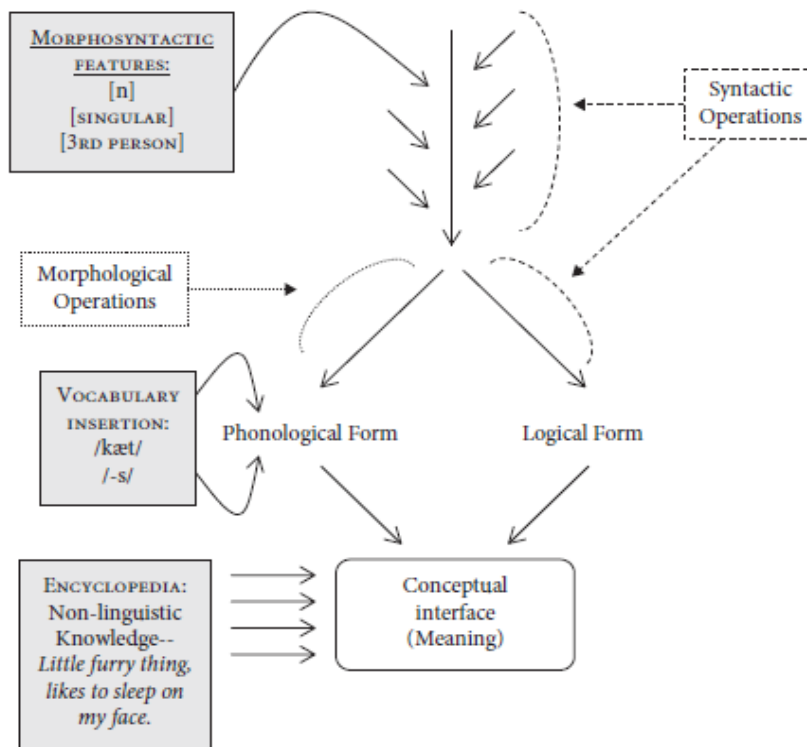
- (7)
- a. *A bola é redonda.*
the.F ball(F) is round.F
'The ball is round' or 'A girl whose nickname is 'ball' is round.'
 - b. *O bola é redondo.*
the.M ball(F) is round.M
'The ball is round' or 'A guy whose nickname is 'ball' is round.'
 - c. **A bola é redondo.*
the.F ball(F) is round.M
 - d. **O bola é redonda.*
the.M ball(M) is round.F

If it is possible for the computational system to generate structures with gender incompatibility, then the value of the gender feature needs to be irrelevant for syntax and for morphology. In this sense, we propose that the gender licensing may, in fact, be treated as an epiphenomenon of the Encyclopedic interpretation.

3. On the encyclopedic knowledge

In this section, we intend to characterize the non-linguistic knowledge that speakers of a language possess. In the DM framework, this knowledge is placed in a list known as the Encyclopedia, which interfaces both with the Phonological Form (PF) and with the Logical Form (LF). To illustrate that, we assume the architecture of grammar as it is postulated by DM.

Figure 1: Architecture of Grammar (Siddiqi 2009: 14)



Considering that DM is a non-lexicalist theory, in other words, a theory that advocates against the existence of a generative Lexicon (see Halle and Marantz 1993), then the properties

formerly attributed to the Lexicon have to be distributed to the above Architecture of Grammar.

The DM architecture is composed of three lists. List 1 is the list of morphosyntactic features and it contains the building blocks that feed the syntactic derivation. The morphosyntactic features are of two types: grammatical features (as number, person, tense and category, for example) and acategorial roots .

The morphosyntactic features in List 1 are abstract in the sense that they are devoid of phonological content. Phonology is only going to be inserted post-syntactically through a morphological operation known as Vocabulary Insertion. At this point List 2, also called the Vocabulary, is activated. This list contains the Vocabulary Items (henceforth VI), which are phonological rules that link the phonological content to the bundles of features located at the terminal nodes.

The third list is the Encyclopedia, whose content is the target of this work. This list contains the contextual special meanings attributed to roots and expressions and the world knowledge of the speaker. According to Harley and Noyer (2000), the Encyclopedia associates phonological expressions with meanings. The encyclopedic knowledge can interfere in the grammaticality of sentences. This is exactly the point that we explore in the next subsection, based mainly on Harley and Noyer (2000), one of the few works which explores the functioning of the Encyclopedia.

3.1. The encyclopedic knowledge and the structure of sentence

Harley and Noyer (2000) propose that the formal properties of the VIs determine their distribution in the sentence. These properties are intended to replace both the thematic roles and the mechanisms of selection. Thus, these formal properties of VIs determine if an expression is grammatically well-formed. Nevertheless the encyclopedic properties may influence the speaker's judgment on the proper use of certain expressions.

To illustrate this fact, the authors use the sentence 'John's growth of tomatoes', stating that its anomaly does not come from its syntactic structure or from the formal properties of VI 'grow', but it results from the encyclopedic knowledge itself. The central point of the argumentation is that the Encyclopedia assures that growing is a spontaneous activity (caused internally, according to Levin and Rappaport Hovav 1995), and, in this sense, the subject of the nominalization of 'grow' is not pragmatically constructed as an agent. Therefore, the authors attribute this kind of anomaly to the combination of the encyclopedic knowledge with the semantic type associated with certain syntactic structures.

Besides nominalizations, the authors use other evidence to show how the ill-formedness of an expression could be related not to its formal properties, but instead to pragmatic factors attributed to encyclopedic knowledge.

According to these authors, it is the syntactic structure that leads a particular verb to be interpreted as transitive or intransitive. For example, consider the sentences below:

(8)

- a. *The sun melted the snow.*
- b. *The snow_i melted t_i.*

In a lexicalist theory, one would say that the lexicon hosts two different verbs MELT (an intransitive one and a transitive one). Each verb 'melt' would be assigned specific thematic roles and, therefore, would project distinct syntactic structures. In this sense, the lexicon is responsible both for creating verbs and for relating them. In the DM framework, on the other hand, in the absence of a lexicon, it is argued that there is a single VI MELT. The interpretation

of ‘melt’ as a transitive or as an intransitive verb depends on the syntactic structure into which it is inserted.

This ultimately means that the structure in (8a) forces an interpretation in which the sun is doing something and the snow is undergoing this event. Harley and Noyer (2000) call this aspect of the meaning of a sentence its *structural semantics*.

However, the authors make it clear that a VI cannot be licensed in any structure. Thus, what, in fact, could cause the ill-formedness of a sentence? We will look at the sentences below to illustrate this question:

(9)

- a. *Chris thought the book to Martha.*
- b. *The bridge exploded the engineers.*
- c. *The red under did not five lunch.*
- d. *James put yesterday.*

The ditransitive structure in (9a) has a canonical interpretation: the subject (Chris) is an agent, the direct object (the book) is the theme and the indirect object (to Martha) is the target. Thus, although a verb such as ‘to think’ does not usually appear in this type of ditransitive structure, it is still possible to attribute an interpretation to the sentence. In this sense, the authors claim that the interpretation is subject to a process of *structural coercion* of the meaning of the verb ‘think’. In (9b), the interpretation that must be given is that the bridge is causing the exploding (a thing bridges do not normally do), while the engineers who are shattered by the explosion.

The sentences in (9c) and (9d) differ from those in (9a) and (9b). So, (9c) is only interpretable if ‘the red’ was something capable of being the subject of the sentence and ‘five’ was something capable of being a verb, but this is clearly not the case.

In this way, what Harley and Noyer (2000) have proposed is a theory of licensing that ensures the grammatical conditions under which the VIs are inserted into syntactic structures. In this theory, the sentences in (9c) and (9d) are marked by the grammar as ill-formed, i.e. ungrammatical (*), and non-interpretable under any circumstances, because the VI ‘under’, ‘five’ and ‘put’ are not properly licensed. The underlying syntactic structures of these sentences, however, are well-formed, since they are the same structures that ordinarily occur in sentences such as: ‘the tall man did not eat lunch’ or ‘James swam yesterday’. In contrast, the sentences in (9a) and (9b) are not ill-formed, but they are pragmatically anomalous.

The central conclusion is that there is a difference between sentences which are ungrammatical for structural reasons (because their VI are not licensable) and those which are rejected due to the speakers’ world-knowledge. If this reasoning is on the right track, it is possible to say that the sentences *O bola está na minha casa* ‘The.M ball(F) is in my.F house(F)’ and *O garrafa chegou* ‘The.M bottle(F) arrived’ are not syntactically ill-formed sentences, since all their VIs are perfectly licensable and since the structure in which these items are licensed is the very same structure which licenses a sentence as *O João está na minha casa* ‘The.M John(M) is in my house’, for example. The mismatch, which causes a new interpretation of the sentence, is the result of a reanalysis based on world knowledge.

In the next section, we will see how this encyclopedic knowledge is important for the licensing of sentences like (3b) and (3d), and we will discuss what information is actually listed in the Encyclopedia.

4. What is inside the Encyclopedia?

The most basic formulation of the Encyclopedia (see Marantz 1997) is that it consists of a list of roots, which in certain specific syntactic contexts show non-compositional readings. This means that the Encyclopedia limits itself to a list of exceptions, of “lexicalized” meanings. That is what we can call a Restrictive Encyclopedia. However, Harley and Noyer's (2000) proposal requires an Encyclopedia that also has systematic and compositional meanings of a language. Hence it is necessary to assume that the Encyclopedia relates roots to the speakers' world knowledge. This is, thus, a Generalist Encyclopedia contrasting with the previous basic formulation.

We assume that this concept of Encyclopedia brings more coherent consequences within the Distributed Morphology framework. A Generalist Encyclopedia provides a straightforward account for mismatches such as those of argument structure and gender. This section sketches what we call the Generalist Encyclopedia and how it can explain gender mismatches.

The most common conception of the Encyclopedia is that it is a list just as the Vocabulary Items list: a correspondence between formal features and phonological features. The example below is the default plural rule in Portuguese:

(10) [+pl] → /s/

In the case of the Encyclopedia, the list would be quite similar, except for the fact that it relates the outputs of the Syntactic derivation to special meanings.

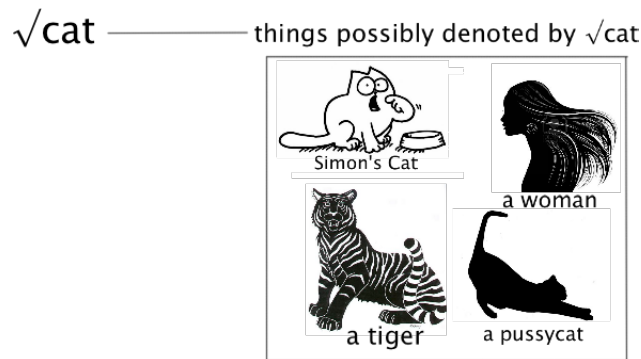
(11)	“bucket”	→	‘a container’
	“kick the bucket”	→	‘to die’
	“cat”	→	‘a fuzzy animal’
	“raining cats and dogs”	→	‘raining too much’

This approach is, nevertheless, too simplistic and it doesn't allow us to visualize all the features of a list responsible for relating derivational output and meaning. We propose a structured list account for the Encyclopedia. Such a list is organized in terms of concepts and sets, which are referred to by roots and grammatical features. A concept can be a member of an infinite number of sets, making the Encyclopedia an open list representing the world knowledge of the speaker (or interfacing with it).

In terms of Architecture of The Grammar, the Encyclopedia is associated with LF and the interface of the Syntactic Derivation with the Conceptual/Intentional module of the mind². It is crucial in this sense that the formalism used to refer to the Encyclopedia is compatible with that used to deal with interpretation phenomena of the derivational output. Two characteristics are important: the first one is that roots and some grammatical features constitute sets within the Encyclopedia containing all the concepts referred to by them.

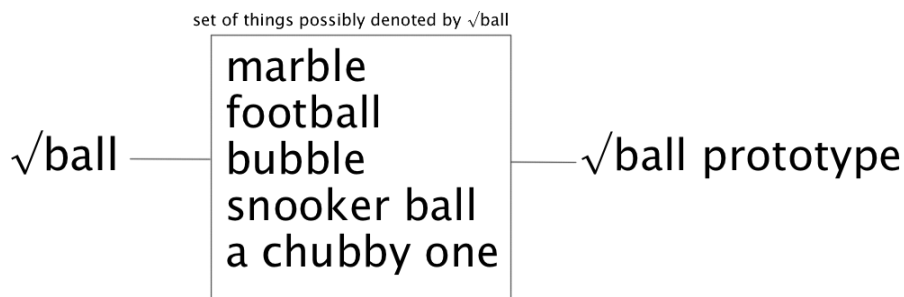
² Although we don't take into account this discussion, it may be important to mention that some authors also relate the Encyclopedia to PF, besides LF.

Figure 2: A root denotes a set of concepts



The second one is that the denotation of a set corresponds automatically to the denotation of a prototype: an abstraction of all the members of that set. Hence, if the Computational System derives a structure containing only one root, and this derivation is convergent, for the Encyclopedia this structure does not denote one concept member of the set correspondent to the root: it denotes an abstraction of all the concepts which constitute the set they belong to.

Figure 3: Denotation of a single root is the denotation of its prototype



Following such a mechanism, the more information is brought to the Encyclopedia by the derivation, the more specific should be the denotation.

As mentioned earlier, some grammatical features can be relevant to the structuring of Encyclopedic Knowledge. We believe gender, at least in Brazilian Portuguese, to be one of them. In the language, gender information cannot be considered relevant only for inflection purposes, in contrast to declinations or verbal conjugation patterns. Besides the phenomena presented in this paper, the relevance of gender to semantic interpretation is also seen in phenomena of referential dependence of DPs (Reinhart and Reuland, 1993; Menuzzi 1999), enriching the debate on syntactic restrictions of anaphors.

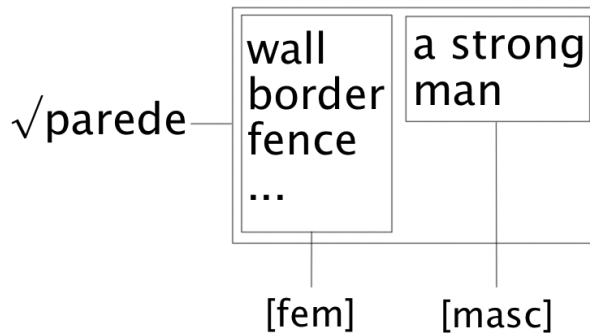
Let us assume that Portuguese speaker's Encyclopedia has two large sets represented by the grammatical features [M] (masculine gender) and [F] (feminine gender). All the concepts of Brazilian Portuguese are members of one of these two concepts, and the speaker learns that from clues given by the language's grammar. We can say, then, that these features can act in a set of roots to specify the denotation. See below:

(12)

- a. *Eu vi o Jonas conversando com a parede.*
I saw Jonas talking to the.F wall(F).
- b. *Eu vi o Jonas conversando com o parede.*
I saw Jonas talking to the.M wall(F).

Both sentences are grammatical and it is possible to say that the word *parede* ‘wall’ represents the same root in both cases. However, it is more probable that *parede*, in the first case, refers to the wall literally while in the second case, it refers to a human person that is so called because of showing some properties in common with the literal wall. This distribution of meanings can be represented in the Encyclopedia in the following way:

Figure 4: The meaning of $\sqrt{\text{parede}}$



As we can observe, the “Encyclopedic entries” are, actually, the sets to which roots and grammatical features refer. If the derivation provides a structure which is interpreted as the conjunction between the root $\sqrt{\text{parede}}$ and the feature [F], the Encyclopedia will map the intersection of the sets $\sqrt{\text{parede}}$ and [F]. On the other hand, if the derivation provides $\sqrt{\text{parede}}$ and [M], the intersection between $\sqrt{\text{parede}}$ and [M] will be mapped and this will necessarily correspond to a more specific, metaphoric interpretation.

Considering that the Encyclopedia is an open inventory list, it is possible for new concepts to be added at any moment or even to be created through *structural coercion*, from the simply convergence of certain syntactic structure. In the cases of gender *mismatch* a frequent effect is the denotation of a personified entity. We believe this to be an epiphenomenon of the Gricean Maxim of Relevance (see Grice 1989). If an element occurs with a different gender feature than the expected one, it should be because this gender difference is relevant. In a language like Portuguese, in which grammatical gender is related somehow with sex, the personified interpretation is the most probable.

5. Final Considerations

This paper investigated, from within the Distributed Morphology framework, the licensing of roots with respect to gender information: a crucial problem to the model. We based our discussion in Brazilian Portuguese pairs such as *a bola* ‘the.F ball(F)’ / *o bola* ‘the.M ball(F)’ in which the mismatch between root and gender does not lead to ungrammaticality, but confers animacy to the noun. Therefore we pointed out the inadequacy of post-syntactic licencing conditions proposed in the literature (cf. Acquaviva 2009, Kramer 2012), which predicts ungrammaticality to the mismatch between root and gender: clearly not the case for Brazilian Portuguese. As an alternative, we propose that gender information should be accounted for as sets within the Encyclopedia. Thus, whenever a structural association between root and gender feature is sent to the Encyclopedia it should undergo an operation verifying whether the referred entity is included in the correspondent set. When it is not included (a gender mismatch), a semantic rescue operation, of the same nature as metaphors and idiomatic interpretations, is triggered. Gender licensing is, therefore, taken as an epiphenomenon of Encyclopedic interpretation.

Two consequences of the present proposal are crucial. The first one is that gender features are constituted as labels to two large Encyclopedic sets. This means that roots do not present

an inherent gender feature that must somehow be checked for means of structural convergence. In this case, the second consequence is that nouns do not need to bear gender features. Maybe only determiners and adjectives bear them, with an agreement relation between one another. In this case, a noun may only have its interpretation specified in terms of gender when it comes together with a determiner or adjective.

The main advantage of this account is that it does not rely on extra mechanisms besides those already traditionally assumed with the Distributed Morphology framework. In this sense, our proposal provides a simple and uniform explanation for the incompatible relations between gender and root, metaphors and idiomatic expressions.

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