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Spatial Prepositions as Kind-level Predicates: on the Existence of Spatial Entities[1]

Preposições Espaciais como Predicados Instanciadores de *Kind*: sobre a Existência de Entidades Espaciais

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RESUMO: Neste trabalho, discutimos, no quadro da Nanossintaxe e da Semântica Formal, a natureza do argumento interno das preposições espaciais (PEs), denominado GROUND. Com isso, revisitamos o papel atribuído a essa classe na literatura, argumentando que a ontologia mobilizada nos estudos linguísticos deve contar com entidades espaciais de tipo $< l >$, que são de natureza abstrata e denotam *kinds espaciais*. Nesse sentido, o GROUND é uma entidade do tipo $< l >$ e faz referência a uma classe, o que, por sua vez, exige um predicado instanciador, papel amplamente atribuído nas sentenças de língua natural às PEs. Defendemos que o traço de Região [Reg], sugerido inicialmente em Romeu (2014), atua como um núcleo sintático de livre acesso, sendo responsável pela criação dessas entidades espaciais, constituídas a partir de um objeto ordinário. Para dar conta da instanciação dessas entidades abstratas criadas por [Reg], atribuímos ao traço de Lugar [Loc], lexicalizado pelas preposições espaciais [P_{loc}], o predicado de realização, conforme definido por Carlson and Sussman (2005). Nesse sentido, este trabalho coloca as PEs como uma classe *sui generis* dentre as preposições, pois demonstra que esses itens são predicados capazes de selecionar, manipular e instanciar um nível de referência específico, o das entidades espaciais, associadas ao argumento GROUND.

PALAVRAS-CHAVE: Preposições espaciais; Entidades espaciais; Nanossintaxe; Semântica Formal.

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ABSTRACT: In this paper, I discuss the nature of the internal argument of spatial prepositions (SPs), namely GROUND, within the framework of Nanosyntax and Formal Semantics. I revisit the role attributed to this class in the literature, arguing that the ontology mobilized in linguistic studies must rely on spatial entities of the type $< l >$, which are abstract in nature and denote *spatial kinds*. In this line, the GROUND argument denotes an entity of the type $< l >$ and makes reference to a class, which, in turn, requires an instantiating predicate, a role widely attributed in natural language sentences to SPs. I argue that the Region feature [Reg], suggested initially by Romeu (2014), acts as a free access syntactic head, being responsible for the creation of these spatial entities, constituted from an ordinary object. To account for the instantiation of these abstract entities created by [Reg], we can assign the realization predicate, as defined by Carlson and Sussman (2005), to the feature [Loc], lexicalized by the spatial prepositions [$Ploc$]. In this sense, this work places spatial prepositions as a *sui generis* class among the prepositions, as it demonstrates that these items are predicates capable of selecting, manipulating and instantiating a specific reference level, that of spatial entities, associated with the GROUND argument.
KEY-WORDS: Spatial Prepositions; Spatial entities; Nanosyntax; Formal Semantics.

Introduction

Prepositions have been one of the greatest research topics in formal linguistics in the last two decades, given the amount of widely circulated papers and textbooks dedicated to this grammatical class (e.g. Svenonius, 2006; 2010; Asbury et al., 2008; Cinque & Rizzi, 2010; Pantcheva, 2011; Garzonio & Rossi, 2020). In this paper, I intend to contribute to this topic by investigating spatial prepositions (SPs) in a syntactic-semantic framework, focusing on the internal argument of this type of predicate. I argue that spatial prepositions are a *sui generis* type within the class of prepositions, as they are capable of manipulating a specific reference level of spatial entities, associated with their internal argument.

In the literature, it is assumed that spatial prepositions are relational predicates, which convey a location between two entities, named FIGURE and GROUND (Talmy, 2000). Roughly, when referring to objects in the world, we can either identify or locate these objects (Jackendoff, 1983, p. 50), and when we employ the second operation, we associate an individual to a space. In this sense, spatial prepositions would relate entities of different natures: from the domain of individuals (FIGURE) and from the spatial domain (GROUND). In the sentences below, in (1a) the FIGURE "Ana", which refers to an individual, is located in the space that conFIGURES the GROUND "the hospital", a region; in (1b), the FIGURE "Pedro", also an individual, is moving towards the region-GROUND "the hospital". In (1b), the region that "the hospital" occupies is interpreted as the target or goal-place of the movement event, because the event involves a path. Semantically, the notion of region to which we associate the GROUND is treated as referring to a set of unstructured spatial points (cf. Ferreira 2021).

(1) a. Ana está no hospital.
'Ana is at the hospital'
b. Pedro correu para o hospital.
'Pedro ran to the hospital'

In the cartographic research tradition, although much has been discussed about the syntax involved in the composition of a spatial PP (Cinque & Rizzi, 2010; Svenonius, 2006, 2010; Pantcheva, 2011; Terzi, 2017), very little is said about the semantics associated with the syntactic heads mobilized to convey a place relationship[3]. While it is emphasized that the GROUND on which the FIGURE is located is a space, from the point of view of linguistic composition, this internal argument of the preposition is treated as referring to an ordinary individual (an entity of type <e>), not to the spatial domain (composed of entities of type <l>). This fact can be observed, for example, in the structure below, from Koopman (2000), in which there is nothing that guarantees an interpretation of space for GROUND. As this argument is associated with a DP, its reference is necessarily an individual of type <e> (Partee 1986).

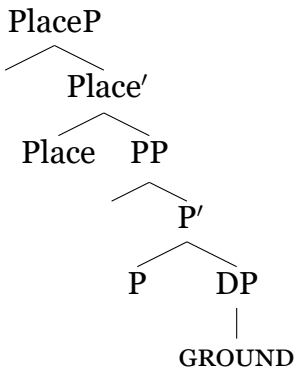


Figure 1: Koopman's spatial hierarchy (2000) and the GROUND as a $DP_{<e>}$

This mismatch between what has been proposed for the syntax of spatial prepositions and the research on semantics of these items does not appear without consequences. One of them is the fact that we can be led to propose the existence of certain heads for the PP architecture that actually belong to another domain. This is the case of the "axial part" feature, first suggested by Jackendoff (1996) and incorporated into the syntax by Svenonius (2006).

According to Jackendoff (1996, p. 14-24), there are, in natural languages, a series of items specialized in indicating the projection of axes departing from a given object to the space that surrounds it. In this sense, the head of prepositional phrases like 'in

[3] It is important to highlight that only three semantic studies have been widely used and discussed in the research of spatial prepositions: Jackendoff (1983), Wunderlich (1991) and Zwarts & Winter 2000.

front of' or 'next to' and certain dimensional adjectives, such as 'high' and 'wide', are axial items, because they refer to the projection of an axis in space. When we consider only the class of prepositions, in general the so-called prepositional phrases contain an axial part, conveyed by items such as 'topo' in Brazilian Portuguese, 'front', in English, and 'taxat' ('under'), in Hebrew. In common, these elements indicate the projection of a spatial region from an axis, as opposed to indicating a part of an object identified from that axis. That is, the phrase 'front of' in 'the front of the house' can either be interpreted as "the front wall of the house", when it is an object, or it can refer to a place identified "in front of the house", where the relevant interpretation is not the object, but the region.

Assuming, then, the existence of "axial parts" as elements that can have spatial reference, in addition to the object interpretation, Svenonius (2006) argues that lexemes as 'front', in the spatial PP 'in front of', exhibit neither nominal nor prepositional behavior, so they would lexicalize a functional special feature called "axial part" ([AxPart]), responsible for its hybrid nature. This feature would prohibit, for example, modification for axial items interpreted as a space (2a), as well as it restricts the possibility of determination for the class (2c).

(2) a. *There was a kangaroo in smashed-up front of the car.
*Tinha um canguru em frente amassada do carro.
b. There was a kangaroo in the smashed-up front of the car.
??Tinha um canguru na frente amassada do carro.
c. *O canguru está no trás na casa.
The kangaroo is in the back in the house

This proposal, widely accepted in the literature, cannot be sustained when we look closely at the semantics of axial parts. According to Matushansky and Zwarts (2019), Basso and Ferreira (2020) and Ferreira (2021), axial terms are actually weak definites, that is, items like 'front', 'behind' and 'side' have a peculiar behavior not because they lexicalize a specific functional head, but because they are definite nouns with particular characteristics, such as numerous modification restrictions ('Ana camped in the middle of the rainforest' vs. '*the kangaroo is in the smashed-up front of the car') and enriched meaning, characteristic of nominal elements (cf. Carlson & Sussman, 2005).

Considering this type of problem, this work aims to fill the gap between the study of the syntax and the semantics of spatial prepositions, contributing with a theoretical discussion about the nature of the GROUND argument and the role of spatial prepositions in sentences. Our proposal is that GROUND should be interpreted as a spatial entity of a particular type, a *spatial kind*. The idea is that the DP 'the market' in a sentence like (3) below does not refer to an ordinary object (of type <e>), i.e. a particular commercial

facility, but to an entity from an abstract level of reference, namely, the region that this type of structure can occupy (of type <l>). This accounts for the intuition present in the literature that spatial prepositions relate an individual (FIGURE) to a space (GROUND).

(3) Ana está no mercado.
Ana is in the market.

As it is recognized since Carlson (1997), elements that refer to a kind require a predicate able to realize them, providing an exemplar of the species (Carlson & Sussman, 2005; Aguilar-Guevara, 2014). This is needed because in each sentence of natural languages we are dealing with a particular individual of the species and not with the class as a whole, thus spatial arguments, by denoting a kind, would require a predicate that is able to instantiate them. Because of this, spatial sentences built without prepositions are ungrammatical: as there is no predicate capable of performing the GROUND argument, derivation clashes, as the ill-formed sentences below illustrates[4].

(4) a. *Ana está casa.
'*Ana is in/inside house'
b. *Pedro escreveu o envelope.
'??Pedro wrote the envelope'
c. *O gato está baixo da mesa.
'*The cat is bottom the table'

In order to argue that the internal argument of a spatial preposition (GROUND) refers to the spatial domain and to justify the realization function attributed to the preposition, this work relies on the theoretical framework of Nanosyntax and Formal Semantics. This association is justified insofar as, concerning the internal argument of a spatial preposition, we need to address a question raised by Vandeloise (2006) about our way of referring to objects in the world and the space that these objects occupy. According to the author, it is a rather complicated task to separate in natural languages what refers to a material entity from what refers to a spatial entity (Vandeloise, 2006), since, in our ordinary speech, we are constantly alternating between these two interpretations.

This reference floating can be observed in the examples below: in (5a) the DP 'the office' refers to an entity of type <e>, as it is nothing more than a material/ordinary object; in (5b), on the other hand, the same DP 'the office' refers not to an object, but to a space delineated from that object, being, therefore, of type <l>. According to our

[4] Note the contrast between (3a) "*Pedro went with the market" and "Pedro went to/in the market". In the first sentence, there is a non-spatial preposition, so there is no element in the structure that is able to manipulate and instantiate the spatial entity, which makes it ungrammatical; in "Pedro went to/in the market", on the other hand, we have a spatial preposition, so the GROUND – the spatial entity — is instantiated and the sentence is well-formed.

proposal, the fact that 'the office' in (5b) has a spatial reference requires the presence of the preposition, a dispensable predicate in (5a), when the reference is at the individual level.

(5) a. Ana viu o escritório.
'Ana saw the office'
b. Ana está no escritório.
'Ana is in the office'

By connecting the lambda representation employed by Formal Semantics to the assumptions and articulated hierarchies of Nanosyntax, we believe that it is possible to account for this reference floating in a natural way, as the system allows for a strictly compositional interpretation. In a Montaguean spirit, we hope to demonstrate how important it is to work with an interpretable formal system and not just with a syntactic computation isolated from semantic interpretation and *vice-versa*. In this context, we suggest that the interpretation of the space occupied by objetcs is associated with an independent syntactic head, a free access operator named Region ([Reg]), initially suggested by Romeu (2014). This feature is, in our proposal, a nominal modifier that acts as a type-shifter, taking the individual <e> as its argument and returning, as a result, the space that this individual occupies <l>. [Reg] would therefore be located right above the DP that serves as the basis for GROUND, below the PP architecture.

With this assumption, we avoid, for instance, assuming something like homophony for two items that are definetly related: the object and the space it occupies. In other words, there are no two nouns 'house' or 'hospital' in natural languages, there is a single lexeme, referring to an individual, which can be converted into the space the individual occupies by means of a free access operator. Whenever speakers wish to mobilize a space in linguistic construction, [Reg] is constructed in syntax and provides a space from an ordinary object. This space, in turn, is associated with an entity of abstract nature, being a *spatial kind*. As it is a kind, I propose that it is the role of the preposition to select and realize the spatial entity, making it compatible with the subsequent derivation.

The realization (instantiation) of the spatial argument is also associated with a specific syntactic head, called "Place" [Loc]. Since Jackendoff (1983), it is assumed that spatial prepositions are constructed based on a locative notion. In this work, what we do is give another role to this locative notion present in the preposition: [Loc] selects as its internal argument a spatial entity and provides a realization of the kind to which this entity refers. Spatial prepositions, then, whether denote a place or a path, lexicalize a structure minimally composed of [LocP [PP]], which must be constructed as a complex specifier to the left of the nominal portion of the sentence that holds the spatial argument.

Given this framework, in order to argue for the need to assume spatial entities in our ontology, let us demonstrate that these entities are of a more abstract level of reference (kind) and, therefore, require a predicate that instantiates them, role largely attributed to spatial prepositions. The text is organized as follows: in Section 1, we see linguistic arguments to assume the existence of spatial entities in our ontology. In Section 2, I briefly explore the behavior of these spatial entities in comparison to weak definites, which, in the proposal of Aguilar Guevara and Zwarts (2013), denote kinds. Next, in Section 3, I deal with the syntactic architecture that has been proposed for spatial prepositions in Nanosyntax and discuss the presence of the Region feature [Reg], providing, in Section 4, an adequate semantic interpretation for this feature, as well as for the other heads that constitute the architecture of spatial prepositions, such as [Loc]. Finally, in the Conclusion, I present the final considerations, pointing out its advantages and limitations.

The main contribution of this paper lies in the change of perspective regarding the nature of the GROUND argument and, consequently, regarding the role of the preposition in the structure. By assuming the existence of spatial entities, spatial prepositions can no longer be treated as simple relational predicates, as they are capable of handling an abstract and more specific level of reference than other items of the prepositional class. This new perspective is promising because it allows us to explain a number of unrelated facts, such as the requirement of a preposition for the good formation of certain sentences and the peculiar behavior that a certain class of definite nouns exhibits. This discussion is only possible because syntax and semantics are computed *pari passu*, a process that, in a sense, suggests that the principle *Semantics all the way down* should be incorporated into the model, so that we can provide more fine-grained analysis of many phenomena observed in natural languages. Although this work discusses a series of theoretical concerns about the syntax-semantic interface, at the end, the results presented here are only a small contribution to the understanding of this great puzzle that spatial prepositions represent.

1 On the existence of spatial entities: discussing the nature of the ground argument

Assuming that "space" is part of our ontology does not mean taking a radical position. In Link (1998, p. 201), for example, space appears as a class of objects in the construction of the model, represented by H, the domain of spatial regions architected as a complete semi-lattice[5]. Also in Kaplan (1989), the notion of place is incorporated as one of the context variables, and, in Jackendoff (1983), Place appears as one of the

[5] A lattice is a set with a particular ordering, therefore a partially ordered set. In this case, the lattice is complete because every subset $X \subseteq L$ admits an infinitesimal and supreme element in L.

relevant ontological categories in linguistic construction. In this section, we will present arguments that support the existence of spatial entities; first, however, we must clarify what is meant by "spatial entity".

In literature, any entity that can be independently perceived in the world is understood as a material entity. Material entities are concrete objects that, hypothetically, occupy a place in space (cf. Casati & Varzi, 1997; Link, 1998; Vandeloise, 2007); when we deal, then, with the space that these material entities (objects) occupy, we have a spatial entity, which is nothing more than the place/space occupied by concrete entities in the world. Syntactically, I suggest that it is at the height of the head [Reg], as discussed in Section 3, that we obtain these spatial entities.

According to Jackendoff (1983, p. 50), a spatial PP like 'on the table' contains as part of its internal structure an object characterized as 'the table'. However, a place is simply not the same thing as a material object. For the author, each of these entities must receive its own ontological status, otherwise the contrast between sentences in (6) would not exist.

(6) a. Aqui está seu casaco e lá está seu chapéu.
'Here is your coat and there is your hat'
b. Este é seu casaco e aquele é seu chapéu.
'This is your coat and that is your hat'

When we say 'here' and 'there' we are **locating** objects in the world, while when we say 'this is x' and 'that is y' we are **identifying** objects in the world, two different operations related to existence of also distinct entities. With this distinction in mind, the central argument to defend the existence of spatial entities is the fact that spatial deictic terms can, for this very reason, retrieve an antecedent that refers to a space, but not an antecedent whose denotation is in the domain of individuals (a material object), as the sentences in (8) illustrate[6].

(7) a. O cachorro correu **aqui**, dá pra ver que tá tudo destruído.
'The dog ran **here**, you can see that everything is destroyed'
b. Joana andava **ali** quando era criança.
'Joana used to walk **there** when she was a child'

(8) a. Pedro foi na farmácia$_i$, ***ela**$_i$**/lá**$_i$ não tinha o remédio que ele queria.
'Pedro went to the drugstore, *it/there wasn't the medicine he wanted'

[6] Note that this test also captures the fact that certain abstract terms, taken as spatial, do not denote in space, such as 'cold' in "Pedro got into a cold/in a trap", as these elements cannot be recovered by a spatial deitic term: "Pedro got into a cold, *there he had a problem".

b. Maria comprou uma casa$_i$, **ela**$_i$**/*lá**$_i$ tem a fachada azul.
'Maria bought a house, it/??there has a blue facade.'

c. Maria está na casa nova$_i$, **ela**$_i$**/lá**$_i$ tem quatro quartos.
'Maria is at the new house, it/the place has four bedrooms'

It should be noted that the ungrammaticality observed in (8b) does not depend on the distance value of the deictic. The incompatibility of 'lá' (or 'ali') as an anaphora for the DP 'the house' derives from the fact that this phrase is an object and therefore denotes an individual. Spatial deictic expressions, therefore, can only take as antecedent a DP that makes reference to a space and this seems to be a strong argument for assuming spatial entities in our ontology[7] as it seems to be valid crosslinguistically, as illustrated below with an example from Spanish and another one from German.

(9) a. Juan está en su casa → Juan está ahí.
b. João está em casa → João está lá.
c. Juan piensa em su casa → *Juan piensa ahí.
d. João pensa em sua casa → *João pensa lá.

(10) a. Hanna ist in ihrem Haus → Hanna ist **da**
Hanna be.3SG.PRES in POSS.DAT house Hanna be.3SG.PRES **there**
"Hanna is at her house" → "Hanna is there"

b. Hanna hat ihr Haus gesehen → *Hanna
Hanna have.AUX.3SG.PRES POSS house see.PRF *Hanna
hat **da** gesehen.
have.AUX.3SG.PRES **there** see.PRF
"Hanna saw her house" → "*Hanna saw there"

In addition to spatial deixis, the existence of "space" as a category in our ontology also allows the formation of wh-questions, with an item specialized in this concept. In Brazilian Portuguese we have 'onde', whereas 'where' appears as the specialized spatial item in English, 'wo' in German, 'donde' in Spanish, 'hvor' in Danish and Norwegian, and so on. The point is that, as far as we know, any natural language has a *spatial wh item*.

(11) a. Joana caiu **onde**?
'Where did Joana fall?'

b. **Onde** a Maria deixou o documento?
'Where Maria left the document?'

[7] In Kaplanian theory, indexical terms are, by definition, not anaphoric, so we avoid using 'aqui'/'here' (a notably indexical item) in the examples above.

(12) a. **Where** did Mary go?

'Onde a Mary foi?'

b. **Wo** hat Marie die Katze gehen lassen?
where have.AUX.3SG.PRES Marie DEF.F cat go.INF deixar.INF
'Where did Marie let the cat go?'

It should be noted that the "wh-question argument" was first presented by Jackendoff (1983, p. 53). In this book, which is a major reference for any study on the semantics of space, the author also discusses the fact that spatial entities can also be quantified, which generates, for example, 'somewhere' in English, 'irgendwo' in German and 'algum lugar' in BP. In the sentences below, we offer some examples of spatial quantification, to make the phenomenon clearer.

(13) a. Ana foi em **algum lugar** que a Maria visitou.

'Ana went somewhere that Maria visited'

b. Pedro viajou para **todas as cidades** em que Ana morou.

'Pedro traveled to all the cities where Ana lived'

c. I've been **everywhere**.

'eu estive em toda parte'

A third linguistic evidence that we have nouns denoting in the spatial domain and not referring to <e> comes from German. There are, in this language, two classes of relative pronouns, the w-pronouns, such as 'was' ('that'), 'womit' ('with what'), 'wovon' ('than'), and the d-pronouns, such as 'die', 'der', 'das', which display syncretism with feminine, masculine and neuter determinants, respectively. The d-pronouns are associated with the class of individuals, while the w-pronouns are associated with a notion of space. In the examples below, adapted from Moltmann (2013, p. 8), we note that a d-pronoun cannot be linked to the name that precedes it, because nouns like 'Munich' and 'Italy' do not refer necessarily to an individual, but can also refer to a place, and therefore only w-pronouns can be used in this context.

(14) a. München, **was/*das** ich sehr gut kenne.
Munique that 1SG very well know.1SG.PRES
'Munich, which I know very well'

b. Ich liebe Italien, **was/*das** dir ja auch gut gefällt.
1SG love.1SG.PRES Italy that 3SG.DAT also well please.3SG.PRES
'I love Italy, which also pleases you'

A fourth linguistic evidence for arguing that we need to incorporate spatial entities in our ontology is related to the verbal domain. In addition to the distinction in the pronominal domain, certain languages also present different strategies regarding the

copula mobilized for predication about an ordinary individual and the space this individual occupies. According to Welmers (1973, p. 311), this is the case of Igbo, which employs the copula /-bt̰/ for sentences expressing identity, and the copulas /-dl̰/ and /-nʘ̰/ for location sentences of inanimate and animate entities, respectively. Among Romance languages, this is a very clear strategy in Portuguese and Spanish, which employ the copula 'estar' instead of 'ser' with location expressions. This fact is illustrated in (15) below, in which we also present a data from a typologically unrelated language regarding Romance, notably Mandarin, taken from Li and Thompson (1977, p. 422).

(15) a. Ana está/*é em casa. [PB]

b. Ana está/*es en Argentina. [Spanish]

c. nei-ge rén shi xuésheng
that.CLF person COP student
'that man is a student' [Mandarin]

d. Lisì zái hai-bian
Lisi be.in.COP ocean-side
'Lisi is close to the ocean' [Mandarin]

The fact that we have several specialized items and strategies for refererring to a place seems to be a substantial argument for incorporating spatial entities into our ontology. Therefore, we must consider that, if "spatial nouns", which refer to a place, can be quantified, linked anaphorically, serve as an argument for the formation of wh-questions and present constraints on copula combination, then "space" must be an element present in the ontology, since the behavior of nouns denoting in the spatial domain is parallel to the behavior observed in items that denote individuals and events. I believe that I have listed important evidence to defend the need for spatial entities in the ontology, which, syntactically, will be associated with the head Region [Reg]. As suggested earlier, spatial entities would then be of a distinct logical type <l>.

In the following section, I will argue that these entities of type <l> are build from a weak definite. In the proposal of Aguilar-Guevara and Zwarts (2014), weak definites denote a kind. Spatial entities, in this sense, are spatial kinds and therefore require an instantiating predicate. This association between weak definites and what we call "spatial nouns" is relevant insofar as nouns like 'hospital' and 'market', which have a clear spatial reference, are always present in the lists of lexemes that, when determined, do not present uniqueness at the individual level, but at the kind level. This parallel between weak definites and nouns that refer to a space is interesting because it shows that spatial language involves an abstraction over physical spaces and promotes a new way to look at the role of spatial prepositions in sentences, which reinforces its syntactic-semantic importance.

2 RELATING WEAK DEFINITES TO THE GROUND ARGUMENT: ON THE EXISTENCE OF *SPATIAL KINDS*

In the classical accounts given to the semantics of the definite article, definite noun phrases are characterized by *uniqueness* (Russell, (1905)), that is, when a NP is determined by a definite article, it is guaranteed that there is only one referent in the discourse to which the property given by the NP applies. In other words, the descriptive content of a definite expression is satisfied by one and only one entity in the context; if we say that "the king of France is bald", then there must be an entity x, such that x is king of France, and nothing else is king of France and is bald ($\exists x$[King(x,France) $\wedge$ $\forall y$[King(y,France) $\rightarrow$ x=y] $\wedge$ Bald(x)]). Definites with the uniqueness property are called "strong or regular" (cf. Aguilar-Guevara 2014; Sá, 2017, p. 22). To better understand the uniqueness property presented by regular definites, let us consider the sentence below.

(16) Ana protestou contra o presidente do Brasil no dia 19 de junho e Pedro também.
'Ana protested against the president of Brazil on June 19th and Pedro did it too'

We can say that the referent of the DP 'the president of Brazil' in this sentence is one uniquely identifiable entity in the context, given that it is a definite description. Considering this, the only reading available for (16) is that "Ana and Pedro protested against the same president", that is, the VP ellipsis 'protest against the president of Brazil' shows that the DP 'the president of Brazil' is co-referential in the protesting event of Ana and in the protesting event of Pedro, because there is uniqueness. This is the general working picture of the definite expressions/NPs, but there are some cases where the DP does not seem to satisfy this criterion. As we can see with the examples below, the VP ellipsis does not certify that 'the phone' answered by Ana is the same as the one answered by Pedro (the two may have answered each their phone at the same time). There is also no assurance that 'the market' towards which Ana and Pedro walked is the same.

(17) a. Ana atendeu o telefone e Pedro também.
'Ana answered the phone and Pedro did it too'
b. Ana foi pro mercado e Pedro também.
'Ana went to the market and Pedro did it too'

It is possible to imagine a context for (17b) where there is more than one market in the city where Ana and Pedro live in, so Ana may have gone to market A, whereas Pedro may have gone to market B. The picture becomes even clearer if we imagine that Ana and Pedro do not live in the same city, so Ana would have gone to a market(x), in city C1, while Pedro would have gone to a market(y), in city C2; even in this scenario the

sentence (17b) would be true. According to Carlson and Sussman (2005), this happens because the DP 'the market' does not bear uniqueness, therefore it can be associated with more than one referent in the context. Definites like 'the telephone' and 'the market', which do not bear uniqueness, are called "weak definites"[8].

Following the proposal of Aguilar-Guevara and Zwarts (2013), we can say that for a case like (17b) there is, specifically, a lack of uniqueness at the individual level, and that is what characterizes the class of "weak definites" compared to "strong or regular definites": it is not the case that weak definites do not present uniqueness, what happens is that their uniqueness does not occur at the individual level, but at the kind level[9]. That is, the different 'markets' Ana and Pedro walked to in the situation discussed refer to the same type of place, a class of objects, but they do not necessarily refer to the same instance in that class of objects, i.e. the same individual.

This observation is relevant insofar as "spatial nouns", such as 'house', 'market' and 'school', which serve as the internal argument of spatial prepositions, always appear listed as members of the class of names that can escape uniqueness (cf. Carlson & Sussman, 2005; Sá, 2017). In light of this, what I intend to demonstrate here is that this relationship between weak definites and "spatial nouns", i.e. names whose denotation occurs in the spatial domain, is not accidental. "Spatial arguments" conform to the class of weak definites because their reference is not a specific individual in the world, but rather a property, a concept, a certain type of entity of a more abstract level of reference.

In my proposal, then, spatial arguments refer to a *spatial kind* and, as they refer to a concept of space, they can escape the uniqueness at the ordinary individual level, as we see in (16); furthermore, spatial arguments demand a predicate to be instantiated. The notion of instantiation/realization is fundamental because a sentence is about a particular event in which a particular/ordinary individual interacts with a particular space (Aguilar-Guevara & Zwarts, 2013, p. 44). As an example, we can take sentence (17b) "Ana went to the market and Pedro did it too". In this case, we know that the individual Ana interacts with a specimen of the kind 'market', as well as the individual

[8] In the literature, there are two main strategies to deal with the definite article in weak expressions. One approach, proposed by Carlson and Sussman (2005) and Carlson et al. (2013), suggests that definite determiners in weak environments are not locally interpreted. The idea is that the noun is incorporated into the predicate, not in the traditional syntactic sense, but considering that the noun and the verb/preposition form a unique constituent, which will then be determined. For a structure such as "Ana went to the hospital", we would have the composition DEF[PP-to NP-hospital], for instance, and the article would contribute with "cultural familiarity" semantics, being responsible, therefore, for the enriched meaning present in weak definites. In this line, "weak definites" are a particular type/a category of definiteness (cf. Sá, 2017). A second approach, suggested by Aguilar-Guevara and Zwarts (2010) and Aguilar-Guevara (2014), which we will adopt in this paper, deals with weak definites maintaining uniqueness. The difference, in this case, between strong and weak definites consists in the denotation of the weak expressions, which do not refer to an individual, but to a kind, being, therefore, similar to generics. Thus, the uniqueness of weak definites is a type-uniqueness, as they do not refer to a unique entity in the world-context, but to a species, a unique type of entity (Carlson et al., 2013, p. 48).

[9] According to Aguilar-Guevara and Zwarts (2013, p. 39 87), "kinds can be defined as abstract objects which are representative of a group of individuals with similar characteristics".

Pedro interacts with another specimen of the same kind.

I will try then to demonstrate that these nouns referring to the space that the objects occupy in the world are weak definites. The argument is the following: if weak definites present uniqueness at the kind level (therefore denoting a kind) and the inner argument of a spatial preposition is a weak definite, then the inner argument of preposition also denotes a kind. Hence, it must be instantiated, role assigned precisely to the preposition. It's important to highlight that the fact that spatial nouns behaving as weak definites also explains a series of idiosyncrasies associated with these items, which led Svenonius (2006) to propose the [AxPart] head, for instance.

Since Carlson and Sussman (2005), it is assumed that the identification of a weak definite involves a series of properties that can be captured by the following linguistic tests: (i) weak definites present sloppy identity in VP ellipsis; (ii) the interaction of the definite with a quantifier promotes a narrow scope reading; (iii) the weak definite has modification constraints; and (iv) the weak definite can have enriched meaning. Let us begin the discussion with property (i). Consider the following sentences.

(18) a. Ana foi para casa e Pedro também.
'Ana went home and Pedro did it too'
b. Joana colocou os pratos no armário e Pedro também.
'Joana put the dishes in the cupboard and Pedro did it too'

(19) a. Ana acampou na floresta e Pedro também.
'Ana camped in the forest and Pedro did it too'
b. Joana mergulhou no mar e Pedro também.
'Joana dove into the sea and Pedro did it too'

When a VP is elided in a given sentence, the DP therein contained is expected to remain linked to the antecedent DP, in such a way that the ellipsis must refer to the same entity; however, as weak definites do not exhibit uniqueness at the ordinary individual level, more than one entity in the context can satisfy the descriptive content of the expression, so the DP of each VP of structures such as "Pedro read the newspaper and Ana did it too" can be associated with a distinct entity in the context: "Ana read newspaper x" and "Pedro read newspaper y". As we can see in the above sentences, the "spatial nouns" 'house', 'closet', 'forest' and 'sea' seem to exhibit sloppy identity in a VP ellipsis, an expected behavior for weak definites. That is, in (18) Ana and Pedro may have each gone to their own house, as well as Joana may have placed the dishes in the cupboard x and Pedro in the cupboard y. We can think, for example, that "Joana placed the dishes in the cabinet above the sink" and "Pedro placed the dishes in the dining room cabinet", or, still, each one placed the dishes in a cabinet in their own home. In (19), Ana

may have camped in a forest in South America while Pedro camped in a forest in North America; in a parallel way, Joan may have dived into the sea at a beach x, while Pedro may have dived in a sea at beach y.

We must say that it is possible that certain sentences also present a strong reading of the definite, but what I want to highlight here is the fact that nouns referring to the space that objects occupy **may have a sloppy reading** when in VP ellipsis, which is, according to Carlson and Sussman (2005), one of the greatest properties of weak definites. Another important point to mention is that, for certain types of spatial entities, there seems to be a clearer sloppy reading than for others. The nouns 'house' and 'forest', for example, have a clear non-coreferential reading in a VP ellipisis, whereas nouns like 'sea' and 'lake' are not so transparent, which means that in certain cases it is necessary a little more contextual information to ensure the weak reading, not coreferential.

The second test mentioned above, which demonstrates whether the DP of a sentence is a weak definite, consists in the interaction of the definite with a quantifier. When the weak definite appears in a structure in which there is a quantified expression, according to Aguilar-Guevara and Zwarts (2013, p. 34), it gets a narrow reading leading to co-variation in the reference, which is why in (20) the wounded may have each been referred to a different hospital; in (21a) each year Ana can camp in a different forest; in (21b) 'the sea' can have a different referent for each season and in (22a) we can interpret that there are several employees from different markets, such that 'employee 1' stands in front of 'market x', 'employee 2' stands in front of 'market y', 'employee 3' stands in front of 'market w', and so on.

(20) a. Todo ferido foi encaminhado para o hospital.
'Every wounded was sent to the hospital'
b. Joana colocou todos os pratos no armário.
'Joana put all the dishes in the cupboard'

(21) a. Ana acampa na floresta todo ano.
'Ana camps in the forest every year'
b. Joana mergulha no mar toda temporada de verão.
'Joana dives into the sea every summer season'

(22) a. Cada funcionário está na frente do mercado.
'Each employee is in front of the market'
b. Toda formiga faz ninho no pé da árvore.
'Every ant makes its nest at the foot of the tree'

So far the DPs that serve as an argument for the spatial preposition conform to the tests proposed for identifying a weak definite. Now let's see if this will also be the case for the third test: weak definites show modification constraints. The idea is that not every modifier can be combined with a weak definite and sustain its weak identity, that is, certain modifiers rule out the lack of uniqueness at the kind level, because they are, precisely, individual-level predicates. That is, weak definites lose their weak reading when modified by adjectives like 'old', because this is an individual-level predicate, and therefore generates only one strong reading. On the other hand, if the adjective is applicable to a subclass of objects, the weak reading remains.

(23) a. Pedro foi para o hospital novo e Ana também.
'Pedro went to the new hospital and Ana did it too'
b. Joana guardou os pratos no armário grande e Pedro também.
'Joana put the dishes in the big cabinet and Pedro did it too'

(24) a. Ana acampou na floresta úmida e Pedro também.
'Ana camped in the humid forest and Pedro did it too'
b. Maria mergulhou no mar gelado e Diogo também.
'Maria dove in the cold sea and Diogo did it too'

(25) a. Maria esperou Pedro na frente nova do mercado e João também.
'Maria waited for Pedro at the new front of the market and João did it too'
b. Maria sentou no pé fresco da árvore e Ana também.
'Maria sat at the fresh foot of the tree and Ana did it too'

As the examples above illustrate, in fact when 'home/hospital', 'cabinet', 'forest', 'front of the market' and 'foot of the tree' are modified, there is uniqueness, that is, the structure preferably allows the strong reading of the definite expression. Again, we note that for some cases the modification test is more easily applied than for others: undoubtedly the hospital to which Pedro and Ana went is the same (23), as well as the cabinet used by Joana and Pedro is the same (23b); with 'forest', the strong reading seems to be less evident, as it is possible that Ana and Pedro went camping in different forests, but both characterized by their humidity (an adjective that applies to a kind).

This observed variation is in fact an expected behavior, given that, according to Aguilar-Guevara (2014, p. 19), some adjectives that qualify a subclass of objects indeed allow for the weak reading. What we observe, then, is that modified spatial definites can exhibit uniqueness at the individual level, but not necessarily, especially if the adjective that modifies them refers to a class. We can take as an example of this last point the sentence (24), "Maria dived into the cold sea and Diogo did it too". In this case, 'the

cold sea' can be the same (coreferent); or not, if we think that "Maria dove in the cold sea of Norway" and "Diogo dove in the cold sea of Iceland". The problem seems to be associated with the issue of the individuation of the entities that serve as the GROUND: as 'sea' is a very large region or an item of volume composed of water, separating it into smaller entities is a less obvious task than saying that there are different lakes, for instance.

Still regarding modification, it is interesting to note that this is an operation that led Svenonius (2006) to suggest the existence of [AxPart] as a functional and independent head in syntax, given that axial items such as 'front' and 'foot' apparently do not allow modification. With the examples in (25) above, we observe that axial elements actually can be modified, so the question seems to be quite idiosyncratic, that is, whether the axial term can be modified or not depends just on the axial item and on the context in which it appears. This fact argues in favor of axial items being nominal in nature, as only nominal items exhibit behavioral idiosyncrasies, whereas functional items do not. Axial items, specifically, can be treated as relational nouns, used to build *part-of* structures.

When an item such as 'the front of' enters into the sentence composition, this DP takes the basic DP or NP and operates on it, selecting only one of the parts that constitute its referent, that is, 'the front of the house' is nothing more than a phrase that refers to a part of a house. In this sense, "spatial relational nouns" ('front', 'side', 'foot', among others), in a way analogous to "spatial nouns", can either refer to a part of an object or to a part of a space. What allows one or another reading is the presence of [Reg] in the structure, which leads the whole to be interpreted as a space and not as an object. In other words, when we have 'the front of the house' as a phrase that refers to a region projected from the front of the house, we first build 'the front of the house' as a part of an object and [Reg] turns that object into the region it occupies, as we will demonstrate in the next sections.

Before moving on to the fourth and last test for identifying a weak definite, it is important to mention that in the literature two large classes of weak definites are identified: there are the "short weak definites", which would be DPs with nouns like 'house', 'newspaper' and 'train', and there are the "long weak definites", represented precisely by relational expressions like 'in front of', 'the left side of', 'the corner of' etc. (cf. Leonetti, 2019). In this sense, axial items are also weak definites (cf. Matushansky & Zwarts 2019; Basso & Ferreira, 2020), which explains their particular behavior. After all, weak definites present idiosyncratic modification, among other properties strictly dependent on the noun in question, just like axial items, so all the idiosyncrasies can be explained in association with the nominal and the weak nature of these elements when determined.

According to Carlson and Sussman (2005, p. 74), weak definites also have an enriched semantic reading. A sentence containing a weak noun generally conveys more

information than what is available in its strictly compositional meaning. For a sentence like "Ana went to the hospital", for example, we know that Ana's goal was not simply 'to go to the hospital', because she probably went there to do something (work, have an appointment, take an exam, search for someone, etc.). This extra information is enriched meaning because it does not appear in the structure of the sentence's constituents and it is quite systematic. For a structure such as "Pedro went to the mountains", we can say that "Pedro went to the mountains to camp", as for "John is in front of the market", possibly "John is in this place waiting for someone or he is taking a break", to name just a few cases.

Despite of the presence of this enriched meaning in structures with weak definites being systematic, the enrichment is more evident in sentences with the verbs 'go' and 'be', because these do not have such a specific meaning as 'camping', for example, as in (26). The idea is that with 'go' and 'be' we already associate that 'who goes somewhere' goes there to do something; with a verb like 'camp' or 'run' (cf. (27) below), the event is enough by itself, that is, a person can 'camp' or 'run' without having to "camp to see the meteor shower", for instance. This is just an observation that we consider necessary, given that semantic enrichment is always pointed out as a fundamental feature of weak definites, but it seems to be triggered more immediately by certain types of verb ('be' and 'go'). In this sense, our proposal is that with these verbs there is always semantic enrichment, while with other verbs this enrichment is possible, but not necessary, as the compositional meaning is sufficiently informative.

(26) Ana acampou na floresta. (para ver a chuva de meteoros – enriquecimento)
Ana camped in the forest. (to see the meteor shower – enrichment)

(27) Pedro correu no parque. (para diminuir o stress – enriquecimento)
Peter ran in the park. (to decrease the stress – enrichment)

We observe that among the four tests suggested by Carlson and Sussman (2005), all of them apply to the internal argument of a spatial preposition, hence nouns that serve as the internal argument of the preposition fit into the class of weak definites. As a consequence, following Aguilar-Guevara and Zwarts (2013), we can say that the DP-GROUND also exhibits uniqueness at the kind level and therefore has a generic reading, the difference lying in the fact that spatial arguments have a spatial generic reading. That is, when a speaker utters something like "Ana is in the hospital", the DP 'the hospital' does not refer to a particular object in the world, but to a type of a spatial entity. The evidence relies on the dialogue represented in (28) below, adapted from Klein et al. (2009, p. 3), because it is not contradictory: we are not manipulating an ordinary individual, an object, but a class, a spatial kind.

(28) A. Do you know where they took Pedro?

B. Yes, to the hospital.

A. Which hospital?

B. I don't know.

Although we have just briefly addressed the treatment of weak definites as referring to a kind, with generic reading (Aguilar-Guevara & Zwarts, 2010, 2013; Aguilar-Guevara, 2014), there is enough data to argue that the internal argument of a spatial preposition is a weak definite and, therefore, following the proposal of Aguilar-Guevara and Zwarts (2010, 2013) and Aguilar-Guevara (2014), we can say that "spatial nouns" denote spatial kinds. After all, the argument that serves as a DP-GROUND for a spatial PP displays (i) sloppy reading in VP ellipsis; (ii) narrow scope interpretation in interaction with quantifiers; (iii) modification constraints; and (iv) enriched meaning.

If 'hospital', 'pharmacy', 'beach', 'table', 'front of the house', (among other spatial arguments) refer to a space, it is expected that they shouldn't necessarily be used to refer to a single entity in context. When we talk about "spatial entities", then, we are talking about a reference to a class, a type, a kind, so the generic reading of these nouns in sentences like "Ana went to the market" (i.e. the preposition argument does not have to be a specific location, it can be any exemplar of the kind "market").

Then, if there are entities that refer to a spatial kind, it is necessary to have predicates in natural languages that are able to manipulate this level of reference and instantiate this type of entity. According to Aguilar-Guevara (2014, p. 43), any semantic treatment that mobilizes reference to a kind must also take into account how this kind can be realized by particular individuals. In this work, I assume that spatial prepositions are predicates capable of instantiating a spatial argument, through [Loc], in such a way that the absence of a locative preposition in structures such as those presented below, in (29), generates the ungrammaticality of the sentence, given that 'write', 'go' and 'be' are simply not predicates that can operate with this class of elements, i.e. with spatial kinds. Spatial prepositions, on the other hand, are designed precisely to manipulate this level of reference, which is why, if we take the sentences from (29) and insert a spatial preposition between the verb and the object argument, we generate grammatical structures (30): 'em' and the whole set of spatial prepositions can realize the argument referring to the space the object occupies.

(29) a. *Pedro escreveu o envelope.

'*Pedro wrote the envelope'

b. *Ana foi o mercado.

'*Ana went the market'

c. *O gato está baixo da escada.
'*The cat is bottom of the stairs'

(30) a. Pedro escreveu no envelope.
'Pedro wrote in the envelope'
b. Ana foi no mercado.
'Ana went to the market'
c. O gato está embaixo da escada.
'The cat is at the bottom of the stairs'

This proposal has some interesting implications as it establishes another role for spatial prepositions, which goes beyond the classical view that these predicates specify how the relationship between FIGURE and GROUND occurs (if there is contact, inclusion, displacement towards a target etc.). Notably, assuming that spatial prepositions are instantiating predicates of a spatial kind justifies why location sentences without a preposition are ungrammatical. It also captures the idea assumed in the literature that the "basic meaning" of prepositions is spatial, as well as it accounts for the fact that in non-spatial contexts the preposition still exhibits notions such as contact and inclusion. That is, with our proposal, we managed to separate the spatial contribution of preposition from its non-spatial uses, in which certain notions remain, except the concept of space. A sentence like "Peter will arrive until tomorrow", for example, sets 'tomorrow' as a time limit for the event (something like a goal), but the PP is not interpreted as spatial, since there is no argument from the type "spatial kind". Note that the absence of a preposition in this case would not make the structure ungrammatical, as we can see in "Peter arrives tomorrow"; the preposition, then, contributes with a specification of a limit over an interval, but it does not instantiate the internal argument in the same way as when we have a spatial relation.

Furthermore, given that prepositions are predicates capable of sustaining the level of reference to a kind, this can also explain the intimate relationship that prepositions establish with events, that is, prepositions can change properties of events, which, somehow also refer to generalizations about what these events might be, because both have a more abstract level of reference. These are clearly just speculations that can be investigated in future research, but we could not go without registering them. In the next section, I discuss the nanosyntactic architecture that has been proposed for spatial prepositions, then we will discuss how the instantiation of spatial entities occurs and how these entities are syntactically formed and interpreted.

3 The Nanosyntax of spatial PPs

In Nanosyntax, there are two researchers who stand out for their incursions into the prepositional domain: Svenonius (2006, 2010), who deals with the hierarchy of place, and Pantcheva (2011), who investigates the path hierarchy. In this work, we only focus on the architecture of the locative portion, that is, we will leave aside the discussion about the path structure, especially because the realization function of spatial prepositions will be associated with the lowest heads of the place domain. It is known that a path is built above a place (Jackendoff, 1983; Koopman, 2000), thus, if locative terminals are lower, they will be closer to the nominal domain than the path heads, therefore, place features will be responsible for selecting and manipulating the spatial entity. With this in mind, let us take, then, the hierarchy of spatial PPs proposed by Svenonius (2010), reproduced below.

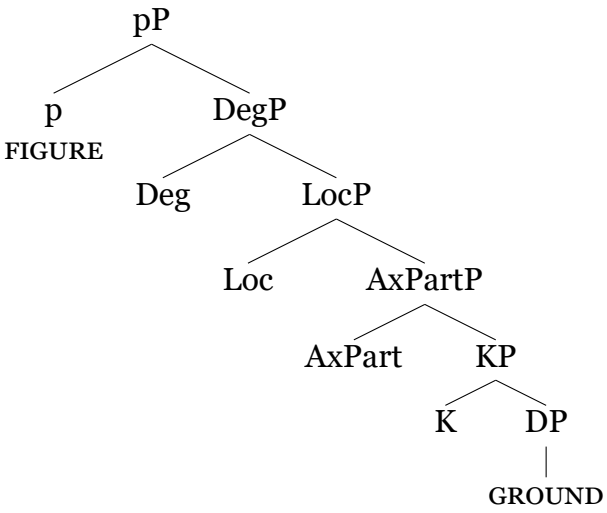


Figure 2: The Nanosyntax of Place

According to Svenonius (2010), the spatial preposition is built above the DP-GROUND, thus, the architecture of the spatial PPs starts with the head [K], to which the author attributes a double role: that of (1) connecting the axial part to the DP-GROUND, when [K] would stand for "genitive case", and also (2) converting the entity <e> denoted by DP into a spatial entity <l>. Also according to the author, [K] would be close to the EIGENPLACE predicate of Wunderlich (1991), which provides, precisely, the region that the object associated with the PP's internal DP occupies; remembering that a region is nothing more than a set of spatial points. The next head, [AxPart], would host, as we indicated in the introduction, a relational element that provides a subregion given by [K], projecting then a space based on an axis; this feature would be lexicalized by lexemes like 'front' and 'up'. The assumption that there is an axial part terminal in the hierarchy is one of the main contributions of Svenonius (2006) and was proposed based on five linguistic tests: (i) axial parts in general do not have a gender mark; (ii)

they show idiosyncratic determination; [AxPart] (iii) do not accept pluralization or (iv) allow adjectival modification; nor can (v) be replaced by pro-forms[10].

[Loc], in its turn, takes the subregion defined by the axial part and projects the axes of the orienting cut, making the region a vector space (Zwarts & Winter, 2000), which can, because of this, be measured and modified in [Deg]. The idea, then, is that [Loc] organizes the spatial points given in [K], connecting them into vectors, oriented straight line segments. Finally, above [Deg], we find the light head little-p hosting the FIGURE and this completes the architecture of a locative spatial PP. The sentence below exemplifies the lexicalization of all the heads of the hierarchy in Figure 2.

(31) Ana está dois metros na frente da casa.

'Ana is two meters in front of the house'

a. $\text{Ana}_{\text{FIGURE}}$ is $[\text{two meters}]_{\text{DegP}}$ in_{LocP} $[\text{front}]_{\text{AxPartP}}$ of_{KP} $[\text{the house}]_{\text{GROUND}}$.

From this structure, we would like to grasp two intuitions. The first one is the idea that there is a transitional head in the syntax, responsible for taking an ordinary individual and converting it into a space/region. As we suggested earlier, this is a compositional way of dealing with the problem of reference floating between individuals and the space they occupy. The problem is that, in the architecture suggested by Svenonius (2010), [K] would have this role, in addition to being the projection that hosts the genitive preposition in axial locutions. Strictly following the "one feature-one head" heuristic (Kayne, 2004), a syntactic terminal should not play two roles, especially since these are of such a distinct nature: on one hand, [K] would be associated with the notion of case; on the other hand, with a transition between domains, which requires an intricate semantic interpretation of the head, certainly not associated with the notion of genitive.

The stability of the head's interpretation is also a proposition of formal semantics (Portner & Partee, 2002), which can even be seen as the common thread in the area. With this in mind, I suggest that [K] is present only when there is an axial term in the sentence, being a requirement of the axial relational noun (cf. Partee & Borshev, 2013; Ferreira, 2021), which lexicalizes [N] but not [AxPart] (Basso & Ferreira, 2020). Thus, for the change from the domain of individuals to the domain of spatial entities, I propose the existence of another terminal, that of Region [Reg], initially suggested by Romeu (2014).

As an argument, Romeu (2014) presents data from three languages: Ainu (a language spoken in Japan) (32a), Tairora (spoken in Papua New Guinea) (32b), and Bará (a Tukano language spoken in Alto Tiquié, Brazil) (32c), to demonstrate that there is a

[10] For the sake of space and considering that we are not discussing axial parts specifically, I will not detail here how these tests work. For this discussion, we suggest the reading of Basso and Ferreira (2020), who explore each of the five tests in detail, showing that they actually only prove the nominal nature of the axial item.

specialized morphology in indicating the space that objects occupy. In these languages, there is a specific lexeme to convey that the DP that complements the preposition should not be interpreted as an individual, but rather as the region of points in space occupied by that individual. The data discussed by the author, taken from Cinque and Rizzi (2010, p. 14), are reproduced below. Note that the morpheme that provides the spatial reading of the ordinary object is, in all three cases, independent of the preposition.

(32) a. Cise **or** ta ahun.
house **place** in enter
'enter the house'

b. Naabu-qi-**ra** bai-ro.
house-em-**place** be.PRES.3SG-he
'he is in the house'

c. Sʉbe-ri-hata-ro hubea-**h**ʉ yā-a-ha ti.
green-PST.PL-box-SG inside-**place** be.3SG.PRES 3.INANIM
'[it] is inside the green box'

The items '*or*', '*ra*' and '*h*ʉ' are then all responsible for indicating that the nouns 'house' and 'box' in these sentences refer to a place, a region. Following Romeu (2014, p. 52), this is an evidence that these items explicitly lexicalize a head as [Reg], ensuring the spatial interpretation for the GROUND argument of the preposition. [Reg] would also be captured by the anaphora test presented in the examples (9) e (10). It is interesting to note that the fact that certain items cannot be retrieved anaphorically by a nominal pro-form is one of Svenonius' (2006) central arguments to defend the existence of [AxPart] as an independent item. However, assuming that there are spatial entities created by [Reg], the incompatibility between the anaphoric pronoun and its antecedent is explained only as a (semantic)type divergence. Excluding [K] as a transitional head between the domain of individuals and the domain of spatial entities, and assigning this role to the terminal [Reg], we then obtain the configuration shown in Figure 3, which also disregards the existence of [AxPart], as defended by Matushansky and Zwarts (2019), Basso and Ferreira (2020) and Ferreira (2021).

In this structure, the entity of type <e> is configured up to DP_2; note that the axial part 'in front of' appears as part of the nominal domain, not the PP, as in Figure 2. When one wishes to speak, then, not about the material object, but about the space that this object occupies, [Reg] is constructed in the target syntax and can be lexicalized by elements such as '*or*', in Tairora, for languages that have this transparent morphology. In languages with opaque morphology, such as Brazilian Portuguese, either [Reg] is lexicalized by a phonologically null item, which is not desirable, or it is lexicalized along with the preposition architecture. As much as it would be interesting to design tests to capture this lexicalization, I will not commit to it at this point, since I just want to argue that [Reg] transforms the entity <e> into an entity <l>, interpreted as the GROUND, and

it is this entity that serves as an argument for the spatial PP, which will instantiate the abstract spatial argument through [Loc].

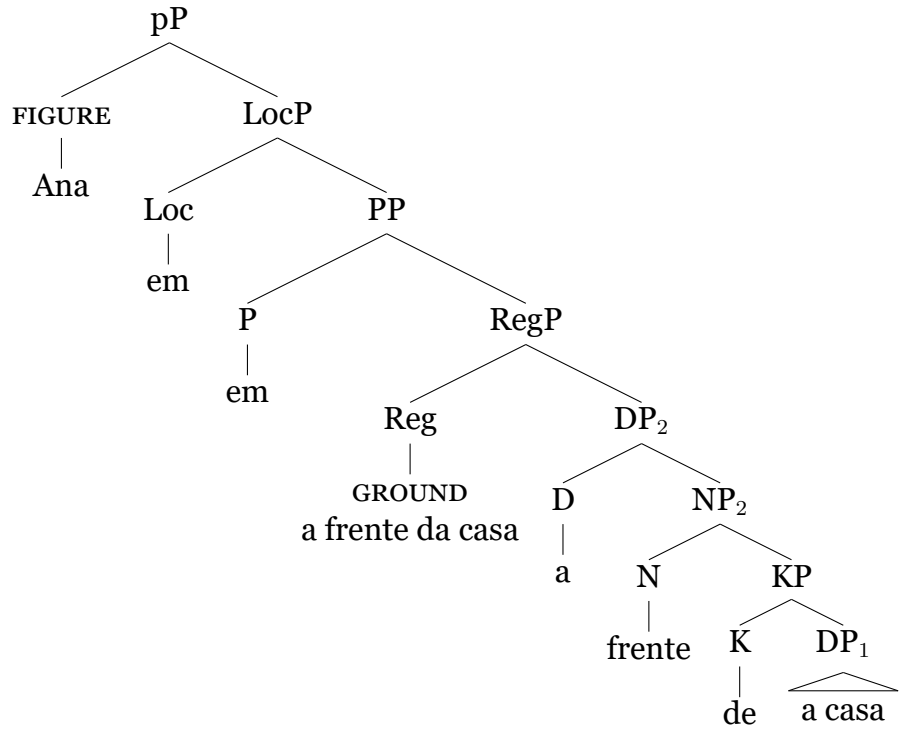


Figure 3: The new Nanosyntax of Place

It is possible to observe above that the preposition lexicalizes, by Phrasal Spell-out, [LocP [PP]]. In the structure proposed by Svenonius (2010), there is no [PP] below [LocP], but I consider it essential that there must be a label of the "preposition" category opening the domain, given three fundamental axioms in Nanosyntax: the Superset Principle, the Anchor Condition and the lexical entry design (</fon/, SMS, CONCEPT>).

By the Superset and by the Anchor Condition, if the preposition lexicalizes the sequence [LocP [PP]], then this item can enter two syntactic environments: that of [LocP [PP]] and that of [PP], but the preposition cannot identify [LocP] alone, as this would ignore the lowest feature of the lexical entry (namely [P]), violating the Anchor Condition. On the other hand, if the lexeme carried in its lexical entry only [LocP], as in Svenonius (2010), spatial prepositions wouldn't be expected to appear in non-spatial contexts, given that the non-spatial context is precisely characterized by absence of [LocP][11]. In

[11] It would be possible to say that there is no [PP] opening the domain and the category is given either by the position or by [pP], the phrase that hosts FIGURE. Both assumptions are problematic. If pP is also lexicalized by the preposition and hosts the FIGURE, we should expect a complex structure of the type XP-X'-X and this does not seem to be an adequate representation (Starke, 2004). Also, the phrase that introduces the FIGURE can be completely independent, something like [voiceP]. Still, it could be argued that we know when we are facing a preposition just by the way this type of predicate is built in the sentence (Starke (2018)). However, this solution would leave the problem of [LocP] not being used in non-spatial contexts: if there is no [PP], the preposition would have no feature to lexicalize the target structure. The solution provided here, namely saying that spatial prepositions lexicalize [LocP [PP]], is clearly contestable, as perhaps certain notions of what has been posed as concept might actually

other words, if the spatial preposition would only contribute with [LocP], this item could not be used in contexts where [LocP] is not called for; as the natural language framework is the opposite of this scenario, that is, spatial prepositions are massively found in non-spatial environments, it is interesting to formulate the structure so that [LocP] can be ignored in computation, but the preposition still has something to contribute in the Spell-out. If [LocP] were the only feature lexicalized by the preposition, in non-spatial contexts this type of item would have nothing to offer to the derivation.

Another argument for the lexicalization of [LocP [PP]] by the spatial preposition can be formulated by the analysis of the sentences below. In the spatial context, at the CONCEPT level, 'em' establishes that the FIGURE is in or at contact with the GROUND, which can be represented as a IN or AT relation (Jackendoff , 1983). In the non-spatial context, as there is no argument of type <l>, there is no need to access [LocP] by matching it with the target structure. However, the notion of inclusion/contact is still present, but it happens that, in this case, this notion is an inclusion/contact of the event in/at a certain time point, accessed after 'two hours'.

(33) a. Ana chegou em casa.
'Ana arrived home'
b. Ana chega em duas horas.
'Ana arrives in two hours'

The need for [LocP] lexicalization, therefore, depends on the internal argument of the preposition, because if the argument refers to a spatial entity, [LocP] must be performed, whereas if the argument has a reference in another domain, this phrase does not need to be identified, and the CONCEPT can account for the observed relationship between the arguments of the preposition. It is possible that certain elements taken as CONCEPT are, in fact, part of the hierarchy of syntactic-morphological-semantic features, but this does not invalidate my proposal. The point is that [LocP] is lexicalized by spatial prepositions and there must be some feature lower than that item being lexicalized by prepositions as well, such that this lower feature persists in non-spatial uses of these items. This accounts, again in a compositional way, for the relationship between the spatial meaning, taken as the basic meaning, and the non-spatial meaning of prepositions (Jackendoff, 2010). Spatial interpretation is, in this sense, a Superset of what we find in non-spatial uses of the preposition.

Three points of my proposal differ, then, from the structure suggested by Svenonius (2010): (a) there is no [AxPart]; (b) there is [Reg], which converts the material object into the space that this object occupies, thus providing the GROUND; and (c) there is a PP

integrate the hierarchy below [LocP]; this, in its turn, would actually solve the problem given that this is the contribution that remains in non-spatial contexts. As it is not trivial to admit a new element in the syntactic structure, let us leave this question open for future work.

opening the prepositional domain. In common with the author's proposal, I maintained the idea that there is a syntactic head responsible for transforming the DP that serves as the preposition's internal argument and the existence of [Loc]. This is, specifically, the second intuition I would like to explore. [Loc] appears, in Svenonius (2010), with the role of organizing the spatial points provided in a previous step of derivation, which results in a vector space (Zwarts & Winter, 2000). In this work, in addition to providing the space organized in line segments, I assign to [Loc] the realization/instantiation function, which takes the DP with reference to a spatial kind and returns a single instance of this kind. Without the instantiation, the spatial argument is not realized and the derivation fails. Therefore, in languages like Brazilian Portuguese, if there is no spatial preposition when there is an argument with a spatial reference, the sentence is ungrammatical.

Thus, once the GROUND argument is instantiated, the PP can be completely computed, in such a way that we associate the individual FIGURE with the space GROUND. The difference between locative prepositions and path prepositions lies in the fact that, when there is a path, there will be more spatial heads between [LocP] and [pP], which hosts FIGURE. What unites both classes is the fact that [LocP] is an instantiating phrase of spatial kinds. In this sense, the P_{loc} class is special in that it can handle this level of abstract space reference.

With Nanosyntax, we were able to capture compositionally a series of issues that permeate the literature on spatial prepositions, such as the fact that spatial prepositions can be used in non-spatial contexts, keeping a certain meaning stable, except for the spatial notion itself. With [Reg], we demonstrate how it is possible to naturally derive the problem of reference floating between a material entity of the individual type <e> and the space that this entity occupies <l>. I have shown, albeit quickly, that axial items are nominal elements, which allows one to create, in the same way, spatial entities from a simple object, like 'the house', and from a complex object, like 'the front of the house'. In the next section, I attribute to the heads proposed here a formal semantic interpretation, which can be taken as a semantic argument for the syntactic construction of prepositions as a complex left branch.

4 A SEMANTIC INTERPRETATION TO THE NANOSYNTAX OF SPACE

In order to demonstrate how the semantic construction of a spatial entity of type <l>, a spatial kind, occurs, and how this spatial entity is realized by [Loc], consider the following sentence.

(34) O gato está na caixa.
'The cat is inside the box'

The DP 'the box' that will serve as the GROUND is first constructed as a weak definite, so it displays reference to a kind and uniqueness at the kind level. In order not to confuse ordinary individuals of type <e> with the kind type, we will use, for these, type <e_k>. Below, we provide the interpretation of the NP kind followed by the definite article; in these formulas, P stands for the descriptive content/property given by the NP.

(35) $[\![\text{NP}]\!]_{\text{OBJ}} = \lambda x_k.P(x_k)$

(36) $[\![\text{D}]\!]_{\text{DEF}} = \lambda P_k.\iota x_k.P(x_k)$

The uniqueness provided by the definite article is given by the iota operator; as defined by Partee (1986), iota maps a property to the maximum/unique individual that displays that property. The difference here is that the uniqueness occurs at the kind level and not at the level of the individual, that is, through the iota operator, the definite provides a single/maximum entity of the type kind (Borik & Spinal, 2019, p. 300). Considering this, the GROUND 'the box' of (34) is constructed first as a weak definite, of type kind <e_k> as follows:

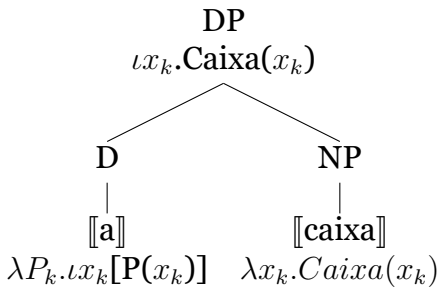


Figure 4: Derivation of a DP *kind*

By convention, when the noun is determined and it refers to a kind, that is, when we have uniqueness at kind level, it is possible to represent the DP by a bold capital letter **P**. The above formula can then be represented by **C**[12]. After constructing this DP, if the speaker wishes to speak about 'the box' not as an object but as a space, [Reg] is built in the target syntax and takes the DP <e_k> as its argument, returning an entity of type <l>. For [Reg] we suggest the following denotation:

(37) $[\![\text{Reg}]\!]_{\text{OBJ,REG}} = \lambda x_k.\chi x_l.\lambda p[\text{EIGEN}(x_l, p) \wedge \text{GROUND}(x_l) \wedge x_k = x_l]$

In words, the Region head takes an object and provides the space that the object occupies, its region; notably, [Reg] converts a *kind of individual* into a *kind of space*, via the chi operator (χ), which corresponds to the first letter of the Greek word for "region",

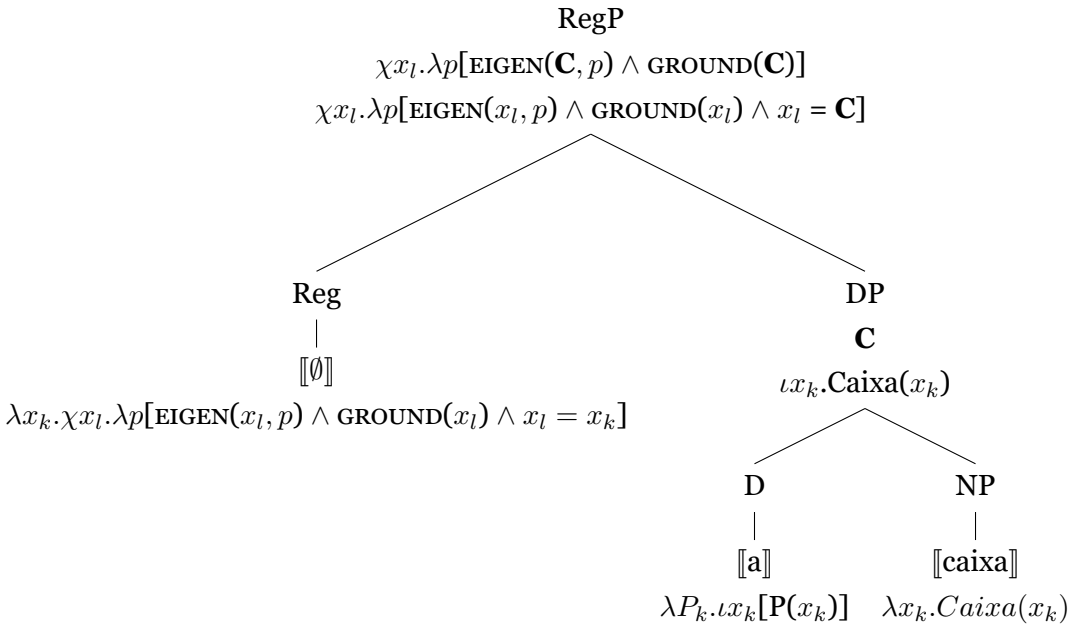
[12] Because of space, we will not deal with the derivation of a GROUND with an axial part. For a detailed derivation of this type of argument, see Ferreira (2021, p. 185–192)

namely χωρίον (*chorion*). The role of this operator can then be defined as a type-shifter from $< e_k >$ to $< l >$, a spatial kind. In addition to this change from the domain of individuals to the spatial domain, [Reg] specifies that the space is formed by a set of spatial points (p) and that the space that the argument x_l occupies is this set of points (EIGEN), and, finally, that x_l is the GROUND. In a nutshell, [Reg] has three functions: (i) it converts the object into the space that object occupies; (ii) establishes that the space is formed by a set of spatial points; and (iii) determines this space as the GROUND argument.

(38) $\chi =_{def} \lambda x_k.\exists y_l[x_k = y_l]$

The Region head is freely accessible, like any other type-shifting operator (Partee, 1986); It is important to notice that [Reg] position in the hierarchy must be between the prepositional structure and the nominal portion of the sentence, given that [Reg] creates the appropriate argument type for the spatial preposition, as this terminal acts as a nominal operator, converting a DP of category $< e_k >$ into a GROUND of the category $< l >$. [Reg] cannot be just above NP because that would allow the structure [RegP [NP]] to be determined and, classically, determiners are elements capable of manipulating an entity of the individual type, but not a space, that is, the sequence [DP [RegP [NP]]] is blocked by a type mismatch. As an independent operator, it can be said either that in languages with poorly transparent morphology there is a null element lexicalizing this position, or [Reg] is also lexicalized by the preposition. For simplicity, let us consider that in BP there is a null element identifying this terminal, which generates the following configuration for the sentence "the cat is inside the box".

(39) 'a caixa' ('the box') as the GROUND argument:



Having in hands a spatial argument, the prepositional structure can be built in order to instantiate this argument. A key question is how the PP will be architected, as the structure as shown in Figure 3 suggests that the PP directly selects [RegP], but, as previously discussed, PP alone is not able to manipulate a spatial entity. In the structure, the element that can perform this function is [LocP], thus to compute a spatial argument, the spatial preposition needs to be built in its own work environment, so that [LocP [PP]] has access, as a whole, to the [RegP] phrase. That is, we need to configure [LocP [PP]] as a complex branch to the left of the nominal part which includes [RegP]. This idea can be seen as a semantic evidence for the need to create complex objects as specifiers, suggested by Starke (2018): we need to have access to a certain semantic interpretation, which is only achieved through a certain syntactic configuration.

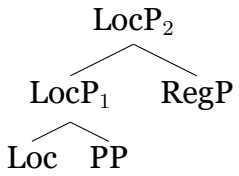


Figure 5: Spatial prepositions as a complex left-branch: a matter of semantic adequacy

As we are dealing only with spatial prepositions, we can simplify the discussion by assuming that a [PP], whose denotation is presented in (40), is of type $< e, < e, t >>$, so the first argument of [Loc] will be a $Q_{<e,<e,t>>}$ predicate. Furthermore, [Loc] needs to guarantee the selection of a spatial argument of type <l> and its instantiation. In the literature, the instantiation (or realization) relationship is noted as R(a, **A**) (Aguilar-Guevara & Zwarts, 2013, p. 44), which establishes the individual a as a realization of the kind **A** to which it belongs. With this information, I suggest the interpretation below for [Loc].

(40) $[\![\text{P}]\!] = \lambda x.\lambda y[\textsc{concept}(y, x)]$

(41) $[\![\text{Loc}]\!] = \lambda Q_{<e,<e,t>>}\lambda x_l \exists V \exists v[\text{R}(x_l, \mathbf{P}) \wedge \mid v \mid \geq 0 \wedge Q]$

The head [Loc], therefore, takes as its first argument a predicate of type $< e, < e, t >>$, which will be the PP, and, as its second argument, a spatial entity (λx_l), which will be saturated only when [LocP] combines with [RegP]. In addition to selecting these arguments, [Loc] closes the set of spatial points that make up the region, providing an ordering for these points, specified as a vector space ($\exists V$). Following Zwarts and Winter (2000, p. 5), I assume that vectors (v) are nothing more than straight lines between points, which can be measured. In the formula in (41), there is a specification of a vector norm ($\mid v \mid \geq 0$), which will allow modification in [Deg]. To provide a concrete example of how the semantic combination of [Loc] and [PP] occurs, to generate, at the end, a spatial preposition, let us take the following lexical entry suggested for the preposition 'em' and the structure that follows.

(42) ‘em’ = $</\mathrm{e^n}/ \Leftrightarrow$ [LocP [PP]] $\Leftrightarrow$ IN/ON/AT>

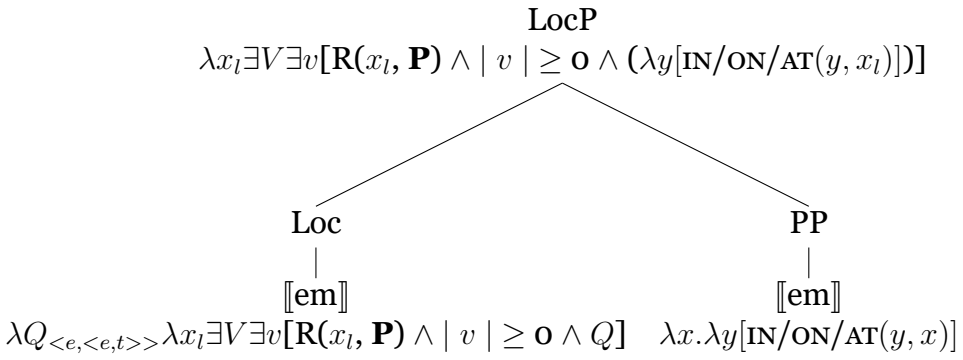


Figure 6: Semantic construction of spatial ‘em’

The locative preposition ‘em’, whose phonology is transcribed as $/\mathrm{e^n}/$, lexicalizes [LocP] and [PP] and pairs this information with a certain CONCEPT, which will indicate, later, if the relationship between the preposition arguments (i.e. FIGURE and GROUND) is of type IN, ON or AT, where IN guarantees an inclusion relationship, ON a support relation, also understood as a contact in a fixed upper position, and AT an unspecified and non-inclusion contact relation. For the semantic computation of [LocP [PP]], the entire [PP] formula serves as input for the argument $\mathrm{Q}_{<e,<e,t>>}$ present in [Loc]. By functional application, then, [Loc] selects [PP] and, in words, results in a predicate [LocP] that will take as its argument a spatial entity (λx_l), giving a vector space ($\exists V$), a vector ($\exists v$) that presents a norm ($\mid v \mid \geq 0$) and the realization of the spatial argument (R(x_l, **P**)). Note that, without the preposition that provides the instantiation by [LocP], the sentence becomes ungrammatical:

(43) *O gato a caixa.
‘*The cat the box’

Again for the sake of simplicity, it should be noted in Figure 6 that the PP variable x is now linked to the variable λx_l of [Loc], leaving its local binding given by λx. This step must be done since the preposition, when spatial, selects a spatial argument. Now let us see how this spatial preposition ‘em’ enters the computation, selecting and instantiating a spatial argument. For that, let us take the sentence “the cat is inside the box”. In the structure below, [$\mathrm{LocP_1}$], which is the spatial preposition ‘em’, takes [RegP] ‘the box’ as its argument, which is noted, in simplified terms, as C_l, since we know that in [RegP] the DP ‘the box’ is a spatial kind entity and not just an ordinary individual.

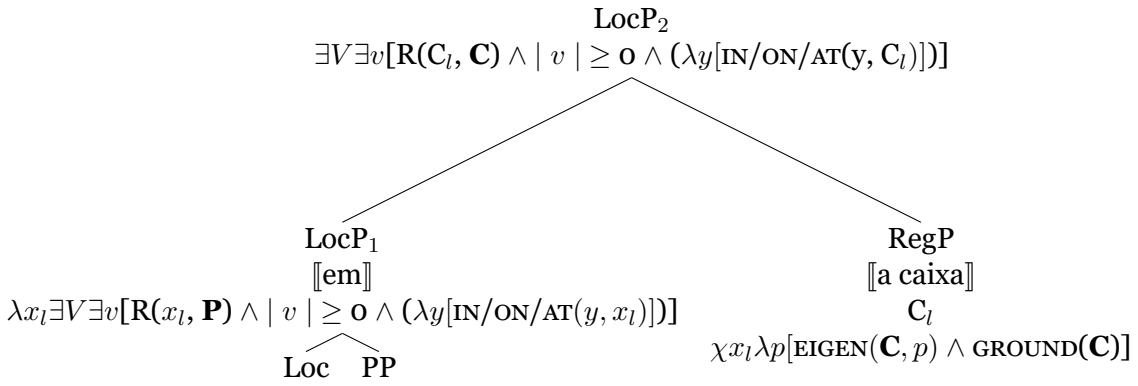


Figure 7: Realization of the GROUND argument by the spatial preposition

In [LocP$_2$], given a vector space and a vector, which close the set of points in the region, we have the instantiation (R) of the spatial entity 'the box' (C$_l$), according to which (C$_l$) is an exemplar of the kind box **C** to which it belongs, i.e. C$_l$ corresponds to the region (now modeled as a vector space) that an instantiation of the object of type **C** occupies; the vector norm is $\mid v \mid \geq 0$, which will allow modification, and the entity C$_l$ will be in an IN/ON/AT relation with one argument λy. About the saturation of this argument, we can consider two ways: either λy is closed directly in [pP], with the insertion of the FIGURE, or else, only later, when the verbal structure is built to carry the TAM features. The new configuration of a spatial PP, then, is as follows:

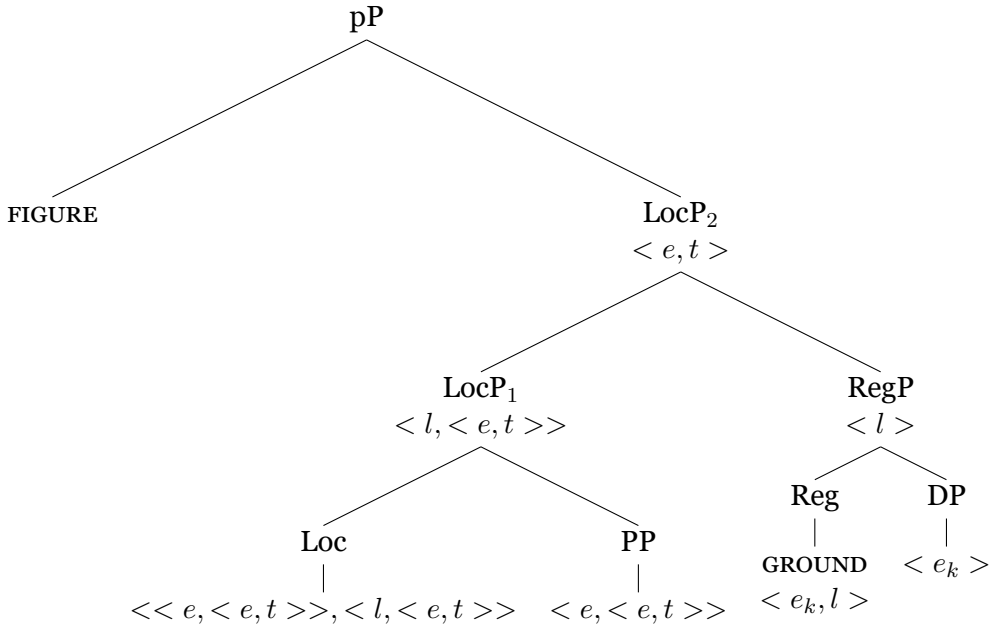


Figure 8: Configuration of a spatial PP as a kind-level predicate

With this, I had demonstrate how the complete syntactic-semantic computation of a locative spatial PP takes place. To configure a location relationship between FIGURE and GROUND, then, first the DP (simple or with axial part) is built, which will serve as a basis for GROUND as a weak definite, with reference to an *e-kind*. Next, [Reg] appears as a free access operator in the computation and acts as a type-shifter, providing the spatial entity <l>, or an *l-kind*; the preposition, which selects and instantiates this spatial argument, is constructed as a complex left branch, so that we have access to the correct semantic account, which considers the contribution of both [PP] and [LocP] selecting, as a whole, [RegP].

Conclusion

In this paper, I discussed the nature of the inner argument of a spatial preposition and the role of this class of predicates in natural language sentences. I argued that the GROUND on which we locate a FIGURE, through the preposition, is a spatial kind, because it refers to an abstraction of space. To do so, I initially presented linguistic evidence to support the existence of spatial entities in our ontology and then compared the behavior of spatial arguments to the class of weak definites, a nominal class whose reference does not occur in the domain of ordinary individuals, but at the kind level. We demonstrated that nouns like 'house' are weak spatial definites, and, therefore, as they refer to a kind, they require a predicate that can realize them in the sentence, a role widely assigned to prepositions. This discussion then revisited not only the nature of the internal argument of a spatial preposition, but also provided a new look at the role of the preposition in the sentence, which is of more complex semantic nature than what is assumed to be the role of these items in the literature.

The central contribution of this paper is to promote this new look at the class of spatial prepositions, but I must also highlight the work developed at the interface between syntax and semantics. Paying attention to both areas, it is possible to find finer properties and mechanisms that can explain the behavior of the linguistic phenomena we observe, such as the fact that sentences with an object that refers to a space are ungrammatical without an instantiating predicate of that space. Looking at the syntactic-semantic component of the grammar's architecture allowed us to decouple the notion of the "axial part" from the PP structure, to provide [Reg] as an operator that resolves compositionally the reference floating between objects and the space that they occupy, as well as it made possible to give a semantic evidence for the construction of prepositions as complex left-branches, also allowing an explanation, again compositional, for the fact that prepositions with spatial meaning constantly appear in other environments that do not exhibit any notion of space.

I hope to have illustrated, with this exercise in theoretical and empirical analysis,

the advantages of not doing syntax without semantics or semantics without syntax. I believe that Nanosyntax, as a grammar model, provides the right tools to put the Montague spirit to the test. In this context, this work also leaves a series of gaps to be answered, which only improves the productivity of a syntactic-semantic investigation.

The first question that remains open is how lexical items can store [Reg]. In the examples discussed, I remain impartial in this respect, but considering that [Reg] is adjacent to [DP] at its lower limit and to [PP] at its upper limit, it is predictive that if the language does not have a specific morpheme to lexicalize this terminal, [Reg] can be lexicalized then either with DP or PP. This can account for the discussion in the literature between the nominal or functional nature of certain space predicates. With this proposal, in fact, in some languages, spatial relations can be conveyed in nominal classifiers and, in others, in the adpositional system. The only configuration blocked, due to a semantic incompatibility, would be [Reg] in between the [NP] and the classifier or determiner [DP]. Although the discussion was based on Brazilian Portuguese data, this question opens an interesting path for crosslinguistic research.

The second issue concerns the need to assume a [PP] opening the domain before [LocP]. With this investigation, I hope to have made clear the need for assuming something below [LocP], since this accounts for the non-spatial uses of spatial prepositions. However, it is not clear whether the required phrase is, in fact, [PP], or whether some element of what we have been calling CONCEPT can be incorporated into the syntax, thus keeping the contribution of prepositions in various domains stable. This is the third question that remains open for future investigation: are there more features that enter the make up of the spatial domain or can CONCEPT actively contribute to the derivation?

Finally, we would like to emphasize that, despite having focused this paper on the case of prepositions, the discussion should, by hypothesis, be extended to the entire framework of adpositions. The syntactic-semantic ingredients thought to be necessary were all presented, so we need now to investigate how natural languages assemble their puzzles with the available pieces.

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