On Determiners in languages with and without articles*

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1. Our goals

- To discuss the structures which are to be attributed to nominal expressions in languages with and without articles.
- On the basis of empirical evidence from Brazilian Portuguese (BrP) and Russian (R), we will support the Universal DP-Hypothesis (UDPH; Longobardi 1994) for two groups of languages predicted to exist according to the Nominal Mapping Parameter (NMP; Chierchia 1998).

2. Predictions from the Nominal Mapping Parameter.

- According to the NMP, languages fall into different groups according to the basic semantic characteristic of nominals. One group of languages (e.g., Romance) have nominal expressions that are [-arg, + pred]. Another group of languages (e.g., Germanic, Slavic) have nominal expressions that are [+arg, +pred].
- The NMP is often used to account for the distribution of bare nouns (determinerless NPs occurring in canonical argument position): languages that are [-arg, + pred] are predicted to ban bare nominals (BNs) in argument positions, whereas languages that are [+arg, +pred] are predicted to allow BNs to occur in argument positions.
- French (F) is a good representative of the first group, since nominal expressions in this language always require some sort of D(eterminer) in order to be licensed as a syntactic and a semantic argument. English (E) is a good representative of the second group, since BNs (singulars and plurals) may occur as arguments in restricted contexts (Carlson 1977, Stvan 1998). Both F and E have overt articles.
- BrP, according to the NMP, should be classified as [-arg, + pred]. However, it allows for BNs in subject, object and predicate positions, and therefore this language seems to be a challenge to the NMP (Schmitt & Munn 1999, Schmitt & Munn 2002, Munn & Schmitt 2005).
- R, a language without articles, behaves, at first sight, fully in accordance with the NMP and freely allows for BNs in argument and predicate positions. However, the interpretation of nominal phrases in argument positions can differ drastically in different environments: direct objects, for instance, can refer to individual objects, kinds or properties. These differences remain unexplained under NMP, according to which arguments are BNs in this language.
- We will argue that, given these problems, the NMP alone does not suffice to fully account for the distribution and interpretation of nominal phrases in BrP and R

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and we will propose that the predictions made by the NMP for these languages should be understood under the UDPH to yield a desired result.

3. Predictions from the Universal DP Hypothesis.

- According to the UDPH (Longobardi 1994, Matthewson 1998, Progovac 1998, among others), the canonical syntactic structure for nominal arguments in all languages is (1):

(1) \([\text{DP} \ D \ [\text{NumP} \ Num \ [\text{NP} \ N ]]]\)

- All languages with or without articles would have all nominal arguments projected as full DPs, and this applies to languages as different as Italian, Serbo-Croatian, Albanian, Norwegian, etc.
- There is not much debate in the literature concerning languages with articles: (1) is the standard structure associated with referential arguments in languages with overt articles since Abney (1987).
- However, there is a disagreement as to whether the DP structure can just be assumed for nominal arguments in languages without overt articles, e.g., Russian, Serbo-Croatian, etc. In particular, contrasting views on R have been expressed with respect to this question:
  - Franks (1994), Pereltsvaig (2007) assume/argue for the DP structure in Russian,
  - whereas Bošković (2005, 2008) argues against it: R and Serbo-Croatian only require an NP structure for nominal expressions.
  - Pereltsvaig (2006) argues that the distinction between DPs and Small Nominals (NPs, Qps) is language-internal and that both can be found in canonical argument positions (subjects, objects and complements of prepositions) in R.
- We will adopt the UDPH hypothesis for articleless languages like R and also for a language with articles like BrP. Furthermore, we will show that the DP structure in (1) is not the only structure that can be associated with bare nominals in these two languages.

4. Our theoretical proposal

- The DP structure in (1) is available in all languages, including those which do not have overt articles (R) and those which do not require overt articles (BrP).
- We assume that if a language by default has the structure in (1), ‘smaller’ structures like those listed in (2) are also available (de Swart & Zwarts 2009):

(2a) \([\text{NP} \ N ]\)

b. \([\text{DP} \ D \ [\text{NP} \ N ]]\)

c. \([\text{NumP} \ Num \ [\text{NP} \ N ]]\)

- We will argue that all four structures (the one in (1) and the three structures in (2)) exist in both BrP and R.
• It follows from the UDPh that languages may have more than one structure associated with nominal expressions, whereas under a view that predicts a parameterization of the DP (Bošković 2005, Bošković & Gajewski 2008), languages are expected to have either DPs or NPs for argumenthood, but not possibly both.

• In what follows, we illustrate on the basis of the empirical data from BrP and R that these different syntactic structures are all available in languages with and without articles and constrain different interpretations:

(1) constrains an entity reading
(2a) constrains a property of kinds interpretation
(2b) constrains a definite kind interpretation
(2c) constrains a property of objects interpretation

5. The full DP structure

• **Goal**: in this section we provide support for the structure in (1) in the grammar of R and BrP

• In R there are no overt lexical elements that look like articles, which prototypically express the category D. Thus, to justify the structure in (1) for R, we rely on the semantic interpretation associated with (1): a nominal argument realized as a DP refers to an entity of type <e>, an individual object (i.e. not a kind or a property), which can be characterized as [+/- specific] and [+/- definite].

• Syntactically, support for (1) in R comes from the distribution of demonstratives. These items, just like articles, obligatorily yield an individual (i.e. type <e>) interpretation of the NP they combine with.

• R has demonstratives, so the null hypothesis should be that they signal the presence of the D-projection in examples like (3):

(3) Ėtot dom prinadležit našej sem’je.
this.NOM house.NOM.SG belongs.PRES.3SG our.DAT.SG family.DAT.SG
‘This house belongs to our family.’

• However, Bošković (2005, 2008) argues that demonstratives in languages like R and Serbo-Croatian are adjectives. We think that his hypothesis is problematic at least for two reasons.
  o First, the order of demonstrative pronouns is fixed with respect to adjectives: while adjectives sometimes allow for certain freedom in order (cf. 4a), demonstratives obligatorily precede the nouns, as in (3), and adjectives, as shown in (4b):

(4a) a. bol’šoj krasivyj dom / krasivyj bol’šoj dom
    big beautiful house/beautiful big house

b. Ėtot bol’šoj (*Ėtot) krasivyj (*Ėtot) dom
    this big (*this) beautiful (*this) house

  o Second, if demonstratives were adjectives, their denotation should also be like the one attributed to adjectives, i.e. they should denote properties and hence be of type <e,t>. Hence, when combined with a noun, they
should yield a sort of property reading, just like adjectives do. However, the expression étot dom ‘this house’ in (3) clearly refers to an entity, not to a property-type expression.

- Hence, we conclude that demonstratives in R cannot be analyzed on a par with common adjectives and do in fact indicate the presence of a D projection, contra Bošković (2005, 2008). This conclusion suggests that the full DP structure in (1) is available in R.

- In BrP the availability of the DP structure is uncontroversial and generally accepted at least for nominal arguments with overt determiners (Müller 2002, Munn & Schmitt 2005, among others).

- BrP allows nominal expressions with overt articles and without articles in exactly the same argument positions, for example in object position of a causative transitive verb like limpar ‘to clean’.

   I cleaned the bathroom yesterday left it well bright
   ‘I cleaned the bathroom yesterday. I left it completely spotless.’

b. Eu limpei banheiro ontem. Deixei ele bem brilhante.
   I cleaned bathroom yesterday left it well bright
   ‘I cleaned the bathroom/a bathroom yesterday. I left it completely spotless.’

- We postulate that the nominal expressions o banheiro and banheiro correspond to DP structures, under the simplest assumption that in BrP only DPs, but not both DPs and NPs are canonical syntactic arguments, since they have exactly the same distribution. Note that discourse relationships with the weak pronoun ele, which is only compatible with a DP antecedent, are the same independently of the fact that we encounter an overt DP or a BN (Cyrino & Espinal 2012).

- Furthermore, a syntactic argument for a full DP structure, even when the D is not overt, is based on control of PRO and the possibility of anaphor binding. Note that in (6) both the object and the subject of the causative transitive verb contratar ‘to hire’ can control the subject of the subordinate clause and serve as antecedents of the reflexive pronoun. This test, initially postulated by Pereltsvaig (2006) for R, shows that the controller of PRO and antecedent of se in (6) must be a DP.

(6)a. A Mariai contratou empregada para PROij seij vestir
de odalisca no carnival.
   the Maria hired maid to se.3.SG.REFL dress
   ‘Maria hired a maid to dress herself as an odalisque for carnival.’

b. A Mariai contratou uma empregada para PROij seij vestir
de odalisca no carnival.
   the Maria hired a maid to se.3.SG.REFL dress
   of odalisque in-the carnival

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1 Bošković (2009) is fully aware of this argument. In fact, he argues that a ‘semantic filter’ accounts for the relative order of demonstratives and adjectives: demonstratives need to be on top of adjectives to derive an expression of type <e>. However, if this is not an indication of the D-status of demonstratives, the rules of syntax-semantics mapping would lose their uniformity: semantically, the same happens with English or BrP demonstratives, which are syntactically in DP. We opt for uniform and universal syntax-semantics mapping rules, not for Bošković’s (2009) perspective.
‘Maria hired a maid to dress herself as an odalisque for carnival.’

- **Summing up**: both in R and in BrP, there is evidence for a full DP structure associated with BNs.

6. The structure for bare nominals: bare NP

- **Goal**: we will argue that object position of HAVE-predicates (Dobrovie-Sorin et al. 2006, Espinal & McNally 2011) in both BrP and R is the argument position in which a real BN (structure (2a), repeated here as (7)) can occur:

\[(7) \quad [\text{NP} \quad \text{N}]\]

- This BN is associated with a property-type denotation, more specifically, they denote properties of kinds of individuals that share the property denoted by the noun (Espinal & McNally 2007, 2011; Dobrovie-Sorin & Pires de Oliveira 2007; Espinal 2010)
- This BN is also associated with number neutrality, imperfectivity in R, and can be semantically composed with the Verb by means of an operation of semantic (pseudo) incorporation (Dayal 2003, 2011).
- The empirical evidence supporting the structure in (7) for R is provided by a restricted number of V+N constructions, since R is not a HAVE-language but a BE-language (Harves & Kayne 2012). See the following example:

(8) Katya nosit jubku, (*kotoruju ona vsegda pokupaet sama).
    Katya wear.IMP skirt[ACC.SG] which she always buys.IMP self
    ‘Katya is a skirt-wearer.’ (It could be one or more than one skirt)

- The object *jubku* ‘skirt’ in this example does not allow for modification by a relative clause because in a bare NP structure there is no room for descriptive modifiers. However, a classifying modifier is allowed in this sentence:

(9) Katya nosit mini-jubku.
    Katya wear.IMP mini-skirt[ACC.SG]
    ‘Katya is a mini-skirt wearer.’ (It could be one or more than one mini-skirt)

- Note, furthermore, that the object *jubku* ‘skirt’ encodes a morphophonological number+case cluster. We assume that this cluster is not an instantiation of syntactic Number, because it does not have semantic effects.

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2 We would like to correlate the fact that R is not a HAVE-language with the fact that the distribution of real BNs (i.e., bare count nouns unspecified for number and definiteness) is extremely restricted. Bare plurals, on the other hand, are very common. See (i):

(i) pisat’ detektivy, čitat’ žurnaly, est’ banany

Note that in previous work on BNs in R, most notably in Perelstvag (2006, 2011a,b), it has been claimed that R has a restricted number of other constructions where nominal expressions receive a number neutral interpretation. One of them is exemplified by a PP where the noun occurs as a complement of the preposition v ‘into’: v prezidenty lit. into presidents.[ACC.PL].
• In BrP, BN objects of HAVE-predicates are also associated with a property-type denotation, not with an entity-type, and with number neutrality. Therefore, they are assumed to be associated with an NP structure.

• A syntactic argument showing that this is the case is shown in (10), from Cyrino & Espinal (2012). (10a) shows that a BN object of a HAVE-predicate, which has an NP structure, cannot be a controller of PRO and cannot be the antecedent of an anaphor. Interestingly, if we have a singular indefinite, (10b), which has a DP structure, both phenomena are allowed.

(10) a. A Maria tem empregada para PROi se,v se3v dress
    de odalisca no carnival.
    ‘Maria has a maid to dress herself as an odalisque for carnival.’

b. A Maria tem uma empregada para PROuj se3j dress
    de odalisca no carnival.
    ‘Maria has a maid to dress herself as an odalisque for carnival.’

• An additional semantic argument is based on adjective modification of the BN: classifying adjectives vs. qualitative adjectives:

(11) a. Na festa, a Maria usou vestido de gala
    in the party the Maria used dress of gala
    porque sua mãe lavou ele.
    because her mother washed it
    ‘In the party, Maria wore a gala dress, because her mother had washed it.’

b. Na festa, a Maria usou vestido que estava limpo
    in the party the Maria used dress that was clean
    porque sua mãe lavou ele.
    because her mother washed it
    ‘In the party, Maria wore a dress that was clean, because her mother had washed it.’

• (11a): the BN is modified by a PP that classifies the nominal expression and, together with the noun (vestido de gala ‘gala dress’), denotes a property of a subkind of dress (Espinal 2010). The subsequent discourse only allows a null object; weak pronouns are ungrammatical when referring back to property-type nominals, since no reference is made to a specific individual entity by the bare NP.

• (11b): the BN is modified by a relative clause that is a predicate of the structure and denotes a property of particular individual entities. The subsequent discourse allows the weak pronoun over individual entities, either ele ‘it’ or the null object.

• Summing up: both in R and in BrP, only real BNs are NPs.
7. The structure for definite kinds: DP with no Number

- **Goal**: we will argue that structure (2b), repeated here as (12), is associated with the meaning of definite kind arguments in languages with and without (overt) articles, i.e. in both R and BrP.

(12) \[ DP \ D [NP N] \]

- In a previous recent work (Borik & Espinal in press), we defend the following hypotheses:
  - Definite kinds are referred to by definite DPs with no Number involved.
  - Languages that have (null or overt) Determiners do not differ wrt definite kinds: they all have them.
- On the basis of evidence from both R and BrP, we will now provide empirical support for two claims: the presence of the D-projection and the absence of Number.
- The evidence for the presence of D in the structure of the kind referring subjects comes from the fact that they can be antecedents for personal strong pronouns (`ona ‘she’ in R, the strong pronoun `ele ‘he’ in BrP).
- To begin with, consider the examples in (13) and (14).

(13a. *Panda* nahodit’sja na grani ischeznojenija.  
*Panda* Nom.SG is.found on verge extinction.Gen  
*Ona* javljaetsja oficjal’nym simvolom vsemirnogo fondadikoj prirody.  
She appears official symbol world fund.wild nature  
‘The panda is on the verge of extinction. It is the official symbol of WWF.’  
(14) *Panda* está em extinção. *Ele* é o símbolo oficial do WWF.  
Panda is in extinction he is the symbol official of.the WWF  
‘The panda is on the verge of extinction. It is the official symbol of WWF.’  

- In both languages, the subject of the first sentence has a kind interpretation, it names the class of object individuals that share the property denoted by the N *panda*. This subject is the external argument of the kind-level predicate ‘to be on the verge of extinction’ in the two languages.
- In (13) the pronoun *ona* refers back to the kind entity denoted by the name *panda*.
- In example (14), *panda* is also the name of a kind – it doesn't refer to the maximal sum of individuals and because of this in the following discourse, the form of the pronoun is *ele* and not *eles*.
- A second argument for the structure given in (12) is that definite kinds license reflexive pronouns in the two languages. Both (15) and (16) show that the antecedent of the reflexive pronoun must be referential.

(15) *Dront* ischez s liča zemlji potomu chto ne mog dodo. Nom.SG disappeared from surface of.earth because that not could zaschitit’ sebja ot napadenija. defend self from attacks.  
‘The dodo disappeared from the surface of the earth because it could not protect itself from being attacked’.
(16) *Dodô desapareceu da superfície da terra porque ele não pôde se proteger de ataques.

‘The dodo disappeared from the surface of the earth because it could not protect itself from being attacked’.

• The third argument is that, in BrP, definite kinds can also be expressed by means of an overt D, as exemplified in (17).³

(17)a. O panda logo estará extinto.

‘The panda will soon become extinct.’

b. *Panda logo estará extinto.

‘The panda will soon become extinct.’

(Müller 2002: 285, examples (22) and (25))

• The examples given so far in this section show that kind-denoting expressions require a determiner, be it overt or covert.⁴

• It should be remarked that the structure in (12) does not involve Number, which means that numerical expressions are predicted to be incompatible with definite kinds. It is easy to show that this prediction is borne out both in R and in BrP.

(18) *Dva dronta ischezli v XVII veke.

‘Two dodos disappeared in the 17th century’

(19) *Dois dodôs desapareceram no século XVII.

‘Two dodos disappeared in the 17th century’

• These examples illustrate that if Number is imposed on nominal expressions that refer to species, the output is ill-formed, even when a taxonomic reading is...

³ Note that, according to Müller (2002:285 and footnote 12), example (17b) is ungrammatical, but can “improve its acceptability if the subject is given a contrastive stress”. See also, for a similar comment Pires de Oliveira & Rothstein (in press).

⁴ Predicates that are usually said to require kind-referring objects (e.g., invent) seem to show a different behaviour. Consider an example from BrP:

(i) Jack Dorsey inventou *(o) Twitter, Steve Jobs inventou *(a) Apple, Mark Zuckerberg inventou *(o) Facebook, J.K. Rowling inventou *(o) Harry Potter,…


We think that there are reasons to believe that the reference of the object argument in this case is not really equivalent to kind reference, as already suggested by Beyssade (2005) for French. Her proposal is that objects of verbs like invent refer to concepts/prototypes, which are different from kinds.

Our reasons to support this claim are the following: (a) this is the only case in BrP where the article with a kind referring expression is really obligatory, (b) these objects cannot be antecedents for personal pronouns ele/elas in BrP, as opposed to all the other kind referring expressions, and (c) these nominal expressions cannot be replaced by definite plurals, which are expected to denote the maximal sum of individuals that instantiate the kind (i.e. inventou o telefone vs. *inventou os telefones, as opposed to (a) baleia está em extinção vs. (as) baleias estão em extinção).
intended. Hence, we conclude, that a kind-referring expression is incompatible with number, both syntactically and semantically.

- Numerals in both languages must combine with lexical items such as *vid, tip, class* ‘type, kind, class’ in R, and *tipo, classe* ‘type, class’ in BrP, to derive a subkind interpretation. See (20a) for R, and (21a) for BrP. These lexical items (just like numerals) cannot directly combine with a kind-referring expression, as shown in (20b) for R and (21b) for BrP5:

(20)a. Dva vida kitov ischezli s lica zemli.
   two type.GEN.SG whale.GEN.PL disappear from surface of.earth
   ‘Two types of whales have become extinct.’

b. *Vid kita ischez s lica zemli.
   type whale.GEN.SG disappeared from surface of.earth

(21)a. Dois tipo(s) de baleia(s) desapareceram da superfície da terra.
   two types of whale disappeared from the surface of the earth
   ‘Two types of dodos disappeared from the surface of the earth.’

b. *Tipo(s) de baleia(s) desapareceram da superfície da terra.
   type of whale disappeared of the surface of the earth

- **Sum up:** The conclusion to be drawn from this section is that definite kinds require a D projection, but do not show any evidence for the presence of Number.

8. **NumP without D**

- **Goal:** in this section we will show that the structure in (2c), repeated here as (22), is restricted to predicate position in BrP, but is allowed in argument position in R, and the prediction of this split comes from the NMP, as will be explained below.

(22) [NumP Num [NP N]]

- It was argued by Pereltsvaig’s (2006, 2011) and Pereltsvaig and Kagan (2011) that in R, there are a number of constructions with bare nominals, including, in particular, genitive objects of intensive reflexive verbs exemplified in (23):

(23) Lena najelas’ kotlet
    Lena na.ate.REFL burger.GEN.PL
    ‘Lena ate herself full of burgers.’

- We argue that these objects are not bare NPs, but at least NumPs, as in (22). First of all, it should be noted that in the examples like (23) the object does not really have a number neutral interpretation, in contrast with the interpretation of the object skirt in (8) and (9) from section 6, since kotlet in this context is only compatible with non-atomicity entailments.

5 We assume that the reference to subkinds is built on number, either singular or plural (Borik & Espinal in press).
As in R the morphophonological realization of case and number appears in one synthetic cluster, we assume a distinction between morphophonological and syntactic number (cf. also Pereltsvaig 2011). Only the latter has semantic effects.

Since the object of (23) is not number neutral, we conclude that it has syntactic number, i.e. it is structurally represented as (22).

Moreover, genitive complements of intensive reflexives can take both descriptive and classifying modifiers, as in (24a), and be antecedents of relative clauses, as illustrated in (24b):

(24) a. Lena najelas’ maminys/vkusnyh/ rybnyh kotlet.
   ‘Lena ate herself full of mother’s/tasty/fish burgers.’
b. Lena najelas’ kotlet, kotoryh ej nažarila mama.
   ‘Lena ate herself full of burgers which her mother fried for her.’

This provides an additional contrast with the complements of HAVE-predicates which, as true bare nominals, can take only classifying modifiers (cf. examples (8) and (9) from section 6).

We take (24) as evidence for a structure more complex than a bare NP.

In BrP, the canonical syntactic and semantic argument has a DP structure with a determiner that can be null. Consider (25):

(25) (Os) brasileiros são trabalhadores. (Müller 2002: ex. (2) and (5))
   ‘The Brazilians are hardworking.’

Note that the preferable English translation for the subject expression is a bare plural as in ‘Brazilians are hardworking.’ However, we do not adopt this translation because the bare plural in English is standardly associated with a kind-referring expression, whereas the subject of these sentences in BrP denotes the maximal sum of individuals that share the property of being Brazilian.

In (26b), as opposed to (26a), the mass-like interpretation comparable to the English BP is available, whereas (26a) refers to the maximal sum of individuals sharing the property of being Russian.

Recall that in the case of BrP, the evidence for the claim that the articleless version of (25) has a null determiner, comes from the fact that the only way to
refer back to these nominal expressions in preverbal position is by means of eles:

(27) (Os) Brasileiros são trabalhadores. Eles se preocupam com o futuro.  
the Brazilians are hardworking they self worry with the future  
‘The Brazilians are hardworking. They are concerned about the future.’

- By contrast, the bare plural in predicate position is not a DP, but a Number Phrase. Evidence for this claim is that in the following discourse eles is not possible:

(28) (Os) Brasileiros são trabalhadores, mas não costumavam ser *eles.  
the Brazilians are hardworking but not used be them  
‘The Brazilians are hard-working, but they didn’t use to be.’

- We know that the antecedent of eles in BrP must be a DP. Therefore, trabalhadores cannot be a DP. But it is syntactically marked for plural; therefore, it cannot be a bare NP, and it must be at least NumP.

- **Summing up:**
  - We have shown that all these examples should be analyzed as involving a Number projection, i.e. they are associated to our structure (2c).
  - The crucial difference between R and BrP is that R allows for NumPs in argument position, whereas BrP does not. This difference follows from the Nominal Mapping Parameter, since BrP is [-arg,+pred] and R is [+arg,+pred].

**Conclusions**

- In this paper, we have shown that the full range of nominal structures presented in (1) and (2) are available both in languages with no overt articles like R and in languages with ‘optional’ instantiations of articles like BrP.
- These different structures are associated with different interpretations.
- The more structure we have the less constrained the distribution is:
  - The minimal structure in (2a) is highly restricted to object of HAVE-predicates.
  - The DP structure in (2b) is restricted to argument positions of kind-selecting predicates.
  - The Number Phrase structure in (2c) is restricted to predicate positions in BrP, but it occurs in both argument and predicate positions in R. This difference is predicted by the NMP.
  - The full DP structure in (1) is the least restricted syntactic structure for nominal expressions in argument positions in both R and BrP.

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6 It should be noted that this sentence is possible in BrP when VP ellipsis applies, as in (i):

(i) Os brasileiros são trabalhadores, mas não costumavam ser.   
the Brazilians are hard-working but not used be  
‘The Brazilians are hard-working, but they didn’t used to be.’

On VP ellipsis in BrP, see Cyrino and Matos (2002).

7 Besides that, it is interesting to compare this example with what happens in other Romance languages that make a distinction between different types of clitics depending on the antecedent. One of these languages is Catalan, which distinguishes between 3rd person accusative clitics el, la, els, les, which also require a DP antecedent, and a neuter clitic ho, which must be linked to an NP or an AdjP in predicate position.
The occurrence of these structures is predicted by the UDPH, which is relevant for both languages.

Appendix: The semantics associated with different syntactic structures

Our theoretical assumptions:
- **Common nouns** denote properties of kinds.
- **Number** relates properties of kinds to properties of objects of that kind. It correlates with (but not identical to) Carlson’s (1977) realization relation \( R \) which relates stages to individuals.
- **Definite determiner** is the iota operator with a uniform semantics. The iota operator applies either to properties of kinds (i.e. common nouns) or to properties of objects of this kind (i.e. common nouns with Number). In the former case the output is a kind entity, in the latter case the output is an object entity.

Given these assumptions, we get the following triples of structure-interpretation-denotations:

(i) Bare nouns:
   a. \([\text{NP} \text{ N}]\)
   b. \([\text{N}] = \lambda P \lambda x^k [P(x^k)]\)
   c. \(<e^k, t>\) properties of kinds

(ii) Number phrase:
   a. \([\text{NumP} \text{ Num} [\text{NP} \text{ N}]\])
   b. \([\text{Num N}] = \lambda P \lambda x^k \lambda y^o [P(x^k) \land R(P(y^o), P(x^k))]\)
   c. \(<e^o, t>\) properties of objects

(iii) Numberless DPs:
   a. \([\text{DP} \text{ D} [\text{NP} \text{ N}]\])
   b. \([\text{D N}] = \lambda P \lambda x^k [P(x^k)]\)
   c. \(<e^k>\) kind denotation

(iv) Full DP:
   a. \([\text{DP} \text{ D} [\text{NumP} \text{ Num} [\text{NP} \text{ N}]\])
   b. \([\text{D Num N}] = \lambda P \lambda x^k \lambda x^o [P(x^k) \land R(P(x^o), P(x^k))]\)
   x. \(<e^o>\) object denotation

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