The syntax and semantics of approximate indefinites in Spanish

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ABSTRACT.

In Spanish, combining an indefinite plural article and a cardinal number leads to an approximative interpretation similar to that provided by approximators like *approximately.* In this paper, we advance a syntactic and semantic analysis of these structures. We show that the construction shares a number of properties with structures containing explicit approximative elements, so it justified to assume that a particular constituent contributes the approximative meaning. We propose that an approximative morpheme APPROX is combined with the cardinal number; the morphological realization of this morpheme is as the plural affix on the indefinite article. We advance a denotation for APPROX, and elaborate the necessary assumptions on the functioning of numerals for our analysis to work at a general level.

Keywords: cardinal numbers; indefinites; approximatives; Spanish.

RESUMO.

Em espanhol, a combinação de um artigo indefinido plural e um cardinal implica uma interpretação aproximada semelhante àquela permitida por elementos como *aproximadamente*. Neste artigo, apresentamos uma análise sintático-semântica para essas estruturas. Mostramos que a construção compartilha várias propriedades com estruturas que contêm elementos de aproximação explícitos, então pode-se supor que um determinado elemento introduz o significado aproximado. Propomos que isso seja feito a partir de um morfema aproximado APPROX que é combinado com o cardinal e morfologicamente realizado como um afixo plural no indefinido. Propomos uma denotação para a APPROX, e elaboramos as suposições necessárias sobre o funcionamento dos numerais para que nossa análise funcione em um nível geral.

Palabras chave: números cardinais; indefinidos; aproximação, Espanhol.

1. Introduction

Spanish indefinite articles exhibit agreement in both gender and number with their NP complements.

(1) a. ***Una*** mujer vino hoy.
INDEF.SING.FEM woman came today
'A woman came today.'

b. ***Un*** hombre vino hoy.
INDEF.SING.MASC man came today
'A woman came today.'

c. ***Unas*** mujeres vinieron hoy
INDEF.PL.FEM women came today
'Some women came today.'

d. ***Unos*** hombres vinieron hoy
INDEF.PL.MASC men came today
'Some men came today.'

A striking property of the plural indefinite articles in (1c) and (1d) is that they trigger an approximative reading when combined to a cardinal number, e.g., (2); we call this phenomenon the *approximate indefinite* (AI) construction. The resulting interpretation is equivalent to that reached by employing approximative adverbs as *aproximadamente* 'approximately', or expressions like *alrededor de* 'around of', or *más o menos* 'more or less'.

(2) a. Gerardo tiene ***unos*** ***tres*** amigos en su edificio.
Gerardo has INDEF.PL.MASC three friends in his building
'Gerardo has approximately/around/about three friends in his building.'

b. Compramos ***unas*** ***quinientas*** empanadas.
Bought. INDEF.PL.FEM five.hundred patties
'We bought approximately/around/about five hundred patties.'

c. ***Unas*** ***veintidós*** personas resultaron premiadas.
INDEF.PL.FEM twenty.two persons resulted awarded
'Approximately/around/about twenty two people were awarded.'

The phenomenon is restricted to plural indefinite articles, as it is not attested with neither definite determiners, e.g., (3a), nor morphologically complex indefinites, e.g., (3b).

(3) a. Compramos las quinientas empanadas. * *approximation*
'We bought the five hundred patties.'
b. *Algunas veintidós personas resultaron premiadas.
'Some twenty-two people were awarded.'

While the approximative use of indefinite articles in Spanish has been previously observed in the literature (e.g., Alarcos Llorach 1980: 278, RAE & ASALE 2009, Martínez 2014), there is no explicit systematization of its properties, and no descriptively adequate account of the phenomenon has been proposed. This paper attempts to offer such an account. In particular, there are two main idiosyncrasies of the AI construction that we attempt to capture. First, the interpretation of the examples in (2) is at odds with the ordinary meaning associated with indefinites; that is, it should be explained why the approximative interpretation is concomitant with the appearance of the indefinite determiner. Second, whatever the semantic contribution of the indefinite determiner *unos/unas* is, it affects the denotation of the cardinal number, while the interpretation of the nominal remains constant; in other words, the indefinite seems to function semantically as a modifier to the numeral rather than a head that takes the nominal phrase as a complement.

The structure of the paper is as follows. In section 2, we sketch the relevant theoretical background for our discussion of the phenomenon of approximation. Section 3 introduces some parallelisms between the AI construction and the functioning of the adverb *aproximadamente* 'approximately'; these similarities suggest an account according to which there is a specific element of the AI construction introducing its approximative meaning. In section 4, we present an analysis of the AI construction; it is proposed that plural morphology on the indefinite article is the manifestation of an approximative morpheme that (i) is syntactically combined with the cardinal, and (ii) attaches to the indefinite through affixation. Section 5 develops some further aspects of the analysis. Finally, section 6 draws some conclusions.

2. Prolegomena to the study of approximation

The phenomenon of approximation is intimately related to the broader problem of vagueness in language. Consider the examples in (4). A sentence like (4a) can be judged to be true or false no matter the precise amount of hair Jorge has in his head. Similarly, (4b) can be taken to be true in a scenario in which Cosmo arrived one or two minutes after three o'clock.

(4) a. Jorge es pelado.
'Jorge is bald.'

b. Cosmo vino a las tres de la tarde.
'Cosmo came at three in the afternoon.'

The linguistic literature on vagueness can roughly be divided into two groups. On one hand there are those who aim to offer a unified account of vagueness phenomena (e.g., Lakoff 1973, Lasersohn 1999); on the other, there are those who maintain that vagueness consists of more than one linguistic mechanism (e.g., Kennedy 2007, Sauerland & Stateva 2011).

On the unificationist side, Lakoff (1973) offers an account of vagueness in terms of fuzzy logic. According to him, a concept like *bald* is vague because the set it denotes is fuzzy, i.e., membership to it is not categorical but gradual. Some special expressions called *hedges* allow speakers to manipulate the degree of membership of an entity to a given set. Thus, for instance, a hedge like *totally* expresses 100% of pertainance to a set, e.g. *totally bald*, while an expression like *more or less* denotes a lower degree of membership, e.g., *more or less bald*. While intuitive, this approach has been criticized as fuzzy logic ends up being problematic when truth conditions of complex sentences are considered; for space reasons, we refer the reader to Chierchia & McConnell-Ginet (2000: 389-395) for details.

More recently, Lasersohn (1999) provides a unified theory of vagueness that dispenses with the use of fuzzy logic. According to him, pragmatic mechanisms enrich the meaning of an expression by associating a *halo* to it. These halos are conceived as contextually provided semantic values that, for instance, allow to take as valid a sentence that is false in a strict sense. Consider the examples in (5). Both sentences are strictly false in a situation in which Cosmo arrived exactly at five past three in the afternoon. However, under normal use conditions, (5a) is to be judged as true, given that a five minutes difference can be taken to be pragmatically irrelevant; on the contrary, (4b) remains to be judged as false as a one hour difference does count as relevant.

(5) a. Cosmo vino a las tres de la tarde.
'Cosmo came at three in the afternoon.'
b. Cosmo vino a las cuatro de la tarde.
'Cosmo came at four in the afternoon.'

In Lasersohn's terms, this opposition is due to the fact that 'five past three' is within the pragmatic halo of *tres de la tarde* 'three in the afternoon', e.g., (6a), while *cuatro de la tarde* 'four in the afternoon' is not, e.g., (6b).

(6) a. *Strict denotation of (5a):* 3:00PM
Halo of (5a): the temporal segment from 2:45PM to 3:15PM
b. *Strict denotation of (5b):* 4:00PM
Halo of (5b): the temporal segment from 3:45PM to 4:15PM

This system is also able to account for non-scalar imprecisions. For example, a sentence like (4a) is to be judged as true if the amount of hair in Jorge's head is within the pragmatic halo associated to the predicate *pelado* 'bald'. As Lasersohn notices, this type of account dispenses with the need of adopting fuzzy sets: a predicate like *pelado* 'bald' can be well-defined in traditional terms (e.g., a set of x's such as x is bald), while the pragmatic halo introduces a "margin of error" in which the predicate may be used felicitously.

Pragmatic halos may be manipulated by what Lasersohn calls *slack regulators*. These are expressions such as *exactly* or *precisely*, which "shrink" the pragmatic halo and, therefore, reduce the contexts in which a proposition may be judged as true. For instance, the example in (7) is in strict terms equivalent to (5a), i.e., both sentences share the same denotation.

(7) Cosmo vino exactamente a las tres de la tarde.
'Cosmo came exactly at three in the afternoon.'

Nevertheless, (7) includes the slack regulator *exactamente* 'exactly', which has the effect of "shrinking" the pragmatic halo, e.g., (8). This predicts, for example, that the utterance will be considered false if Cosmo arrived at five past three.

(8) *Strict denotation of (7):* 3:00PM
Halo of (7): the temporal segment from 3:00:00PM to 3:00:59PM

In this proposal, approximative modifiers such as *aproximadamente* 'approximately' or *alrededor de* 'around of' do not alter the pragmatic halo itself, but they extend the strict denotation of the utterance until it coincides with the halo. Take as an example the sentence in (9).

(9) Cosmo vino aproximadamente a las tres de la tarde.
'Cosmo came approximately at three in the afternoon.'

Under normal use conditions, the pragmatic halo associated with *tres de la tarde* 'three in the afternoon' is taken to be the same as in (5a). The adverb *aproximadamente* 'approximately' modifies the denotation of the expression by making it match the contextually provided halo. Therefore, (9) is taken to be strictly true in a scenario in which Cosmo came at five past three, not only 'pragmatically true" as it would happen with (5a).

(10) *Strict denotation of (9):* identical to its halo
Halo of (9): the temporal segment from 2:45PM to 3:15PM

As shown in this example, Lasersohn's proposal makes a clear prediction with respect to the meaning of approximative elements: the range of values corresponding to the interpretation of an approximator depends on the contextually determined pragmatic halo. We will return to this issue in section 3.2.

The former discussion poses two big questions regarding the AI construction. The first one tackles on the descriptive adequacy of a unificationist theory of vagueness: do the sentences in (2) and (5a) pertain to a single natural class in such a way that a unique analysis allows to predict their functioning? In this sense, authors like Sauerland & Stateva (2011) state that epistemic imprecisions like (4a) and cases of scalar vagueness such as (5a) should be analyzed in different ways. Among the reasons they adduce, they notice that both types of vagueness make use of different approximators, e.g., (11). This is unexpected from a unificationist point of view.

(11) *Jorge es aproximadamente pelado.
'Jorge is approximately bald.'

Adopting the epistemic vs. scalar distinction has important consequences for the study of the AI construction: positing that approximatives are instances of scalar vagueness opens the possibility of employing theoretical tools in their analysis that pertain to the scalar domain alone, e.g., especial properties of numerals may be exploited. This option is not available under a unificationist approach to vagueness.

The second question that arises with respect to the AI phenomenon points at the "source" of the approximative interpretation: does the construction acquire its approximative meaning from pragmatic mechanisms, or does it contain some special element carrying that meaning? In other words, does the sentence in (12c) behave like (12a) in having a contextually provided "margin of error" (due to its pragmatic halo, in Lasersohn's terms, or whatever pragmatic mechanism is adopted),

or should it be analyzed as (12b), in which the adverb *aproximadamente* 'approximately' contributes to the meaning of the sentence in a compositional way (i.e., the semantic denotation extends over the pragmatic halo, in Lasersohn's terms)?

(12) A guide takes a group of tourists into an antique library and tells them how many books are kept in there. Although the library has exactly ten thousand and two hundred books, the guide says:

a. La biblioteca tiene diez mil libros.
'The library has ten thousand books.'

b. La biblioteca tiene aproximadamente diez mil libros.
'The library has approximately ten thousand books.'

c. La biblioteca tiene ***unos*** diez mil libros.
'The library has UNOS ten thousand books.'

The answer to these questions is far from obvious. The AI construction does not seem to manifest any overt element contributing to its approximative interpretation. In principle, this would lead us to subsume (12c) to the kind of pragmatic mechanism responsible for vague readings of round numbers as in (12a); the function of the indefinite article in (12c) could be then to avoid blocking the approximative reading, as a definite article would most certainly do.

In what follows, we aim to show that (12a) and (12c) exhibit distinct behaviors when closely examined. Moreover, we show that the AI construction functions in many respects as an expression modified by an explicit approximator.

3. Distinguishing types of vagueness

In this section we develop three empirical arguments showing that the approximative reading emerging from the AI construction is parallel to the one obtained by using modifiers as *aproximadamente* 'approximately'. The discussion is aimed to argue that the approximative meaning in the AI construction is semantically-driven, i.e., there is a particular linguistic formant providing the approximative value.

3.1. Commitment of uncertainty

In some cases, using a vague expression implies that the speaker is being as precise as she can be, and that she does not have further information to make her utterance more precise. We call this condition *commitment of uncertainty.* This constraint can be used, for instance, to further distinguish

between epistemic and scalar vagueness as the former is not subject to it, e.g., a speaker that employs a vague predicate like *pelado* 'bald' can immediately add a more accurate formulation without triggering a pragmatic clash.

(13) Jorge es pelado, le quedan exactamente diez pelos.
'Jorge is bald, he has exactly ten hairs.'

On the contrary, scalar vagueness is sensitive to commitment of uncertainty. A speaker conveying an approximative interpretation either by articulating a round number (14), an overt approximator (15), or the AI construction (16), is committed to the fact that she ignores the exact number she is talking about. Therefore, in these cases is impossible to further specify an exact number.

(14) #La biblioteca tiene diez mil libros, pero esos diez mil doscientos libros son usados.
'The library has ten thousand books, but those ten thousand and two hundred books are second hand.'

(15) #La biblioteca tiene aproximadamente diez mil libros, pero esos diez mil doscientos libros son usados.
'The library has approximately ten thousand books, but those ten thousand and two hundred books are second hand.'

(16) #La biblioteca tiene ***unos*** diez mil libros, pero esos diez mil doscientos libros son usados.
'The library has UNOS ten thousand books, but those ten thousand and two hundred books are second hand.'

The distinct behavior of (13), on one side, and (14), (15) and (16), on the other, provides evidence against a unified approach to vagueness, and further supports the ontological distinction between epistemic and scalar vagueness. Since this opposition seems to be well-grounded, discussion from now on will focus on similarities and asymmetries among different types of scalar vagueness.

While so far round numbers seem to pattern with approximators and the AI construction, there is data that allows to set them aside. For example, given a question that requires a precise answer, round numbers lose their approximative meaning (17a). On the contrary, both the adverb *aproximadamente* 'approximately' (17b) and the AI construction (17c) preserve it in order to convey uncertainty with respect to a precise number, e.g., sentences like (17b) and (17c) can be felicitously continued by

adding *pero no sé cuántos exactamente* 'but I don't know exactly how many'. Thus, in a sense, commitment of uncertainty licenses the approximative reading in these cases.

(17) ¿How many books does the library have exactly?

a. La biblioteca tiene diez mil libros. * *approximation*
'The library has ten thousand books.'

b. La biblioteca tiene aproximadamente diez mil libros. ✓*approximation*
'The library has approximately ten thousand books.'

c. La biblioteca tiene ***unos*** diez mil libros ✓*approximation*
'The library has UNOS ten thousand books.'

The distinctive behavior of round numbers with respect to commitment of uncertainty may also be attested in contexts that aim to cancel the strict denotation of a vague expression. For instance, the sentence in (18a) is felicitous as uncertainty is declared after the approximate round number is uttered. If the clauses are reversed, as in (18b), the result is anomalous.

(18) a. La biblioteca tiene diez mil libros, aunque no sé si son exactamente diez mil.
'The library has ten thousand books, although I don't know whether they are exactly ten thousand.'

b. #Aunque no sé si son exactamente diez mil, la biblioteca tiene diez mil libros.
'Although I don't know whether they are exactly ten thousand, the library has ten thousand books.'

This pair can be explained in terms of pragmatic halos. Notice that the clauses in these examples are contradictory, i.e., the sentence in (18a) has the form *(I assert) p, but I don't know whether exactly p*, while (18b) has the form *I don't know whether exactly p, but (I assert) p*. The difference is given by the moment in which the approximative reading takes place. At the moment the first clause is interpreted in (18a), pragmatic halos enrich the semantic representation giving place to alternative interpretations that differ from *p* in their cardinality; when the second clause is uttered, the content of *p* (and only *p*) is retracted, but its alternative readings survive felicitously. On the contrary, pragmatic halos cannot enrich *p* in (18b) as it is already contradictory with respect to the previous clause at the moment it is uttered.

The pair in (18) contrasts sharply with the behavior of both overt approximators as *aproximadamente* 'approximately' and the AI construction. In these cases, clause order is irrelevant for the acceptability of the utterances.

(19) a. La biblioteca tiene aproximadamente diez mil libros, aunque no sé si son exactamente diez mil.
'The library has approximately ten thousand books, although I don't know whether they are exactly ten thousand.'

b. Aunque no sé si son exactamente diez mil, la biblioteca tiene aproximadamente diez mil libros.
'Although I don't know whether they are exactly ten thousand, the library has approximately ten thousand books.'

(20) a. La biblioteca tiene ***unos*** diez mil libros, aunque no sé si son exactamente diez mil.
'The library has UNOS ten thousand books, although I don't know whether they are exactly ten thousand.'

b. Aunque no sé si son exactamente diez mil, la biblioteca tiene ***unos*** diez mil libros.
'Although I don't know whether they are exactly ten thousand, the library has UNOS ten thousand books.'

If the pragmatic solution offered for (18) is on the right track, then the acceptability of these pairs cannot be explained in the same terms. In fact, these patterns lead to conjecture that both overt approximators and the AI construction unambiguously convey the speaker's commitment to a lack of knowledge about the precise cardinality of a set; this trait of their meaning prevents contradictory statements in (19b) and (20b). For the case of *aproximadamente* 'approximately', it could be argued that such information is part of the lexical entry of the adverb. A similar explanation can be offered for (20b) under the assumption that there is an element of the AI construction that systematically provides this meaning, i.e., if the approximative meaning in the construction comes from a certain constituent.

3.2. Proportionality of the intervals of approximation

When a speaker triggers a vague interpretation of a number *n*, there seems to be at play a continuous interval of possible values around *n* functioning as a sort of "margin of error". While defining the range of values corresponding to a given number is not an easy task, speakers do have intuitions about

the numbers that may be within it. For instance, the approximative interpretation of the number *veinte* 'twenty' seems to us to denote an interval roughly going from 17 to 23.[1]

(21) a. Vinieron aproximadamente veinte personas.
'Approximately twenty people came.' $\approx n$ people came / $17 \leq n \leq 23$

b. Vinieron ***unas*** veinte personas.
'UNAS twenty people came.' $\approx n$ people came / $17 \leq n \leq 23$

Consider now the sentences in (22). In these examples, the range of values for the number *dos mil* 'two thousand' can be intuitively defined as the interval roughly going from 1700 to 2300.

(22) a. Vinieron aproximadamente dos mil personas.
'Approximately two thousand people came.' $\approx n$ people came / $1700 \leq n \leq 2300$

b. Vinieron ***unas*** dos mil personas.
'UNAS two thousand people came.' $\approx n$ people came / $1700 \leq n \leq 2300$

As a comparison of (21) and (22) reveals, there seems to be a more or less proportional relation between a cardinal number and its range of approximation. This property is hard to motivate under the assumption that all types of vagueness are calculated contextually through purely pragmatic means: why should context define proportional relations between a number and its "margin of error"? In any case, one would expect pragmatics to create intervals with contextually dependent widths.

Consider the functioning of overt approximators and the AI construction when combined to cardinal disjuncts. This configuration is interpreted as referring to a specific interval: the range of approximation takes the numerals as its upper and lower limits. The sentences in (23), for example, make use of the interval between *veinte* 'twenty' and *venticinco* 'twenty-five'.

(23) a. Vinieron aproximadamente veinte o veinticinco personas.
'Approximately twenty or twenty-five people came.' $\approx n$ people came / $20 \leq n \leq 25$

b. Vinieron ***unas*** veinte o veinticinco personas.
'UNAS twenty or twenty-five people came.' $\approx n$ people came / $20 \leq n \leq 25$

[1] As observed by Channell (1994), there is a considerable amount of variation regarding the length of the intervals. This variation is not only attested between different types of approximators, but also between speakers, e.g., some speakers could judge that the intervals exemplified throughout the paper are too wide, while others may consider they are too narrow. In particular, we are not attempting to propose an algorithm to obtain "the size" of the range of approximation. For a list of coefficients predicting the logarithmic width of the interval for a number of approximators, see Ferson et al. (2015).

As noticed by Channell (1980), there is a limit on the "distance" between the two cardinals participating in this type of construction.

(24) a. #Vinieron aproximadamente veinte o cuarenta personas.
'Approximately twenty or forty people came.'
b. #Vinieron ***unas*** veinte o cuarenta personas.
'UNAS twenty or forty people came.'

One intuitive way of capturing this restriction is by stating it in terms of intervals of approximation: since the interpretation of the sentences in (23) involves a continuous interval of values going from one cardinal to the other, it is just intuitive that the individual ranges of approximation of the cardinals must "overlap" in order to license such a reading. However, since each individual interval is supposed to be somewhat proportional to its numeral, it follows that the ranges of approximation of relatively distant numbers will not overlap and, therefore, the resulting disjunctions will lack an approximative reading, just as it happens in (24).

The proportional relation between a cardinal and its approximative interval seems to be a defining property of overt approximators as *aproximadamente* 'approximately' and the AI construction alone. Other forms of vagueness, e.g., epistemic modals, do allow expressing intervals of greater width.

(25) a. Pueden haber venido veinte o veinticinco personas inclusive, no sé.
Twenty or thirty people even might have come, I don't know.
$\approx n$ people came / $20 \leq n \leq 25$
b. Pueden haber venido veinte o cuarenta personas inclusive, no sé.
Twenty or thirty people even might have come, I don't know.
$\approx n$ people came / $20 \leq n \leq 40$

Round numbers seem to behave like the examples in (23) and (24) regarding disjunction. If both ranges of approximation are close enough to "overlap", the approximative reading involving an interval between both numbers is available, e.g., (26a); if the numerals are too distant, e.g., (26b), the approximative reading is impossible. In both cases, a simple disjunctive reading is always available.

(26) a. Vinieron veinte o veinticinco personas. ✓*approximation*
'Twenty or twenty-five people came.' $\approx n$ people came / $20 \leq n \leq 25$

b. Vinieron veinte o cuarenta personas. * *approximation*
'Twenty or forty people came.'

Besides this parallelism, the way in which round numbers compose their interval of approximation differs from "the proportional calculus" attested with overt approximators and the AI construction. In particular, the imprecision associated to round numbers can be manipulated by pragmatic mechanisms. Consider the example in (27). In this scenario, the exact cardinality of the numeral is irrelevant, so the sentence can be judged as both true and felicitous. In other words, this context licenses a vague interpretation of the number *doscientos* 'two hundred'.

(27) [Context: Gerardo lent 195 dollars to his friend Cosmo. As gratitude, Cosmo wants to give him a present. Gerardo argues that it is not necessary. Cosmo complains:]
¡Te debo doscientos dólares!
I ow you two hundred dollars!

The same utterance false in a context that requires a more precise cardinality.

(28) [Context: Cosmo and Jorge owe Gerardo some money; Cosmo owes him 195 dollars and Jorge 197 dollars. They want to know who of the two owes Gerardo the most. Jorge declares he owes 197 dollars. Cosmo responds:]
¡Yo le debo doscientos dólares!
I ow him two hundred dollars!

In Lasersohn's terms, the context in (28) reduces the pragmatic halo of 195 to a point in which the number *doscientos* 'two hundred' is excluded from the range of approximation. Cosmo's utterance is, therefore, false.

The effect that both *aproximadamente* 'approximately' and the AI construction have in the same context is quite different. If sentences like those in (29) are evaluated in the context described in (28), the result is clearly infelicitous.

(29) a. #Yo le debo aproximadamente doscientos dólares.
'I ow him approximately two hundred dollars.'
b. #Yo le debo ***unos*** doscientos dólares.
'I ow him UNOS two hundred dollars.'

The problem lies in the fact that the interval of approximation in these sentences contains values that are both above and below Jorge's debt. In other words, using approximative resources in this scenario does not allow to decide who of the two owes more money. Crucially, the expressions in (29) do not permit any "shrinkage" of their ranges of approximation; they remain proportional to the cardinal despite of any contextual needs. The conclusion seems to be straightforward: since the "margin of error" emerging in both these cases is not sensitive to pragmatics, it must be due to the semantic contribution of the elements that distinguish these sentences from the one in (28), i.e., the adverb *aproximadamente* 'approximately' in (29a), and the indefinite article *unos* in (29b).

The observation that the meaning of overt approximators is not context-dependent allows to build an argument against the analysis that Lasersohn (1999) advances for them. Consider once again the examples in (17), repeated for convenience in (30). According to Lasersohn, the sentence in (17a) lacks an approximative reading because the preceding question leads to reduce the pragmatic halo of the numeral to a minimum.

(30) ¿How many books does the library have exactly?

a. La biblioteca tiene diez mil libros. * *approximation*
'The library has ten thousand books.'

b. La biblioteca tiene aproximadamente diez mil libros. ✓*approximation*
'The library has approximately ten thousand books.'

c. La biblioteca tiene ***unos*** diez mil libros ✓*approximation*
'The library has UNOS ten thousand books.'

Lasersohn conjectures that the "margin of error" of an overt approximator is the result of extending the semantic denotation of the numeral until it matches its pragmatic halo. However, this fails to predict the behavior of *aproximadamente* 'approximately' in (30b). Since (30a) and (30b) share the same context, their pragmatic halos must also be identical, i.e., "shrunk" enough to cancel any approximative reading. Thus, extending the denotation of the numeral in (30b) to match its halo should lead to no approximation at all. Notice that the same problem arises with the AI construction in (30c): its approximative interpretation should be impossible as it shares context with (30a).

Although this paper is not devoted to offer a detailed critic of Lasersohn's system, the former observations do suggest that his framework is not adequate to model the functioning of the AI construction.

3.3. Approximators may be focused

Consider the following situation. At some event, Jorge complains to Cosmo that there are less people than expected. Cosmo emphatically replies that the number was merely an estimation.

(31) Jorge: Me dijiste que vendrían veinte personas.
'You told me that twenty people would come.'
Cosmo: Te dije que vendrían veinte personas [$_F$ APROXIMADAMENTE].
'I told you that APPROXIMATELY twenty people would come.

This example shows that overt approximators can be contrastively focused. The relevant interpretation of this example is that the numeral should not be interpreted with respect to its precise cardinality, but its interval of approximation should be taken into consideration.

Unsurprisingly, focusing the range of approximation is impossible with round numbers.

(31) Jorge: Me dijiste que vendrían veinte personas.
'You told me that twenty people would come.'
Cosmo: #Te dije que vendrían VEINTE personas.
'I told you that TWENTY people would come.

This is due the fact that the range of approximation associated to round numbers is contextually-dependent, and contrastive focus can only be applied to constituents containing information that is not contextually available, i.e., elements that are not *given*.

However, focusing the indefinite article in AI constructions is perfectly acceptable with exactly the same interpretation than in (30).

(32) Jorge: Me dijiste que vendrían veinte personas.
'You told me that twenty people would come.'
Cosmo: Te dije que vendrían [$_F$ **UNAS**] veinte personas.
'I told you that UNAS twenty people would come.

This is at odds with an analysis of the AI construction according to which it approximative reading is due to pragmatic enrichment. On the contrary, this behavior is expected if the article (or some of its

morphological components) introduces the approximative meaning just as the adverb *aproximadamente* 'approximately' does in (30).

4. Towards an analysis of approximate indefinites

As Lasersohn (1999) and Sauerland & Stateva (2011), among others, observe, expressions like *aproximadamente* 'approximately' affect the strict denotation of a predicate through semantic composition without altering the pragmatic conditions under which the utterance might be considered true (i.e., these elements do not modify the pragmatic halo). The facts discussed in the previous section suggest that the AI construction should be analyzed in similar terms. Proposing such an account necessarily involves defining (i) which element introduces the approximative meaning in the AI construction, and (ii) how it interacts with the cardinal in order to obtain a numeric "margin of error". In what follows we address both issues.

4.1. The syntax of the AI construction

Our proposal is inspired in Rothstein's (2013, 2017) treatment of lexical powers functioning as approximative classifiers. As shown in (33), these numerals introduce a sort of vagueness with respect to the quantities they refer to.

(33) a. cientos de perros
'hundreds of dogs' $\approx n$ dogs / $200 \leq n$

b. miles de personas
'thousands of people' $\approx n$ people / $2000 \leq n$

According to Rothstein, this imprecision is due to an operation dubbed *Approx* that takes a nominal numeral as input, e.g., *ciento* 'hundred' or *mil* 'thousand', and returns an approximative lexical power as result, e.g., *cientos* 'hundreds' or *miles* 'thousands'. This process has the side-effect of adding plural morphology to the noun, which explains why all approximative lexical powers are plural, e.g., **ciento de perros* 'hundred of dogs'.

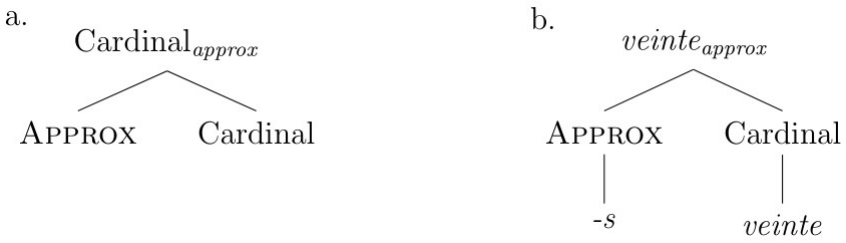
The analysis we advance in this paper differs from Rothstein's in its implementation. Instead of assuming that the vague interpretations in (33) are the product of a particular operation, we propose the existence of a family of morphemes in charge of introducing imprecise and approximative meanings when combined to numerals; we call these elements APPROX. Adapting Rothstein's ideas, we take the exponent of APPROX to be syncretic with the plural affix *-s* in Spanish. Thus, to produce

an approximative lexical power like *cientos* ‘hundreds’ in (33a), APPROX combines with the numeral noun *ciento* ‘hundred’, as sketched in (34b).

(34)

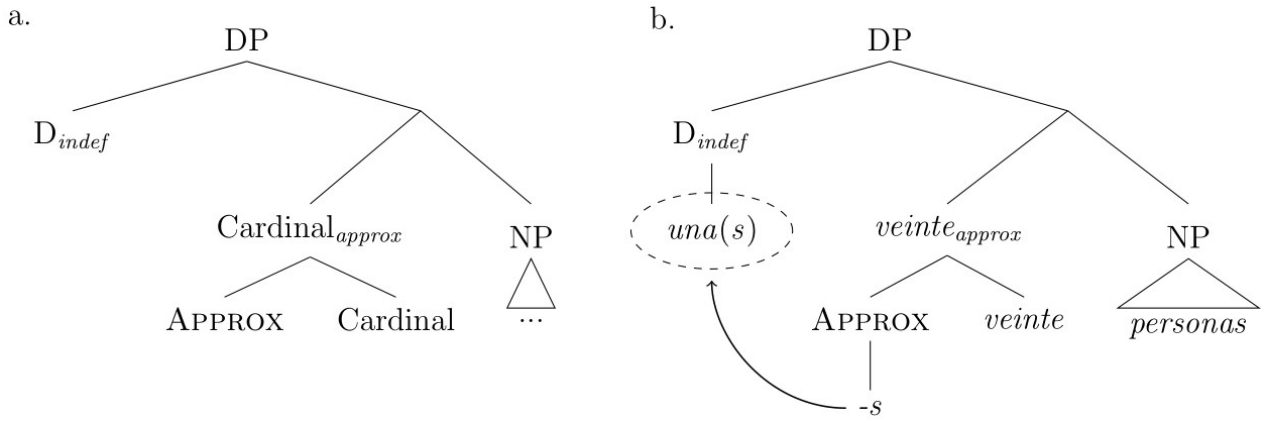
An analogous structure can be advanced to account for the interpretation of cardinals in the AI construction. That is, we propose that APPROX combines with a cardinal number to produce an approximative reading of the cardinal. This is sketchily illustrated in (35) with respect to the cardinal veinte ‘twenty’ that appears in (21b).

(35)



A crucial difference between nominal and cardinal numerals combining with APPROX is that the latter do not inflect in number, i.e., cardinals cannot host plural affixes, e.g., **veintes* ‘twenties’, **cincos* ‘fives’, **catorces* ‘fourteens’. Therefore, the affix *-s* does not attach to the cardinal in AI constructions. Since the affix *-s* cannot remain loose due to morphological requirements, e.g., the *stranded affix filter* of Lanik (1981), an indefinite article is introduced in the construction to host it, e.g., (36b).

(36)



This representation explains why the semantic import of plural indefinites in the AI construction affects the cardinality of the expression. Moreover, it also clarifies why the indefinite behaves as the element carrying the approximative meaning for the purposes of certain grammatical processes, e.g., contrastive focus as in (32).

A further consequence of the analysis in (36) refers to the conditions in which the APPROX suffix can be attached to the indefinite article. Under the assumption that affixation requires adjacency between the affix and its host (e.g., Bobaljik 1995, 2002), no material can appear between the article and the cardinal in the AI construction. This prediction seems to be borne out. As the examples in (37) show, an adjective like *hermosas* 'beautiful' can appear in a prenominal (37a) or in a postnominal position (37b) without affecting the approximative reading of the construction. However, if it appears in between the indefinite article and the cardinal, the approximative interpretation is lost (37c); the determiner in this case functions as a standard indefinite article.[2]

(37) a. Necesitamos ***unas veinte*** personas hermosas.
'We need UNAS twenty beautiful people.' ✓*approximation*

b. Necesitamos ***unas veinte*** hermosas personas.
'We need UNAS twenty beautiful people.' ✓*approximation*

c. Necesitamos ***unas*** hermosas ***veinte*** personas.
'We need twenty beautiful people.' **approximation*

[2] The question remains, however, about why the affix *-s* cannot be attached to other elements other than indefinite articles. At the moment, we do not have an explanation for this selective behaviour.

4.2 The semantics of the AI construction

This section aims to draw an explicit characterization of the semantic composition of AI constructions. As a starting point, we adopt the usual assumption that a noun denotes a set of entities, i.e. a function of type <e,t>. For instance, the denotation for the noun *persona* 'person' is as in (38).

(38) $[\![\text{persona}]\!] = \lambda x \in D_e$. x is a person
'person'

We take that plural nominal phrases denote sets of plural entities (Link 1983); plural denotations are calculated by applying the plural operator * to singular noun phrases.

(39) $*X = \{x: \exists Y \subseteq X: x = \sqcup Y\}$
The plural operation over a set X leads to the set of every x such that there exists a set Y which is a subset of X and x is a plural individual equivalent to the sum of the atomic members of the set Y (alternatively, in lattices terms, x is the higher node or higher i-sum constituted by all the atomic members of Y).

Thus, the denotation of the plural noun *personas* 'people' is the result of applying the plural operator * to the denotation in (38).

(40) $[\![\text{personas}]\!] = [\![*\text{persona}]\!] = \lambda y. \exists Y \subseteq \{x: x \text{ is a person}\}: y = \sqcup Y$
'people'

As for numerals, we assume they pertain to a particular semantic type *n*. Thus, cardinal numerals are assigned denotations as those sketched in (41).

(41) a. $[\![\text{cuatro}_{<n>}]\!] = 4$
'four'
b. $[\![\text{veinte}_{<n>}]\!] = 20$
'twenty'
c. $[\![\text{cien}_{<n>}]\!] = 100$
'one-hundred'

The morpheme APPROX may receive at least two different interpretations. When APPROX combines with a nominal lexical power, e.g., (34), its denotation should be similar to (42), which is an adaptation of Rothstein's (2013, 2017) proposal.

(42) $[\![\text{APPROX}]\!] = \lambda n \in D_n . \lambda x \in D_e. \exists z \in D_n$ such that $z \geq n \times 2 \wedge |x| \geq z$

A function that takes an *n* in the domain of numbers and returns a function taking an x in the domain of entities. This function returns the proposition that there exists a number z that is equal or higher than the product of 2 and n, and that the cardinality of x is equal or higher than z.

When APPROX modifies a cardinal number as in the AI construction, e.g., (35), its interpretation corresponds to the denotation in (43).

(43) $[\![\text{APPROX}]\!] = \lambda n \in D_n . \lambda x \in D_e. \exists z \in D_n$ such that $z > n - \sigma \wedge z < n + \sigma \wedge |x| = z$

A function that takes an *n* in the domain of numbers and returns a function taking an x in the domain of entities. This function returns the proposition that there is a number z higher than n-σ and lower than n+σ, and the cardinality of x is equal to z.

The σ introduced in (38b) represents a number proportional to *n* that allows to define the approximative "margin of error" of *n*, i.e., it allows to pin point the continuous interval of values going from *n*-σ to *n*+σ. As Ferson et al. (2015) observe, there are a number of conceivable ways to define such a proportion, none of which seems to be empirically adequate. For the purposes of this paper, it is enough to assume that the cardinality of σ is simply a fraction of the cardinality of *n*.

The question arises on whether it is necessary to establish such a variable in order to define the range of approximation. For instance, Krifka (2007) and Sauerland & Stateva (2011) maintain that the semantics of approximation depends on the *granularity* with which a certain cardinal is used. That is, an adverb like *exactamente* 'exactly' operates by "zooming the scale" in which a number like *diez mil* 'ten thousand' is perceived, e.g., (44a); as a consequence, only cardinals that are close enough to ten thousand are within the available "margin of error". In contrast, an adverb like *aproximadamente* 'approximately' "zooms out the scale", e.g., (44b); this allows the number *diez mil* 'ten thousand' to refer to more distant cardinalities.

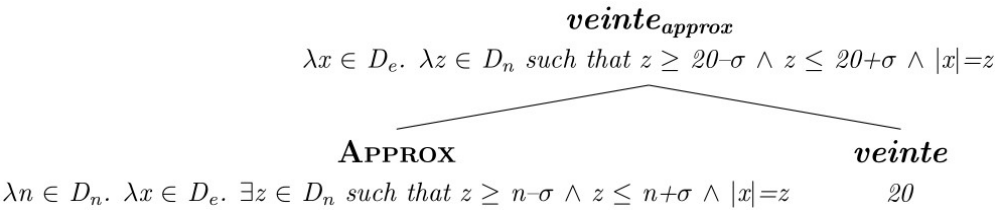
(44) a. Exactamente diez mil: 9.990 … 9.995 … 10.000 … 10.005 … 10.010
'exactly ten thousand'

b. Aproximadamente diez mil: 9.000 … 9.500 … 10.000 … 10.500 … 11.000
'approximately ten thousand'

The problem we see with such an approach is that it does not predict the rather proportional relation between *n* and its "margin of error". That is, granularity alone does not capture the fact that the interval of approximation for *cien mil* 'one-hundred thousand' (e.g., +/-5.000) is broader than the one corresponding to *diez mil* 'ten thousand' (e.g., +/-500); there is no a priori reason for why the "magnifying glass" zooming in and out the scale would become wider for higher numbers. In order to predict a more or less constant relation between *n* and its range of approximation, it seems necessary to adopt a proportionality parameter, i.e., something similar to the value σ introduced in (43). In other words, even in Krifka's (2007) and Sauerland & Stateva's (2011) approaches, some type of proportional variable is required.

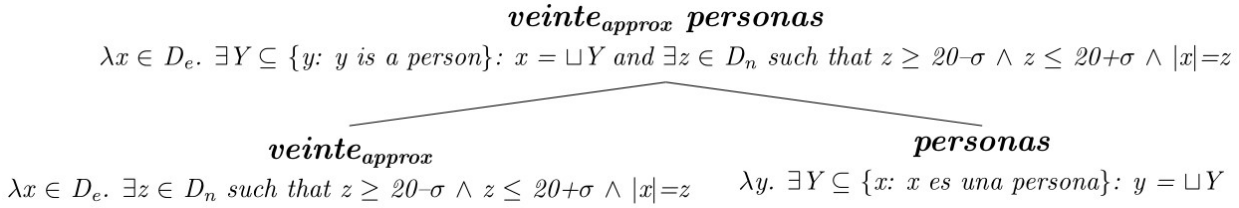
We have already introduced all the denotations we need to derive the semantic interpretation of the AI construction. Take once again the example in (21b), which contains the phrase *unas veinte personas* 'UNAS twenty people'. As sketched in (35), the approximative reading over the cardinal is obtained by combining the APPROX morpheme and the cardinal number through functional application; by employing the denotations in (43) and (41), respectively, the following representation is obtained.

(45)



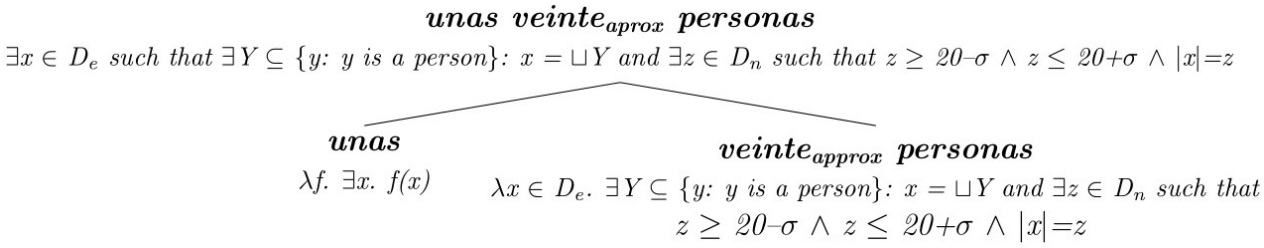
The approximative cardinal then combines with the plural nominal phrase *personas* 'people' through predicate modification. As discussed, the denotation of this element is obtained by applying the operator * in (39) to the entry of *persona* 'person' in (38).

(46)



Finally, the indefinite article is introduced in the structure. As explained with respect to the syntactic representation in (36), the indefinite is inserted to host the approximative affix *-s*, preventing this way a stranded affix violation. Under the usual assumption that indefinites introduce existential quantifiers, the Spanish expression *unas veinte personas* 'UNAS twenty people' denotes the proposition that there is a group of people (i.e. a plural individual formed by people) such that its cardinality is within the range of approximation of the number twenty. The relevant formalization is expressed in (47).

(47)



5. Further issues

While the core aspects of our proposal have been already discussed, some remaining issues should be addressed before advancing our final conclusions.

5.1. The adverb *aproximadamente* 'approximately' vs. the AI construction

Section 3 showed that the meanings of a cardinal modified by *aproximadamente* 'approximately' and the AI construction are analogous. This observation should not be taken to imply that both types of approximator always pattern alike. Consider the sentences in (48). These examples show that separating the indefinite article and the cardinal is impossible in the AI construction. This unsurprising behaviour is predicted by the analysis advanced in section 4.

(48) a. Vinieron ***unas veinte*** personas.
Came unas twenty people
'UNAS twenty people came.'

b. ***Unas veinte*** personas vinieron.
UNAS twenty people came

c. ****Unas*** vinieron ***veinte*** personas
UNAS came twenty people

d. ****Veinte*** personas vinieron ***unas***.
Twenty people came UNAS

On the contrary, the distribution of *aproximadamente* 'approximately' is radically less restricted. As shown in (48), the adverb does not need to move with the DP, i.e., they seem to behave as distinct constituents.

(49) a. Vinieron ***aproximadamente veinte*** personas.
came approximately twenty people
'Approximately twenty people came.'

b. ***Aproximadamente veinte*** personas vinieron.
approximately twenty people came

c. ***Aproximadamente*** vinieron ***veinte*** personas.
approximately came twenty people

d. ***Veinte*** personas vinieron ***aproximadamente***.
twenty people came approximately

This asymmetry suggests that the APPROX morpheme and *aproximadamente* 'approximately' are first-merged in distinct syntactic positions: while APPROX combines directly with the cardinal number and affixes to the article, the adverb never forms a constituent with or within the DP. Thus, *Aproximadamente* 'approximately' is base-generated as a separate constituent from the numeral it semantically modifies. This implies that the adverbial approximator is able to alter the cardinality of the numeral at a certain structural distance.

(50) a. [$_{DP}$ D$_{indef}$ [[APROX Cardinal] NP]] *direct composition*

b. *Aproximadamente* ... [$_{DP}$ Cardinal NP] *composition "at a distance"*

Before accepting this distinction, it should be noticed that the facts in (48) and (49) are also compatible with a homogenizing analysis in which *aproximadamente* 'approximately' combines with the cardinal at some point of the syntactic derivation. Under this approach, the word orders in (49) would be the outcome of syntactic movement; the restrictions in (48) could be attributed to the observation that determiners do not move without their complements.

Such an analysis is not tenable. Take the sentence in (51), which is perfectly acceptable in Spanish.

(51) ***Veinte*** dólares ***aproximadamente*** le di a Eliana.
twenty dollars approximately to.her gave to Eliana
'Twenty dollars, approximately, I gave to Eliana.'

For a movement analysis to capture this pattern, it should be proposed that (i) *aproximadamente* and *veinte* form a constituent within the DP, (ii) *aproximadamente* is extracted from the DP to a topic position, and (iii) the remnant DP moves over *aproximadamente* to a higher topic position.

(52) a. [$_{TP}$ le di [$_{DP}$ [***aproximadamente veinte***] dólares]] a Eliana].
b. [$_{TopP}$ ***aproximadamente***^{i} [$_{TP}$ le di [$_{DP}$ [t^{i} ***veinte***] dólares]] a Eliana]].
c. [$_{TopP}$ [$_{DP}$ [t^{i} ***veinte***] dólares]]^{j} [$_{TopP}$ ***aproximadamente***^{i} [$_{TP}$ le di t^{j} a Eliana]]].

This derivation violates a well-known restriction on remnant movement, the *Müller-Takano generalization* (Müller 1993, Takano 1994).

(53) Remnant XPs cannot undergo Y-movement if the antecedent of the unbound trace has also undergone Y-movement, where Y stands for a movement-related feature (like [wh] for wh-movement, [top] for topicalization, [Σ] for scrambling, etc.).

Therefore, to account for the acceptability of (51), an analysis based on the distinction drawn in (50) must be adopted, i.e., the adverb must be base-generated in a position outside the DP, from where it alters the meaning of the cardinal. Notice that this implies that the denotation of *aproximadamente* 'approximately' must differ in some respect from the one offered in (43) for the APPROX morpheme, as the latter supposes composition through functional application. In other words, while both elements trigger approximative interpretations, their lexical entries must be able to reflect their dissimilar syntactic functioning.

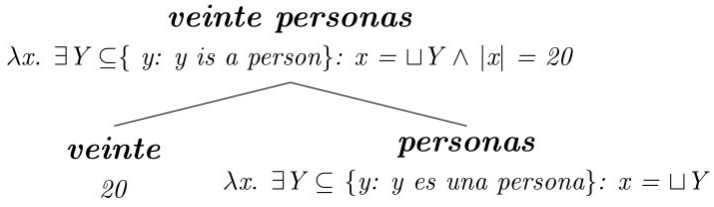
5.2. Cardinality assignment

The system sketched so far still requires additional assumptions to account for the interpretation of precise cardinalities, i.e., cases in which a cardinal is not combined with the APPROX morpheme. This can be done by stipulating a semantic rule of cardinality assignment like (54). This rule captures the intuition that combining a plural nominal and an expression of type *n* produces a constituent denoting a set with a number *n* of atomic elements.

(54) *Cardinality Assignment*
If α is a branching node whose daughters are β and *γ, such that $[\![\beta]\!] \in D_n$ and $[\![*\gamma]\!] \in D_{<e,t>}$, then $[\![\alpha]\!] = \lambda x.\ [\![*\gamma]\!](x) \wedge |x| = [\![\beta]\!]$

Say we want to calculate the precise interpretation of *veinte personas* 'twenty people'. As expressed in (40) and (41b), respectively, the plural noun *personas* 'people' denotes in $D_{<e,t>}$, while *veinte* denotes in D_n. When combined, these elements satisfy the cardinality assignment rule, which allows to obtain the denotation of their mother node as in (55).

(55)



5.3. Complex numerals

We have restricted our discussion to morphologically simple numbers. Intuitively, we might expect to treat numbers like *cinco* in Spanish or *five* in English as morphemes, as both words seem to lack an internal structure. Treating *quince* 'fifteen' as a monomorphemic unit could be plausible in Spanish, given that the opaque morphology of this number hinders its analysis in compositional terms; however, their counterparts in English (*fifteen*) or German (*fünfzehn*) do exhibit a clear compositional formation. Now, taking *veinticinco mil trescientos treinta y dos* 'twenty five thousand three hundred thirty two' as involving a single morpheme is totally untenable for every language that allows the expression of that number. It is clear then that languages like Spanish or English have combinatory rules that allow to put together two or more morphemes to form a single cardinal number. Our intention is to sketch a set of such rules allowing our proposal to work with morphologically complex numbers.

We take that monomorphemic numbers are lexical primitives, just as shown in (56). As already discussed, these elements are of type *n*.

(56) a. ⟦uno / dos / tres / cuatro / cinco / seis / siete / ocho / nueve / diez⟧ = 1/2/3/4/5/6/7/8/9/10
b. ⟦cien(to) / mil / millón⟧ = 100/1,000/1,000,000

Although numbers may be obtained mathematically through a plethora of operations (addition, subtraction, multiplication, division, power, root, logarithm, etc.), natural language grammars seem to employ predominantly two mechanisms: addition and multiplication. Therefore, we propose that complex numbers are built by combining morphemes such as those in (56) through functional

morphemes of addition SUM and multiplication MULT. The denotations of these elements are shown in (57).

(57) a. $[\![\text{SUM}]\!] = \lambda n \in D_n. [\lambda m \in D_n. n + m]$

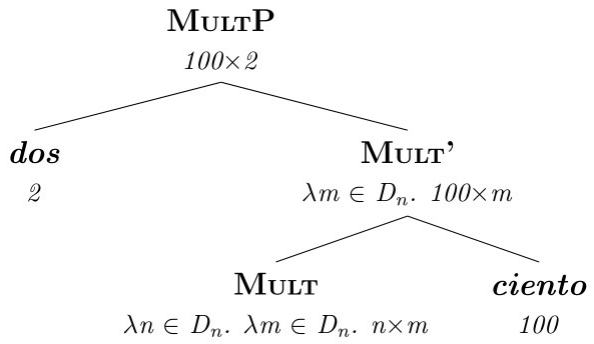
b. $[\![\text{MULT}]\!] = \lambda n \in D_n. [\lambda m \in D_n. n \times m]$

In Spanish, SUM has two possible phonological outputs. The first one consists on the insertion of the conjunction *y* 'and', which is triggered when units are added to tens, e.g. *veint-i-dos* 'twenty-and-two'*, treinta y tres* 'thirty and three'. The second option is the null realization, which is triggered when units are added to hundreds or numbers with more than two zeros (e.g. *thousand, million*): *ciento Ø cuatro* 'one hundred Ø four'*, mil Ø cinco* 'one thousand Ø five'*, un millón Ø cinco*.[3]

As for MULT, this head is always phonologically null in Spanish.

By employing entries for simple numbers as those in (56) and the heads SUM and MULT, it is possible to form complex numbers in the syntactic component. Take the derivation of the number *doscientos tres* 'two hundred and three' as an example. As a first step, the numbers *dos* 'two' and *ciento* 'hundred' are combined through the MULT head; *dos* is merged as the specifier of MULTP, while ciento is selected as the complement of MULTP. Each mother node in the resulting representation receives an interpretation due to functional application.

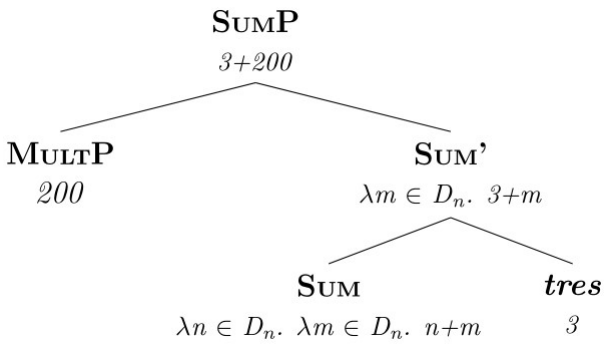
(58)



[3] According to Ionin & Matushansky (2006), cases like *veint-i-dos* 'twenty-and-two' or *treinta y tres* 'thirty and three' need to be analyzed as true coordination. Likewise, they take numbers as *ciento Ø cuatro* 'one hundred Ø four' and *mil Ø cinco* 'one thousand Ø five' to be instances of asyndetic coordination. In particular, their proposal is incompatible with our treatment of approximation as they do not consider cardinal numbers to be constituents, e.g., in an expression like *twenty two books*, the noun *books* combines first with *two,* and then *two books* combines with *twenty*. It is not clear to us how this type of system could deal with approximation under standard assumptions on semantic computation.

As a second step, the resulting MULTP is combined with the number *tres* 'three' through a SUM head. MultP functions in this case as the specifier of the Sum projection, while tres is taken to be the complement. Just as before, each node receives an interpretation via functional application.

(59)



Notice that this system precludes merging two numbers directly, as there is no semantic rule capable of assigning an interpretation to this type of combination. In short, D_n, i.e. the domain of elements of type *n*, is defined in our semantics as follows.

(60) a. If α is lexical number, then ⟦α⟧ is in D_n.

b. If ⟦α⟧ and ⟦β⟧ are in *n*, then ⟦Sum⟧(⟦α⟧)(⟦β⟧) and ⟦Mult⟧(⟦α⟧)(⟦β⟧) are in D_n.

c. If ⟦α⟧ is of type τ and ⟦β⟧ is of type <τ, n>, ⟦β⟧(⟦α⟧) is in D_n.

d. Nothing else is in D_n.

6. Concluding remarks

This paper has dealt with what we have called the approximate indefinite (AI) construction in Spanish, an approximative phenomenon involving a plural indefinite article and a cardinal number. As pointed out early in the article, the construction exhibits two unexpected traits for a structure headed by an indefinite determiner: first, its meaning is unexpected from the standard semantics associated to indefinite articles; second, the approximative interpretation is restricted to the cardinal, despite the fact the determiner is supposed to be combined with the whole NP.

As discussed, a potential way of making sense of these traits is through a pragmatic analysis. For instance, it could be argued that the approximative interpretation of the construction is similar to that associated with round numbers. A closer examination of the AI construction showed that it patterns

with structures containing an overt approximator like *aproximadamente* `approximately' with respect to (i) the commitment of uncertainty it introduces, (ii) the proportional range of approximation it enables with respect to a cardinal, and (iii) the possibility of focusing the approximator, i.e., the indefinite article.

Given these characteristics, we proposed an analysis of the AI construction in which an APPROX morpheme is directly combined with the cardinal number. Following Rothstein's (2013, 2017) ideas, we assumed the exponent of this morpheme to be syncretic with plural morphology. Since cardinals cannot host this type of affix, it attaches to the indefinite article heading the nominal in order to avoid a stranded affix violation. Regarding the semantics of the APPROX morpheme, it draws a "margin of error" around the cardinal number by calculating a proportional value σ. As discussed, this type of variable seems to be necessary even for other approaches to the semantics of approximators.

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