

# Dual number and the typology of the numeral-noun construction\*

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## Abstract

In this paper I propose an extension of Martí's (2020a) theory of the numeral+noun construction (e.g., English *three dogs*) to languages whose nouns distinguish singular, dual and plural. Martí hypothesizes that the number marking of nouns in this construction is the result of the interaction between the compositional semantics of number features, as in Harbour (2014), and that of cardinal numerals, as in Scontras (2014) and others. I argue below that Yimas and Hopi conform straightforwardly to the predictions such an extension makes for singular-dual-plural languages. I also argue that languages like Imere and Ljubljana Slovenian conform to the predictions once a proper understanding of complex numerals (in Ljubljana Slovenian) and number prefixes (in Imere) is in place. I borrow and adapt ideas from Ionin & Matushansky's (2006, 2018) analysis of complex numerals in my analysis of Ljubljana Slovenian complex numerals.

**Keywords:** dual; grammatical number; typology; numerals

## Resum. *El nombre dual i la tipologia de la construcció numeral-nom*

En aquest article estableixo el marc teòric per a una ampliació de la teoria de Martí (2020a) de la construcció numeral+nom (p. ex., l'anglès *three dogs* 'tres gossos') a llengües que al domini nominal fan una distinció entre singular, dual i plural. La proposta de Martí planteja la hipòtesi que el marcatge de nombre que veiem en els noms d'aquesta construcció és el resultat de la interacció entre la semàntica composicional dels trets de nombre, segons la concepció de Harbour (2014), i la dels numerals cardinals, segons la concepció de Scontras (2014) i d'altres. Més endavant argumente que el yimas i el hopi confirmen de manera exacta les prediccions que aquesta ampliació fa per a les llengües amb singular-dual-plural. També argumente que les llengües com l'imere i l'eslovè de Ljubljana també s'ajusten a les prediccions si entenem abans el funcionament dels

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numerals complexos (en l'eslovè de Ljubljana) i els prefixos de nombre (en imere). Per a la meua anàlisi dels numerals complexos de l'eslovè de Ljubljana adopto i adapto idees de l'anàlisi de Ionin i Matushansky (2006, 2018) dels numerals complexos.

**Paraules clau:** dual; nombre gramatical; tipologia; numerals

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## 1. Introduction

Two cross-linguistically common patterns for the numeral+noun construction in languages that distinguish singular from plural on nouns are illustrated in (1)-(3). (1)-(2) illustrate one of those patterns, as realized in English, and (3) illustrates the other pattern, as realized in Turkish (Bale, Gagnon & Khanjian 2011):

- (1) English  
One {**boy** | \***boys**}
- (2) English  
Two/three/twenty-three {**boys** | \***boy**}
- (3) Turkish  
Bir/ iki/ üç/ yirmi üç {**çocuk** | \***çocuk-lar**}  
One/ two/ three/ twenty three boy.SG | boy-PL  
'One/two/three/twenty-three boy(s)'

In the English pattern, the cardinal numeral *one* combines with a noun that is morphologically marked as singular, and other cardinal numerals combine with nouns marked for plural. In the Turkish pattern, all cardinal numerals combine with a noun that is morphologically marked for singular. Note that Turkish and other languages that instantiate this pattern do in principle inflect their nouns for plural (e.g., with the suffix *-lar*, subject to vowel harmony, in Turkish), but choose not to use the plural form of the noun in the numeral+noun construction (in both of the languages exemplified here, singular number is not realized phonologically, but nothing in what follows hinges on that).<sup>1</sup>

1. It is well known that another relevant pattern is that exemplified in Western Armenian, where numerals greater than one may combine with nouns marked for singular or for plural in the numer-

The morphological realization of the noun in the numeral+noun construction is usually considered a matter of number agreement, and the semantics of the construction is derived by a separate set of tools from that (see, e.g., Alexiadou 2019; Bylinina & Nouwen 2018; or Ionin & Matushansky 2006, 2018 for recent instantiations of this approach). In Martí (2020a, under review), however, a different analysis is entertained, one in which the morphological realization of grammatical number and the semantics of the construction arise from one and the same set of tools. There are reasons to think that the second approach deserves to be explored, which is what I do here. One important reason, discussed also in Martí (2020a: 4-5), is that the second approach significantly reduces the number of tools that are needed to account for the number properties of the noun in the construction. In this approach, there is no need to appeal to additional number agreement rules or principles to account for the number marking on the noun in the numeral+noun construction, since that follows already from the tools used to derive its semantics. In other words, the semantic analysis of the construction already predicts the shape that the noun should take, so appealing to any additional principles is unnecessary. It is this economical aspect of the proposal that makes it worth pursuing in principle.

The set of tools that Martí (2020a) appeals to is, in brief, as follows. First, she assumes Harbour's (2014) theory of number features. In particular, she assumes that at most three binary features can appear in NumberP, the locus of grammatical number: [ $\pm$ atomic], [ $\pm$ minimal] and [ $\pm$ additive]. These are features with a semantics that does not vary cross-linguistically and with a specific morpho-syntactic realization in different languages. Second, she follows Scontras' (2014) assumptions about the syntax and semantics of (bare) numerals, which are treated as specifiers of NumeralP that denote numbers (i.e., type  $\langle n \rangle$ ). NumeralP itself is headed by a counting predicate *CARD* and bears a specific syntactic relation to NumberP, namely, it is dominated by it. With these assumptions in place, the patterns we observed above follow.<sup>2</sup>

The theoretical goal of this paper is to work out the predictions that an approach like this makes with respect to languages that, in addition to singular and plural, also distinguish dual in nouns. The extensions to the theory that I propose here entail that, generally speaking, the locus of cross-linguistic variation for the phenomenon at hand rest in two places: (a) the number feature(s) a particular language generates in NumberP, and (b) the structural relationship between NumberP and NumeralP – I will assume that, in a given language, NumberP dominates NumeralP (NumberP  $\gg$  NumeralP), as in Scontras' proposal, or the other way around (NumeralP  $\gg$  NumberP).

The theory is quite restrictive in what it predicts for singular-dual-plural languages, as explained in detail in section 3. In what I will call predicted pattern

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al+noun construction, with interpretative effects (see Ionin & Matushansky 2018; Martí 2020a; Scontras 2014; Sigler 1997). Martí (2020a) shows how that pattern can be understood within the framework defended there. For reasons of space, I will not be able to consider here how the possibility of optionality interacts with the proposal I make below.

2. Martí (under review) shows that the same assumptions can explain the patterns that we find with zero as the numeral.

1, shown in (4), the numeral one combines only with a noun in the singular, the numeral two, only with a noun in the dual, and other numerals, only with the noun in the plural:

- (4) Predicted pattern 1:  
 One + N-**singular**  
 Two + N-**dual**  
 Other numeral + N-**plural**

Predicted pattern 2, shown in (5), is just like Predicted pattern 1 except that with numerals other and one and two, the dual form of the noun is used:

- (5) Predicted pattern 2:  
 One + N-**singular**  
 Two + N-**dual**  
 Other numeral + N-**dual**

On the empirical side, the goal is to find out whether there are languages that exemplify these patterns, and whether there are languages that constitute counterexamples to the predictions made by the theory. I show in section 3 that pattern 1 is straightforwardly exemplified in Yimas and Hopi.

Predicted pattern 2 might seem strange at first but can be viewed as a generalization of the Turkish pattern in that, if attested, we'd have a language that in principle marks plurality on nouns but that chooses not to use that marking in the numeral+noun construction, using other number marking instead. As far as I am aware, there is no confirmation that a language exemplifies this pattern, so it is not yet possible to know whether the theory overgenerates in this respect or not.

I have so far found two languages that are superficially problematic for the theory presented here. In Ljubljana Slovenian, complex numerals that end in one or two do not combine with a plural noun, as predicted, but with a singular or a dual one, respectively. I argue below that this language is not a real counterexample to the theory as long as the syntax and semantics of complex numerals is properly understood, an understanding that, I suggest, may borrow from Ionin & Matushansky's (2006, 2018) analysis of complex numerals. A second case to consider is Imere, which displays the following pattern despite being a singular-dual-plural language as well:

- (6) Pattern attested in Imere:  
 One + N-**singular**  
 Two + N-**plural**  
 Other numeral + N-**plural**

I argue that this language does not actually constitute a counterexample to the theory either. That's because the morpheme that marks dual in Imere, the noun prefix *rui-* plausibly spells out dual number morphology *and* also material in D. Given

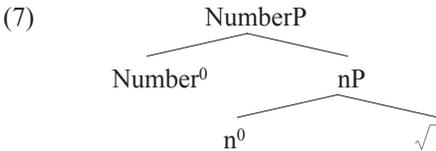
this, we expect it not to be able to co-occur with numerals, such as the numeral two. A different number marking is then used with that numeral.

The organization of the paper is as follows. Section 2 introduces the theoretical tools from Martí (2020a). Section 3 is the theoretical core of the paper and discusses the predictions that an extension of these tools makes for singular-dual-plural systems. Section 4 presents the data from Yimas and Hopi that illustrate pattern 1. Section 5 presents the arguments that (Ljubljana) Slovenian and Imere are not counterexamples to the theory, despite appearances. Ionin & Matushansky's (2006, 2018) proposal regarding complex numerals is discussed in detail in this section as well. Section 6 concludes.

## 2. Martí's (2020a) theory

This section focuses on singular-plural systems (or one-feature systems) and on Martí's account of them, based on Harbour (2014) and Scontras (2014).

Let's begin by spelling out Martí's assumptions on number features and their syntax and semantics, based on Harbour (2014). The syntax of nouns when they are not accompanied by numerals is assumed to be as in (7) (cf. Borer 2005 and many others):



Here, a nominal category nP (which results from combining a root with n<sup>0</sup>, a nominalizer) is the sister to the head of NumberP. The denotation of nP is assumed to contain both plural and atomic individuals (cf. Link 1983):

$$(8) \llbracket \text{nP} \rrbracket = \{a, b, c, ab, ac, bc, abc\}$$

It is on such a denotation that the semantics of the number features [ $\pm$ atomic], [ $\pm$ minimal] and [ $\pm$ additive] operate on. The semantics of the two features that will concern us here, [ $\pm$ atomic] and [ $\pm$ minimal], is assumed to be as follows:<sup>3</sup>

$$(9) \llbracket +\text{atomic} \rrbracket = \lambda P_{\langle e, t \rangle} . \lambda x_e . P(x) \ \& \ \text{atom}(x)$$

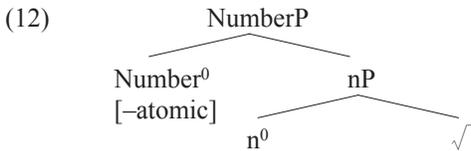
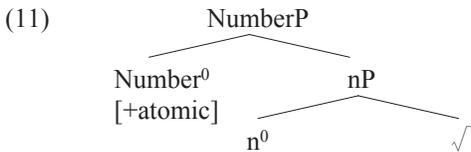
$$\llbracket -\text{atomic} \rrbracket = \lambda P_{\langle e, t \rangle} . \lambda x_e . P(x) \ \& \ \neg \text{atom}(x)$$

$$(10) \llbracket +\text{minimal} \rrbracket = \lambda P_{\langle e, t \rangle} . \lambda x_e . P(x) \ \& \ \neg \exists y P(y) \ \& \ y \sqsubset x$$

$$\llbracket -\text{minimal} \rrbracket = \lambda P_{\langle e, t \rangle} . \lambda x_e . P(x) \ \& \ \exists y P(y) \ \& \ y \sqsubset x$$

3. '⊂' is the proper subpart relation. Lower case variable names range over both atomic and non-atomic individuals. The third of Harbour's features, [ $\pm$ additive], plays no role in singular-dual-plural languages and is therefore not introduced here.

[±atomic] is sensitive to whether something is an atom ([+atomic]) or not ([−atomic]), and [±minimal] is sensitive to whether the set denoted by its sister contains elements with proper parts in that set ([−minimal]) or not ([+minimal]). Possible number systems are those where none of these features are available (so the language would not mark grammatical number), where just one feature is available, or where certain combinations of these features are available. Singular-plural systems may be analyzed, in principle, as either [±atomic] or [±minimal]. Usually, unless the language makes a distinction between 1<sup>st</sup> person inclusive and 1<sup>st</sup> person exclusive in its pronominal system (see Harbour 2011), a singular-plural language is treated as a [±atomic] system. English, for example, would be one such system, with [+atomic] spelled out as null and [−atomic] spelled out as *-s*:<sup>4</sup>



[±Minimal] can, in principle, also give rise to a singular-plural system, but, because of its relative semantics, this feature can give rise to more distinctions than [±atomic]. [±Minimal] is the feature at the heart of the pronominal paradigm of languages like Ilocano (Austronesian), shown in Table 1 (see Corbett 2000: 168; Rubino 1997: 55-56):

[+Minimal] picks the speaker+hearer dyad (crucially not an atom) for the minimal 1<sup>st</sup> person inclusive pronoun *-ta*, giving rise to a pronoun that picks two refer-

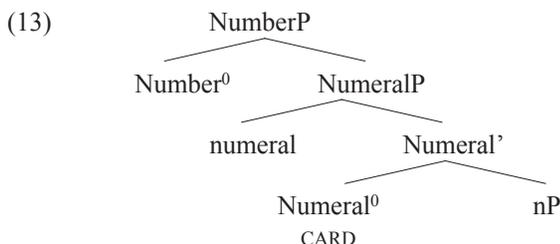
4. (12) gives rise to a so-called exclusive semantics for English plurals, that is, to a semantics concerned only with plural individuals. There is a long-standing debate in the literature as to whether this is the correct semantics for them, given the meaning of sentences such as *I have no children*, which are concerned both with atoms and non-atoms (otherwise the sentence would be predicted incorrectly to be true as long as the speaker has one child). Two main positions exist in this debate: (i) either plural nouns only have an inclusive semantics, unlike that obtained from (12), and exclusive meanings arise pragmatically (see Dvorak & Sauerland 2006; Ivlieva 2013; Krifka 1989; 1995; Laserson 1998, 2011; Sauerland 2003; Sauerland, Anderssen & Yatsushiro 2005; Spector 2007; Yatsushiro, Sauerland & Alexiadou 2017; Zweig 2009), or (ii) plural nouns are ambiguous between an inclusive and an exclusive semantics and their use is regulated pragmatically (see Farkas & de Swart 2010; Grimm 2012). Whereas arguments exist for and against both positions (see Kiparsky & Tonhauser 2012 for an overview), Martí (2020b) argues that only an ambiguity approach (such as (ii)) is compatible with Harbour (2014). Given that argument, and that the goal of this paper is, in part, to extend the empirical coverage of Harbour (2014), we must stick to an ambiguity approach here.

Table 1. Ilocano enclitic pronouns

	minimal	augmented
1excl	-ko	-mi
1incl	-ta	-tayo
2	-mo	-yo
3	-na	-da

ents (not one). That's because the speaker+hearer dyad is an element without proper parts in a set that contains speaker as well as the hearer; [-minimal] picks three or more referents (speaker+hearer+other(s)) for the 1<sup>st</sup> person inclusive augmented pronoun *-tayo*, since these all contain proper parts from the set (the speaker+hearer dyad). In the other persons, which do not include the hearer, one (for minimal pronouns) or more than one (for augmented pronouns) referents are picked. Thus, though close in their semantics, [ $\pm$ minimal] and [ $\pm$ atomic] are not the same feature.

Martí argues that this system, put together with Scontras' (2014) assumptions about numerals, predicts the English and Turkish patterns we saw in section 1.<sup>5</sup> Scontras assumes the following syntax:



Numeral words are generated in the specifier position (cf. Gawron 2002; Gärtner 2004; Haegeman & Gueron 1999; Jackendoff 1977; Li 1999; Selkirk 1977; Zweig 2006, a.o.) of NumeralP and have, uniformly, the semantics of numbers (of type  $\langle n \rangle$ ; cf. Rothstein 2013, 2016, 2017; Ouwayda 2014). For example:

- (14)  $\llbracket \text{one} \rrbracket = 1$   
 $\llbracket \text{two} \rrbracket = 2$

The semantics of CARD is as follows:

- (15)  $\llbracket \text{CARD} \rrbracket = \lambda P \lambda n \lambda x. P(x) \ \& \ \#x = n$

5. Other assumptions about the semantics or syntax of numerals might also work here. Scontras' analysis decomposes the numeral but is not too far removed from non-decompositional analyses that treat numerals as being of type  $\langle \langle e, t \rangle, \langle e, t \rangle \rangle$ , that is, of modifier type (see, e.g., Bale et al. 2011; Ionin & Matushansky 2006, 2018; Link 1983, among others). See Martí (2020a) and section 5.1.3 below for more on this.

That is, CARD takes a property P and a numeral n and returns the set of entities that have property P and numerosity n. For the NumeralPs ‘one CARD nP’ and ‘two CARD nP’, we would obtain the following:

$$(16) \llbracket \text{one CARD nP} \rrbracket = \lambda x. \llbracket \text{nP} \rrbracket \ \& \ \#x = 1$$

$$(17) \llbracket \text{two CARD nP} \rrbracket = \lambda x. \llbracket \text{nP} \rrbracket \ \& \ \#x = 2$$

NumberP, the locus of number features, sits above NumeralP in this syntax. Martí proposes that Harbour’s features, such as those in (9) and (10), operate on meanings such as those in (16) to derive the grammatical number marking on the noun, as follows.

English is a [ $\pm$ atomic] system, with [+atomic] spelled out as null and [-atomic] spelled out as *-s*. When [ $\pm$ atomic] operates on NumeralP, we obtain the following results:

**Table 2.** [ $\pm$ Atomic] with numerals

Feature	Numeral	Noun morphology
[+atomic]	<i>one</i>	singular
[-atomic]	<i>one</i>	<i>x</i>
Feature	Numeral	Noun morphology
[+atomic]	<i>two, three, four...</i>	<i>x</i>
[-atomic]	<i>two, three, four ...</i>	plural

Starting with the top row of the table, when [+atomic] operates on (16), it creates a new set containing those members of (16) which are atoms. All of the members of (16) are atoms, so all of them become members of the set denoted by NumberP. [+Atomic] is spelled out as null in English, so, for a root like *boy*, this means that the form *boy* surfaces (*one boy*). Further material up on the tree will use the set of atomic boys differently, depending on its semantics; e.g., if an existential quantifier over individuals sits in D, an element of this set will be asserted to exist. Importantly, the derivation is not as smooth if the feature that operates on the set of boy individuals whose numerosity is 1 is [-atomic], for none of them are non-atoms. Thus, NumberP denotes the empty set in this case, and, by assumption, this makes this combination ill-formed (see Martí 2020a for more on this issue) – this is the reason why *one boys* is ungrammatical in English. All of the members of (17) have numerosity other than one (2 for *two*, 3 for *three* and so on), so [+atomic] will lead to ungrammaticality, which is the correct prediction (*\*two boy*, *\*three boy*, and so on). On the other hand, [-atomic] returns a set containing all of the non-atoms of sets like that in (17). [-Atomic] is spelled out as *-s* in English. This is why *two boys*, *three boys*, and so on are grammatical in English.<sup>6</sup>

6. Notice that [+atomic] doesn’t change the semantics of NumeralP case depicted in the first row of Table 2: the denotation of NumeralP in that case, in (16), is already composed of only atoms. Likewise, [-atomic] doesn’t change the semantics in (17), since (17) already contains only

Turkish is a [ $\pm$ minimal] system, with [+minimal] spelled out as null and [-minimal] spelled out as *-LAR*. When [ $\pm$ minimal] operates on NumeralP, we obtain the following results:

**Table 3.** [ $\pm$ Minimal] with numerals

Feature	Numeral	Noun morphology
[+minimal]	<i>bir</i> ‘one’	singular
[-minimal]	<i>bir</i> ‘one’	x
Feature	Numeral	Noun morphology
[+minimal]	<i>iki, üç, ...</i> ‘two, three, ...’	singular
[-minimal]	<i>iki, üç, ...</i> ‘two, three, ...’	x

When [+minimal] operates on (16), it creates a new set containing those members of (16) which do not have proper parts in (16). All of the members of (16) lack proper parts in (16), since they are all of numerosity one, so all of them become members of the set denoted by NumberP. [+Minimal] is spelled out as null in Turkish, so, for a root like *çocuk* ‘boy’, this means that the form *cocuk* surfaces (*bir çocuk* ‘one boy’). [-Minimal] creates a new set containing those members of (16) which do have proper parts in (16) – none of them do, so the set denoted by NumberP in this case is empty, and the ungrammaticality of *\*bir çocuklar* follows, assuming that *-LAR* spells out [-minimal] in Turkish. None of the members of (17) have proper parts in that set – hence, [+minimal], which spelled out as null in Turkish, will create a new set containing all of the members of (17), and *çocuk* ‘boy’ will co-occur with *iki* ‘two’ (and *üç* ‘three’, and so on), giving rise to *iki çocuk* ‘two boys’ (and *üç çocuk* ‘three boys’, and so on). [-Minimal] yields the empty set when combined with (17), as none of the members of that set have proper parts in it, so *\*iki çocuklar* (and *\*üç çocuklar*, and so on) is correctly predicted to be ungrammatical.<sup>7</sup>

As we can see, positing that English-like languages and Turkish-like languages are one-feature systems, one [ $\pm$ atomic], the other [ $\pm$ minimal], and combining that with Scontras’ syntax and semantics for numerals, explains the relevant patterns in languages that distinguish singular from plural.

The next question is what the predictions are that are made for singular-dual-plural languages, which is what we turn to in the next section.

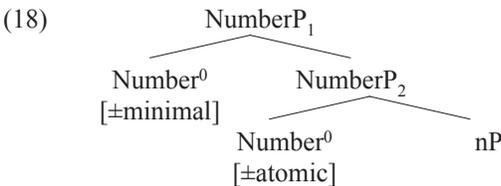
non-atoms. It would be wrong to conclude from this, however, that [+atomic] and [-atomic] play no role here, since [+atomic] is what blocks the ungrammatical *\*two/three... boy*, and [-atomic] is what blocks *\*one boys*. NumberP is present in the derivation of all of these examples as a matter of principle. As a matter of principle, then, [+atomic] is present in the derivation of *one boy*, and [-atomic], in the derivation of *two/three... boys*.

7. There is independent evidence that [ $\pm$ minimal] occurs in the Turkic language family (cf. Nevskaya 2005), but search for independent evidence in Turkish in particular is still ongoing.

### 3. Extending the theory to singular-dual-plural systems (or two-feature systems)

Two ideas are crucial in the extension of Martí (2020a) I propose here. First, the number features that are used in Harbour (2014) to derive singular-dual-plural systems also play a role in accounting for the semantics and morphology of the noun in the numeral+noun construction in languages with such systems. Second, and more innovatively, the structural relationship between NumberP and NumeralP may vary across languages. This second idea is what allows the proposal to predict pattern 1, for which I present positive confirmation in section 4. The derivations provided in Table 4 and Table 5 below will be crucial. The assumption that the structural relationship between NumberP and NumeralP may vary cross-linguistically will require us to revisit the analysis in section 2 for singular-plural languages, which I also do here.

To account for singular-dual-plural systems, Harbour (2014; see also 2011, and Noyer 1992) assumes that a language may choose more than one feature to be generated in Number<sup>0</sup>. Choosing both [ $\pm$ atomic] and [ $\pm$ minimal] allows us to generate a system with the required number distinctions. The syntax for these systems is assumed to be as in (18):



This gives rise to the following possible feature combinations:

- (19) a. [+minimal, +atomic]  
 b. [-minimal, +atomic]  
 c. [+minimal, -atomic]  
 d. [-minimal, -atomic]

The feature combination in (19)a gives rise to a singular semantics. To see this, consider (20):

- (20) [[+minimal] [[+atomic] [[nP]]]]

[+Atomic] selects all the atoms from [[nP]]; [+minimal] then selects all of the members of that set with no proper parts in it, which results, again, in the set of atoms in [[nP]]. This is a singular semantics. (19)b leads to ill-formedness: there are no members of the set of atoms in [[nP]] with proper parts in [[nP]]. (19)c gives rise to a dual semantics, because [+minimal] selects the members of the set of non-

atoms in  $[[nP]]$  which don't have proper parts in  $[[nP]]$  – these are the non-atoms of numerosity two. (19)d gives rise to an exclusive plural meaning, with  $[-minimal]$  selecting from the set of non-atoms in  $[[nP]]$  those that do have proper parts in  $[[nP]]$  – these are the non-atoms of numerosity three and above. Note that the plural semantics (19)d gives rise to is one where plural nouns are taken to be about pluralities of numerosity three and above. This seems to be correct for languages that distinguish dual from plural.<sup>8,9</sup>

Predicted pattern 2 is what results from the combination of a  $[\pm minimal, \pm atomic]$  with numerals. Consider Table 4.

**Table 4.**  $[\pm Minimal, \pm atomic]$  with numerals (NumberP  $\gg$  NumeralP)

Feature	Numeral	Noun morphology
$[+minimal, +atomic]$	one	singular
$[-minimal, +atomic]$	one	x
$[+minimal, -atomic]$	one	x
$[-minimal, -atomic]$	one	x
Feature	Numeral	Noun morphology
$[+minimal, +atomic]$	two	x
$[-minimal, +atomic]$	two	x
$[+minimal, -atomic]$	two	dual
$[-minimal, -atomic]$	two	x
Feature	Numeral	Noun morphology
$[+minimal, +atomic]$	three, ...	x
$[-minimal, +atomic]$	three, ...	x
$[+minimal, -atomic]$	three, ...	dual
$[-minimal, -atomic]$	three, ...	x

The denotation of NumeralP in the case of the numeral one is the set of elements of  $[[nP]]$  of numerosity one, that is, the set of atoms in  $[[nP]]$ . The application of first  $[+atomic]$  and then  $[-minimal]$  to that set still yields a set of atoms. If we assume that in a language that instantiates this setting, the feature combination

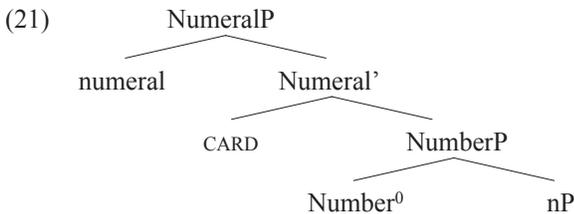
- There are important arguments for this decompositional treatment of the dual (cf. Nevins 2011), having to do with patterns of language change and with the acquisition of the dual. These patterns show that the dual is always dependent on the plural, which is captured in this analysis via their sharing of the feature  $[-atomic]$ .
- Harbour's (2014) argument that the theory should postulate both  $[\pm atomic]$  and  $[\pm minimal]$  is as follows. If the theory only had  $[\pm minimal]$ , singular-dual-plural systems would have to be generated by repeating  $[\pm minimal]$  (e.g., the dual would arise from the feature combination  $[+minimal, -minimal]$ ) (repeating  $[\pm minimal]$  is a possibility that his theory allows, in order to account for languages that distinguish minimal, unit augmented and augmented pronouns, for example). For languages with trials, though, we need a kind of repetition which, if allowed, over-generates number systems. Trial would arise from the feature combination  $[+minimal, -minimal, -minimal]$  – but if a feature with the same value can repeat, you can generate non-attested number values such as quadrat ( $[+minimal, -minimal, -minimal, -minimal]$ ), pentat ( $[+minimal, -minimal, -minimal, -minimal, -minimal]$ ), etc. We can generate trials (and duals) but no quadrats, pentats, etc. if the feature combination for trial is  $[+minimal, -minimal, -atomic]$  instead.

[+minimal, +atomic] is realized as singular morpho-phonologically, we will have singular number marking on nouns when they combine with the numeral one. Any other feature combination yields an ill-formed result with the numeral one: [-minimal, +atomic] because there are no elements in a set of atoms with proper parts in the set, and [+minimal, -atomic] and [-minimal, -atomic] because there are no non-atoms in a set of atoms.

The denotation NumeralP in the case of the numeral two is the set of elements of  $\llbracket \text{nP} \rrbracket$  of numerosity two, that is, the set of dyads in  $\llbracket \text{nP} \rrbracket$ . Neither the feature combination [+minimal, +atomic] nor the feature combination [-minimal, +atomic] can yield well-formedness when combined with such a NumeralP, since there are no atoms in its denotation (the latter, as we know, never gives rise to well-formedness). The feature combination [+minimal, -atomic] does, however, because it is possible to choose the members of a set of non-atomic dyads (dyads are always non-atomic) which have no proper parts in that set – that’s all of its members. Assuming that this feature combination is spelled out as dual morpho-phonologically, this gives rise to a noun with dual number marking that combines with the numeral two. The feature combination [-minimal, -atomic] gives rise to ill-formedness again, since it is not possible to choose from a set of dyads elements with proper parts in it.

The reasoning we just went through for the numeral two generalizes, in fact, to all numerals greater than one. Take the case of the numeral three. Neither the feature combination [+minimal, +atomic] nor the feature combination [-minimal, +atomic] can yield well-formedness when combined with a NumeralP that denotes a set of threesomes, since there are no atoms in its denotation. The feature combination [+minimal, -atomic] does, as before, because it is possible to choose the members of a set of non-atomic threesomes (threesomes are always non-atomic) which have no proper parts in that set – that’s all of its members. The feature combination [-minimal, -atomic] gives rise to ill-formedness, since it is not possible to choose from a set of threesomes elements with proper parts in it. Thus, all numerals greater than one are predicted to combine with dual number marking on the noun.

I do not know whether Predicted pattern 2 is attested but, without any further changes, this is all that our theory currently predicts for singular-dual-plural languages. However, as I will argue in sections 4 and 5, pattern 1 is indeed attested. It is interesting to note that just such a pattern is predicted if the hierarchical relationship between NumberP and NumeralP is allowed to change: that is, if NumeralP dominates NumberP, as in (21):



The resulting numeral+noun patterns are in Table 5.

Table 5. Numerals with [ $\pm$ minimal,  $\pm$ atomic] (NumeralP»NumberP)

Numeral	Feature	Noun morphology
one	[+minimal, +atomic]	singular
one	[-minimal, +atomic]	x
one	[+minimal, -atomic]	x
one	[-minimal, -atomic]	x
Numeral	Feature	Noun morphology
two	[+minimal, +atomic]	x
two	[-minimal, +atomic]	x
two	[+minimal, -atomic]	dual
two	[-minimal, -atomic]	x
Numeral	Feature	Noun morphology
three, ...	[+minimal, +atomic]	x
three, ...	[-minimal, +atomic]	x
three, ...	[+minimal, -atomic]	x
three, ...	[-minimal, -atomic]	plural

The feature combination [+minimal, +atomic] gives us a denotation for the now-lower NumberP that is a set of atoms. NumeralP with the numeral one in its specifier will result in a well-formed set of atoms, since they are all of numerosity one. If [+minimal, +atomic] spells out with singular morphology, we then obtain a singular number marked noun in combination with the numeral one. No other numeral will work here: members of a set of atoms have no other numerosity besides one, so this feature combination will yield an ill-formed result when combined with any numeral other than one. The feature combination [-minimal, +atomic] is ill-formed on its own, as before. The feature combination [+minimal, -atomic] yields a set of dyads. Since these are elements of numerosity two, the numeral two will be able to combine with it. No other numeral will be able to do so, since dyads have no other numerosity. If [+minimal, -atomic] spells out with dual morphology, we will obtain a dual marked noun in combination with the numeral two. Finally, the feature combination [-minimal, -atomic] will yield a set of non-atoms of numerosity greater than two. This set can combine with any numeral greater than two, but not with two or one. If this feature combination spells out as plural, we will obtain a plural marked noun in combination with all numerals greater than two.

Departing from Martí (2020a, under review) and from Scontras, we thus need to consider the possibility that the syntactic relationship between NumberP and NumeralP may vary cross-linguistically, that is, that the derivations in *both* Table 4 and Table 5 are allowed. If we do so, pattern 1 is a predicted pattern for singular-dual-plural languages where NumeralP dominates NumberP, and Pattern 2 is a predicted pattern for singular-dual-plural languages where NumberP dominates NumeralP. This, I contend, is the only innovation that is needed in order to extend Martí's theory of the numeral+noun construction to singular-dual-plural systems.

In developing this hypothesis further, we should look for independent evidence for the relationship between NumberP and NumeralP in particular languages. This

evidence may take many forms and come from a variety of phenomena, and is a crucial part of the account that I am proposing here. My goal here, however, is, more humbly, to understand the possibilities and the limits that the theory of the numeral+noun construction under consideration affords us. I will, nevertheless, point at the numeral+noun construction with complex numerals as a possible source of independent evidence at the end of section 5.1.3.

An important question must be answered before we proceed with the more empirical part of the paper. If the hierarchical relationship between NumberP and NumeralP can vary cross-linguistically, are there new predicted patterns for the numeral+noun construction in languages that distinguish only singular from plural? Recall from section 2 that, in deriving the English-type and the Turkish-type patterns, we only considered one possible relationship between these two phrases, namely, the one where NumberP dominates NumeralP. What happens in singular-plural languages when their relationship is reversed? The answer, in short, is that no new predictions are made, but that there is now space for considering that English may be a [ $\pm$ minimal] language after all.

Consider first the possibility of [ $\pm$ atomic] in a NumberP that is dominated by NumeralP:

**Table 6.** Numerals with [ $\pm$ atomic] (NumeralP»NumberP)

Numeral	Feature	Noun morphology
one	[+atomic]	singular
one	[-atomic]	x
Numeral	Feature	Noun morphology
two, ...	[+atomic]	x
two, ...	[-atomic]	plural

The subset of elements from  $\llbracket$ nP $\rrbracket$  which are atoms is a set of elements of numerosity one, so combination with the numeral one is well-formed and yields a set of atoms, that is, a singular semantics. Such a set of atoms cannot combine with any other numeral, since its members only have numerosity one. The subset of elements from  $\llbracket$ nP $\rrbracket$  which are non-atoms is a set of elements of numerosity greater than one, so combination with the numeral one is ill-formed, and combination with other numerals is well-formed. These predictions are as in section 1, so we can conclude that, for languages that are [ $\pm$ atomic], different assumptions about the hierarchical relationship between NumberP and NumeralP do not yield different predictions for the morphological realization of number on the noun in the numeral+noun construction. Things are different for [ $\pm$ minimal] languages. Consider Table 7.

Interestingly, the predictions do not vary from Table 6. If the feature [+minimal] applies directly to nP, it will in effect select all the atoms in  $\llbracket$ nP $\rrbracket$ . This can combine well with the numeral one, but not with any other numeral, since atoms have numerosity one. Thus, nouns marked for singular morphologically combine with one. As for other numerals, they will only yield a well-formed result for

Table 7. Numerals with [ $\pm$ minimal] (NumeralP»NumberP)

Numeral	Feature	Noun morphology
one	[+minimal]	singular
one	[-minimal]	x
Numeral	Feature	Noun morphology
two, ...	[+minimal]	x
two, ...	[-minimal]	plural

[-minimal], since only [-minimal], when applied directly to nP, will select all and only the non-atoms in  $\llbracket$ nP $\rrbracket$ . Nouns morphologically marked for plural will combine with numerals other than one. Again, this is the English-type pattern.

To sum up, allowing for variation in the hierarchical relationship between NumberP and NumeralP still predicts the English-type and the Turkish-type patterns for singular-plural languages – it now becomes a question of language-internal evidence (regarding the syntax of NumberP and NumeralP), and/or other considerations, whether we take English to be a [ $\pm$ atomic] or a [ $\pm$ minimal] language. The Turkish-style pattern, however, necessitates [ $\pm$ minimal] in NumberP and for NumberP to dominate NumeralP. This entails that a given singular-plural system has in principle the possibility of choosing the derivations in Table 2, Table 3, Table 6 or Table 7 for the numeral+noun construction.<sup>10</sup> As for singular-dual-plural languages, this variation plays a crucial role in predicting pattern 1 (see derivation in Table 5). Pattern 2 already follows from the syntactic assumptions made in Marti's and Scontras' work (see derivation in Table 4).

Having reviewed in this section the basic predictions of our extension of Marti's theory, we now turn to the first steps in the investigation of whether the theory's predictions are met empirically.

#### 4. Yimas and Hopi instantiate pattern 1

The first step in that investigation is the confirmation of predicted pattern 1. I show here that Yimas and Hopi, languages with a singular-dual-plural system on nouns, exemplify predicted pattern 1 straightforwardly.

Consider first Yimas,<sup>11</sup> whose nouns are organized into noun classes and distinguish singular, dual and plural via suffixation (or lack thereof, in the singular

10. A reviewer asks whether the fact that, in this theory, the Turkish-style pattern has one analytical source (see Table 3), whereas the English-style pattern has three (see Table 2, Table 6 and Table 7), suggests that the English-style pattern should be more common cross-linguistically. This might indeed be taken as a prediction of the proposed theory, though one must also consider the consequences that might follow from a language choosing NumberP»NumeralP vs. NumeralP»NumberP. Depending on what evidence it is possible to find for this choice (see end of section 5.1.3 for an example), settling the issue of the commonality of one pattern over another might require more nuance.

11. Yimas is Papuan language spoken in Papua New Guinea. All Yimas data presented here is from Foley (1991) or from Bill Foley, p.c.

of some classes), with number and class suffixes specific to each class. A few examples of nouns in this language are provided in Table 8 (Foley 1991: 91):<sup>12</sup>

**Table 8.** Some Yimas nouns and their number

singular	dual	plural	translation
wakn	wakn-trm	wakn-tt	'snake' (class V)
trj	trj-kl	trj-k	'tooth' (class VI)
tan-m	tan-pl	tan-pat	'bone' (class VII)

Nouns agree with verbs for number (via singular, dual or plural prefixes on the verb). Thus, Yimas marks grammatical number of nouns productively and is a [±minimal, ±atomic] system in Harbour's typology.

Yimas is an example of a language with predicted pattern 1. The numeral one combines with a (preceding) noun that is marked for singular ((22)), the numeral two combines with a noun marked for dual ((23)), and all other numerals combine with nouns marked for plural ((24)-(26)); no other combinations of numeral and number marking on the noun are allowed (Foley 1991: 101-2 and Bill Foley, p.c.):<sup>13</sup>

(22) **Tan-m** mpa-m  
Bone-VII.SG one-ADJ  
'One bone'

(23) **Tan-pl** p-rpal  
Bone-VII.DU VB-two  
'Two bones'

(24) **Tan-pat** p-ramnawt  
Bone-VII.PL VB-three  
'Three bones'

(25) **Tan-pat** tam mawŋkwat p-rpal  
Bone-VII.PL five other.side VB-two  
'Seven bones'

(26) **Tan-pat** namarawt munta-k-n p-rpal  
Bone-VII.PL person whole-IRR-I.SG VB-two  
'Twenty-two bones'

Notice that numerals in Yimas may display verbal or adjectival agreement markers (such as the numerals *mpam* 'one', *prpal* 'two' and *pramnawt* 'three'),

12. Many common nouns are suppletive in that singular and plural forms have different stems (Foley 1991: 91). Nouns in Yimas also mark oblique Case, an issue ignored below.

13. Key to glosses: ACC = accusative case; ADJ = adjective agreement marker; DEM = demonstrative; DU = dual number; FEM = feminine gender; GEN = genitive case; INSTR = instrumental case; IRR = irrealis; MASC = masculine gender; NOM = nominative case; NFUT = non-future; PL = plural number; SG = singular number, VB = verbal agreement marker. Roman numerals indicate noun class.

may be quite complex internally (like those in (25) and (26)), and may themselves inflect for noun class and number ((26)).<sup>14</sup> Notice also, importantly, that despite the presence of the numeral *prpal* ‘two’ in the formation of the numeral *tam mawɨkwat prpal* ‘seven’ (lit. five other side two) or *namarawt muntakn prpal* ‘twenty-two’ (lit. whole person two), these numerals combine with nouns in the plural, not in the dual – this issue will be discussed again in the context of Slovenian in section 4.

Hopi<sup>15</sup> is another example of a language that displays pattern 1. Hopi has a singular-dual-plural number system on animate nouns and a small set of inanimate nouns (Hill et al. 1998: 870); most inanimate nouns do not have dual or plural forms and thus do not vary for grammatical number. Nouns vary also by case, distinguishing Nominative from Accusative case. Table 9 shows some of its nouns, which, like Yimas, use suffixation (or lack thereof, for the singular) to distinguish singular, dual and plural:

Table 9. Some Hopi nouns and their number (nominative case forms)

singular	dual	plural	translation
kawayo	kawayo-t	kawayo-m	‘horse’
sino	sino-t	sino-m	‘person’
pahaana	pahaana-t	ahaana-m	‘Anglo’

It is not uncommon for languages to treat subsets of nouns differently regarding grammatical number, especially along the animate/inanimate divide we see in Hopi (see Corbett 2000: ch. 3 for discussion and examples).

Hopi nouns in the numeral+noun construction appear in their singular form with the numeral one, as shown in (27), in their dual form with the numeral two, as in (28), and in their plural form with any other numeral, as shown in (29) and (30) for the numerals eleven and twelve, respectively; no other combinations are allowed:

(27) Suukya **kawayo** pinto (Hill et al. 1998: 552)  
 One.NOM horse.NOM.SG spotted.NOM.SG  
 ‘One spotted horse’

(28) Lööyöm **kawayo-t** (Hill et al. 1998: 215)  
 Two.NOM horse-NOM.DU  
 ‘Two horses’

(29) Pakwt suukw siikya ‘ytaqam **kawayo-m**<sup>16</sup> (Hill et al. 1998: 382)  
 Ten one.ACC plus horse-NOM.PL  
 ‘Eleven horses’

14. Numeral number inflection may be a genuine case of agreement, or may constitute a different phenomenon, an issue I will not be able to settle here.

15. Hopi is an Uto-Aztecan language spoken in northeastern Arizona. All Hopi data presented here is from Hill et al. (1998) and has been corroborated by Ken Hill.

16. The accusative form of the numeral may be used in nominative position when *siikya* ‘ytaqam is used (Hill et al. 1998: 895). I have not been able to find a satisfactory explanation of what *siikya* ‘ytaqam

- (30) Pakwt lööq siikya ‘ytaqam’ **pahaana-m** (Hill et al. 1998: 382)  
 Ten two.ACC plus Anglo-NOM.PL  
 ‘Twelve Anglos’

Note that numerals may themselves inflect for case or even number, and that, as before, they can be internally complex, as in (29) or (30). Even then, however, the shape of the noun is not dictated by what the component parts would combine with on their own (e.g., singular for one, or dual for two, as in (27) and (28)), but by whether the numeral is greater than two – if it is, then the noun appears in its plural form. Thus, this is an instance of predicted pattern 1.

The analysis for both Yimas and Hopi is then as explained in Table 5, with NumeralP>>NumberP ((21)).

Thus, predicted pattern 1 is attested. Next I discuss two cases where neither predicted pattern 1 nor predicted pattern 2 seems to obtain, though I argue that complications in the grammar of complex numerals and determiners in the languages in question mask two further instances of predicted pattern 1.

## 5. Imere and Ljubljana Slovenian do conform to the predictions of the theory

In this section I discuss two additional singular-dual-plural languages, Ljubljana Slovenian and Imere. The number marking on the noun in the numeral+noun construction in these languages seems problematic from the perspective of the theory introduced in section 3. Ljubljana Slovenian conforms to pattern 1 for its lower numerals, but the empirical picture for numerals greater than one is more complex. In Imere, dual marking on the noun is never used with the numeral two and thus cannot be considered an instance of either pattern 1 or pattern 2. I argue in this section that neither language is a counterexample to the predictions of the theory once additional complications in their grammars are taken into account.

### 5.1. Ljubljana Slovenian<sup>17</sup>

The numeral+noun construction for lower numerals in Ljubljana Slovenian looks like a straightforward instantiation of pattern 1, but complex numerals present a more complicated picture. I argue below there are good reasons to think that Ljubljana Slovenian is still an instantiation of pattern 1. Below I review the Slovenian data and make a proposal about its analysis that incorporates important insights from Ionin & Matushansky’s (2006, 2018) proposal about complex numerals.

is, or a gloss/translation for it. I tentatively gloss it as ‘plus’ here. Hill et al. call it a modifier and say it is optional in examples with the numerals *pakwt* ‘ten’ and *sunat* ‘twenty’.

17. Ljubljana Slovenian is a dialect of Slovenian spoken in and around the capital city of Ljubljana. For a language to count as a [±minimal, ±atomic] system, it must distinguish singular, dual and plural productively. The dual is being lost in certain dialects of Slovenian, but not in Ljubljana Slovenian, so it is this dialect that is discussed here. All data from Ljubljana Slovenian was provided by Rok Žaucer, p.c. For more on Slovenian more generally, see Derganc (2003), Herrity (2016), Marušič & Žaucer (to appear) and Toporišič (2000).

5.1.1. *The data*

Ljubljana Slovenian distinguishes singular, dual and plural on nouns (and on other categories). Table 10 shows a (partial) nominal declension paradigm for two nouns in this language (Ljubljana Slovenian has an additional gender and makes more case distinctions than shown here) (Rok Žaucer, p.c.):

Table 10. Some Ljubljana Slovenian nouns

	singular	dual	plural	translation
NOM	stol	stola	stoli	chair (masc.)
ACC	stol	stola	stole	
GEN	stola	stolov	stolov	
INSTR	stolom	stoloma/stoli	stoli	
NOM	banana	banani	banane	banana (fem.)
ACC	banano	banani	banane	
GEN	banane	banan	banan	
INSTR	banano	bananama	bananami	

Consider (31)-(35) (Ljubljana Slovenian also marks case on its numerals) (Rok Žaucer, p.c.):

(31) En                    **stol**  
 one.NOM/ACC chair.MASC.NOM/ACC.SG  
 ‘One chair’

(32) Dva                    **stola**  
 two.NOM/ACC chair.MASC.NOM/ACC.DU  
 ‘Two chairs’

(33) Trije                **stoli**,                    tri                    **stole**  
 Three.NOM chair.MASC.NOM.PL three.ACC chair.MASC.ACC.PL  
 ‘Three chairs’

(34) Pet                    **stolov**  
 Five.NOM/ACC chair.MASC.GEN.PL  
 ‘Five chairs’

(35) Dva-in-dvajsetimi                **bananami**  
 Two-and-two.ten.INSTR banana.FEM.INSTR.PL  
 ‘Twenty-two bananas’

The noun appears in singular with the numeral one, in dual with the numeral two, and in plural with numerals three, five and twenty-two,<sup>18</sup> which would seem to suggest that Ljubljana Slovenian follows pattern 1.

If indeed it does, however, the noun should be morphologically marked for plural with any numeral greater than two. But not all such numerals combine with a plural noun: for numerals greater than one, the noun is marked for singular if the numeral ends in one (101, 201, 301, ... 1001 and so on), and it is marked for dual if the numeral ends in two (102, 202, 301, ... 1002 and so on), as illustrated in (36) (Rok Žaucer, p.c.):<sup>19</sup>

- (36) a. Sto-dve                    **banani**  
           hundred-two.ACC banana.FEM.ACC.DU
- b. Sto-dvema                **bananama**  
           hundred-two.INSTR banana.FEM.INSTR.DU  
           ‘One hundred and two bananas’

In (36), the noun *banana* appears in the dual forms *banani* (Accusative case) or *bananama* (Instrumental case) following the numeral *sto dve/dvema* ‘one hundred and two’, not in the corresponding plural forms.

Thus, the question we need to answer is why numerals greater than one behave in this way – apart from these numerals, the rest of the Ljubljana Slovenian pattern conforms to predictions. The insight that will drive the answer I propose below is that in Ljubljana Slovenian complex numerals smaller than one, a small numeral that is added to another comes first in the word order (*en-ajst* ‘eleven, lit. one-on-ten’, *dva-najst* ‘twelve, lit. two-on-ten’, *tri-najst* ‘thirteen, lit. three-on-ten’, *ena-in-dvajset* ‘twenty-one, lit. one-and-two-ten’, etc.). On the other hand, in complex numerals greater than one, the numeral that is added comes last in the word order (*sto-en* ‘a hundred and one, lit. hundred-one’, *dva-sto-en* ‘two hundred and one, lit. two-hundred-one’, *dva-sto-dva* ‘two hundred and two, lit. two-hundred-two’, etc.). If, in both cases, it is the last numeral in the word order that determines the number marking on the noun that accompanies the numeral, the pattern we have observed above follows in full, while allowing us to maintain the hypothesis that Ljubljana Slovenian is a language that exemplifies pattern 1.

In the remainder of this section, I spell out the details of the syntactic and semantic aspects of this analysis and compare it with that in Ionin & Matushansky (2006, 2018).

18. In what is not an unusual pattern in Slavic languages (see Ionin & Matushansky’s 2018: ch. 6), nouns in the numeral+noun construction vary their case depending on the numeral. For example, whereas the numerals one, two and three combine with nouns in Accusative case when the noun phrase appears in syntactic contexts that usually call for Accusative case (e.g., the direct object position of many transitive verbs), and in Nominative case when the noun phrase appears in syntactic contexts where usually that case is called for (e.g., the standard subject position), five combines with nouns in Genitive case even in canonical direct object and subject positions. More on this issue in section 4.1.3 below.
19. This is again a common pattern in Slavic (see Ionin & Matushansky 2018: ch. 6 and references cited there).

### 5.1.2. Ionin & Matushansky (2006, 2018)

In Ionin & Matushansky's approach, simple numerals (like *two* or *hundred*) are semantically of type  $\langle e, t \rangle$ , that is, they have the semantics of modifiers, and the nouns they combine with denote sets of atomic individuals. Consider the denotations in (37), with auxiliary definitions in (38) (for partition) and (39) (for cover) (see Ionin & Matushansky 2018: 13 and references cited there):

$$(37) \begin{aligned} \llbracket \text{two} \rrbracket &= \lambda P \in D_{\langle e, t \rangle}. \lambda x \in D_e. \exists S \in D_{\langle e, t \rangle} [\Pi(S)(x) \ \& \ |S| = 2 \ \wedge \ \forall s \in S P(s)] \\ \llbracket \text{hundred} \rrbracket &= \lambda P \in D_{\langle e, t \rangle}. \lambda x \in D_e. \exists S \in D_{\langle e, t \rangle} [\Pi(S)(x) \ \& \ |S| = 100 \ \wedge \ \forall s \in S P(s)] \end{aligned}$$

$$(38) \Pi(S)(x) = 1 \text{ iff } S \text{ is a cover of } x \text{ and } \forall z, y \in S [z = y \vee \neg \exists a \ a \leq z \ \wedge \ a \leq y]$$

(39) A set of individuals C is a cover of a plural individual x iff x is the sum of all members of C

The notion of partition in (38) ensures that there is no overlap of the cells in the partition, so that individuals are not counted twice. When a numeral like *hundred* in (37) combines with a noun N, a set of atomic individuals and thus of type  $\langle e, t \rangle$ , we obtain a set of plural or non-atomic individuals as in (40):

$$(40) \begin{aligned} \llbracket \text{hundred N} \rrbracket &= \lambda x \in D_e. \exists S \in D_{\langle e, t \rangle} [\Pi(S)(x) \ \& \ |S| = 100 \ \wedge \ \forall s \in S \llbracket N \rrbracket(s)] \\ &= \lambda x \in D_e. x \text{ is a plural individual divisible into 100 non-overlapping} \\ &\quad \text{individuals } y \text{ such that their sum is } x \text{ and each } y \in \llbracket N \rrbracket \end{aligned}$$

Since simple numerals have the semantics of modifiers, they are, in principle, stackable. Thus, the syntax of a noun phrase like *two hundred N*, with the multiplicative numeral *two hundred*, is as follows:

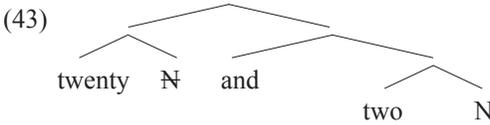
$$(41) \begin{array}{c} \diagup \quad \diagdown \\ \text{two} \quad \quad \quad \diagup \quad \diagdown \\ \quad \quad \quad \text{hundred} \quad \quad \quad \text{N} \end{array}$$

We then obtain the semantics in (42):

$$(42) \begin{aligned} \llbracket \text{two hundred N} \rrbracket &= \lambda x \in D_e. \exists S \in D_{\langle e, t \rangle} [\Pi(S)(x) \ \& \ |S| = 2 \ \wedge \ \forall s \in S \exists S' \in \\ &D_{\langle e, t \rangle} [\Pi(S')(s) \ \& \ |S'| = 100 \ \wedge \ \forall s' \in S' \llbracket N \rrbracket(s')]] \\ &= \lambda x \in D_e. x \text{ is a plural individual divisible into 2 non-overlapping individu-} \\ &\quad \text{als } y \text{ such that their sum is } x \text{ and each } y \text{ is divisible into 100 non-overlapping} \\ &\quad \text{individuals } z \text{ such that their sum is } y \text{ and } z \in \llbracket N \rrbracket \end{aligned}$$

That is, because of the semantics assumed for simplex numerals, the semantics of numerals such as *two hundred* arises straightforwardly from the compositional process.

For additive numerals, such as *twenty-two*, Ionin & Matushansky assume the coordination structure and analysis in (43) (inspired by Zweig 2006, who builds on Kayne 2003, 2007):



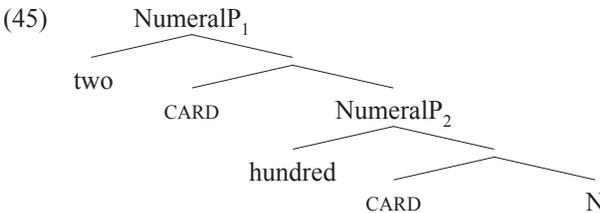
Ionin and Matushansky assume a structure with two Ns, one of which undergoes NP deletion; that is, the syntax and semantics of *twenty-two N* is just like the syntax and semantics of *twenty N and two N*. Whether a conjunction like *and* is pronounced or not in a given language, it is there for syntactic and semantic purposes. With the set-product denotation for *and* (as opposed to an intersective one) in (44) (from Heycock & Zamparelli 2005; see Ionin & Matushansky 2018: 149), the correct semantics is predicted for (43) (for ‘ $\oplus$ ’ the sum operator):

(44)  $[[\text{and}]] = \lambda P_{\langle e,t \rangle} \cdot \lambda Q_{\langle e,t \rangle} \cdot \{x: x = y \oplus z, \text{ for } y \in P \text{ and } z \in Q\}$

(44) takes two sets P and Q and combines their members in such a way that a new set of plural individuals, all of those that are in P are combined with all of those that are in Q, is created. (43) thus denotes a set of plural individuals each combining two-N plural individual with a twenty-N plural individual, which is a set of plural individuals each of which has numerosity 22, as desired<sup>20</sup>. Much empirical evidence, on the basis of case, agreement and other phenomena, across languages, is provided in Ionin and Matushansky in defense of this syntactic and semantic treatment of numerals.

5.1.3. My proposal

The semantics for numerals from sections 2 and 3 is different from Ionin and Matushansky’s; in particular, we’ve taken numerals to denote numbers and to appear in the specifier position of a NumeralP. Whereas numeral stacking is possible in my approach, since CARD takes arguments of type  $\langle e,t \rangle$  and the type of NumeralP is also  $\langle e,t \rangle$ , structures such as (45) (similar to (41), but with one NumeralP per numeral) yield the wrong semantics for multiplicative numerals. The contribution of CARD is repeated as (46) for ease of reference:



20. As Ionin & Matushansky (2018: 151) note, set product allows for the possibility of overlap, which incorrectly allows us to count the same individual twice, and thus include plural individuals of numerosity 101 in the denotation of (33). Ionin and Matushansky propose that the lack of overlap is pragmatic, motivated by the fact that “the whole purpose of measuring and counting is to achieve the maximal precision given the context and the speaker’s knowledge. Treating overlap as a possibility is expressly contrary to this purpose” (p. 151).

$$(46) \llbracket \text{CARD} \rrbracket = \lambda P \lambda n \lambda x. P(x) \ \& \ \#x = n$$

This is because the denotation that (45) is assigned is as follows:

$$(47) \llbracket \text{NumeralP}_1 \rrbracket = \lambda x. \llbracket \text{NumeralP}_2 \rrbracket(x) \ \& \ \#x = 2 \\ = \lambda x. \llbracket N \rrbracket(x) \ \& \ \#x = 100 \ \& \ \#x = 2$$

The numerosity of an individual cannot be both 100 and 2 at the same time.

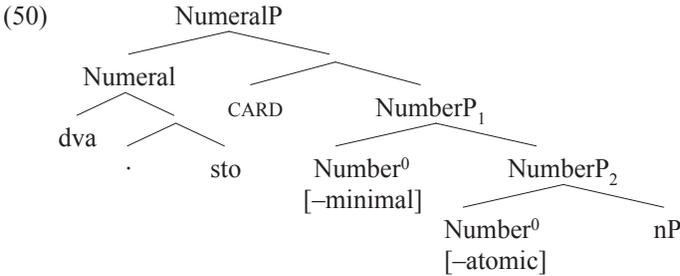
It is, however, possible to combine a decompositional approach to complex numerals with the approach to numerals assumed in sections 2 and 3. Starting with multiplicative numerals, the most important assumption is the multiplicative operator  $\cdot$  in (48), of type  $\langle n, \langle n, n \rangle \rangle$  (cf. Rothstein 2013: 184; Scha 1981; Ouwayda 2014; Zabbal 2005), which operates on numeral words themselves, i.e., the ones that appear in the specifier position of NumeralP:

$$(48) \llbracket \cdot \rrbracket = \lambda n. \lambda m. n \cdot m$$

$$(49) \text{ a. } \llbracket \text{two} \rrbracket = 2$$

$$\text{ b. } \llbracket \text{hundred} \rrbracket = 100$$

If more than one numeral word can appear in that position (cf. Giusti 1991, 1997; Ritter 1991; Zamparelli 1995, 2002), we would have the following structure for *dva-sto N*:



The  $\cdot$  operator multiplies 100 by 2, resulting in (51):

$$(51) \llbracket \text{dva} \cdot \text{sto} \rrbracket = 200$$

The rest of the computation now proceeds as normal, producing a numeral+noun combination where the noun is marked for plural, correctly (recall Table 5). Thus, we can maintain that the meaning of *two* is unique and constant across the board (that is, as in (49)a), as long as the specifier position of NumeralP can be more complex than we assumed previously. Doing so allows us to maintain the attractive hypothesis, together with Ionin and Matushansky, that complex cardinals are derived from simple ones.<sup>21</sup>

21. Much like in Ionin and Matushansky, this proposal needs to invoke additional constraints, e.g., nothing in what I have said here prevents a numeral like, say, *six-five*, meaning 'thirty-five', from



that is what Ionon and Matushansky's argument is based on; see pp. 51-52). In Russian, the numerals two, three and four assign what Ionin and Matushansky call 'paucal case' to the noun/NP; numerals higher than four assign genitive case instead:

(53) Četyre **šagá**  
four step.PAUCAL  
'Four steps'

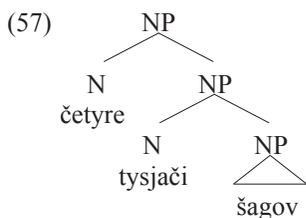
(54) Šest' **šagov**  
six step.GEN.PL  
'Six steps'

With complex numerals like four thousand or five thousand, thousand appears in the paucal case in the former, but in the genitive case in the latter:

(55) Četyre tysjači **šagov**  
four thousand.PAUCAL step.GEN.PL  
'Four thousand steps'

(56) Pjat' tysjač **šagov**  
five thousand.GEN.PL step.GEN.PL  
'Five thousand steps'

If heads, not phrases, are responsible for case assignment, as is typically assumed, the best structure for multiplicative complex numerals is, they argue, as in (57) (cf. (41)):



The proposal that numeral words form a constituent in complex multiplicative numerals, as in (50), is problematic in light of this data in that it would have to be the whole complex numeral (e.g., *četyre tysjači*) that assigns case to the accompanying noun (phrase). That's because there would be no direct relationship between *tysjači* and *šagov*. Notice that case assignment *within* the complex numeral (e.g., from *četyre* to *tysjači*) or case assignment by a *simplex* numeral (as in (53) or (54)) are not necessarily problematic in my proposal, as case in these circumstances can still be assigned by a head. But not if expressions such as *četyre tysjači* are constituents – in that instance, case assignment would have to be carried out by a phrase.

However, it may actually be necessary to allow phrases to assign case. That's because there is suggestive evidence for the constituency of numerals like *četyre tysjači*. Russian is well-known for the phenomenon of approximative inversion (see Ionin & Matushansky 2018: 118-9 and references cited there),<sup>22</sup> illustrated in (58) and (59) (cf. (55)):<sup>23, 24</sup>

(58) Tysjači                      četyre šagov  
 thousand.PAUCAL four step.GEN.PL  
 'Some four thousand steps'

(59) Šagov                      četyre tysjači  
 step.GEN.PL four thousand.PAUCAL  
 'Some four thousand steps'

The linear order of *četyre* and *tysjači* can be reversed, and the noun can precede the whole numeral. In both cases, an approximative meaning arises. In addition to inversion, however, Russian also allows the insertion of an approximative word, such as *primerno* 'about', illustrated in (60):

(60) Primerno četyre tysjači                      šagov  
 About four thousand.PAUCAL step.GEN.PL  
 'About four thousand steps'

Interestingly, inversion of the whole complex numeral can be combined with *primerno*, but not all possible permutations are allowed. Consider (61)–(63):

(61) Šagov                      primerno četyre tysjači  
 step.GEN.PL about four thousand.PAUCAL  
 'About four thousand steps'

(62) Šagov                      četyre tysjači                      primerno  
 step.GEN.PL four thousand.PAUCAL about  
 'About four thousand steps'

22. Ionin and Matushansky use approximative inversion to argue for a different structure for multiplicative and additive numerals, an argument which I embrace. For more on additive numerals, see below.

23. Data on approximative inversion in Russian is from Masha Esipova and Natasha Korotkova, p.c.

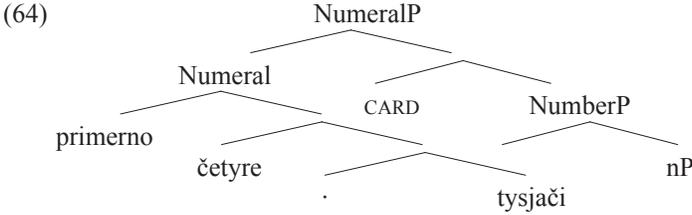
24. Example (i) is deemed ungrammatical by Ionin & Matushansky (2018: 199, their (8)c):

(i) \*Mašin sorok tysjač  
 car.GEN.PL forty thousand.GEN.PL

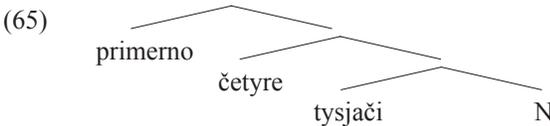
My informants, however, found (59) to be grammatical, or, at most, slightly odd. They also found (59) to be worse than (i), but not ungrammatical. While it is at present unclear what's responsible for this contrast, the argument in the text still stands, as it pertains to the stark contrast between (59) and (63).

- (63) ??*Primerno šagov četyre tysjači*  
 about step.GEN.PL four thousand.PAUCAL

The pattern we observe here is that, if the noun precedes the complex numeral, *primerno* is possible as long as it accompanies the numeral, but impossible if it becomes stranded from it, as in (63). This is suggestive of a constituent structure whereby *primerno četyre tysjači* forms a syntactic unit, as in (64) and assumed above:



If *primerno četyre tysjači* was not a constituent but had instead the cascading structure that Ionin and Matushansky envisage for multiplicative numerals, we'd have (65):<sup>25</sup>

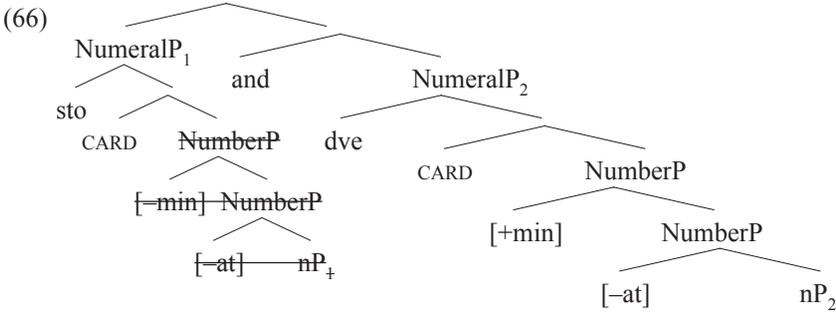


But only (64) provides a straightforward explanation for the ungrammaticality of (63): in order to allow (59), Ionin and Matushansky have to allow the movement or rotation of *četyre* and *tysjači*, but then nothing prevents (63) from being generated. With a structure like (64), however, if approximative inversion involves movement of whatever is in Numeral (or of NumberP/nP), the facts above follow straightforwardly.

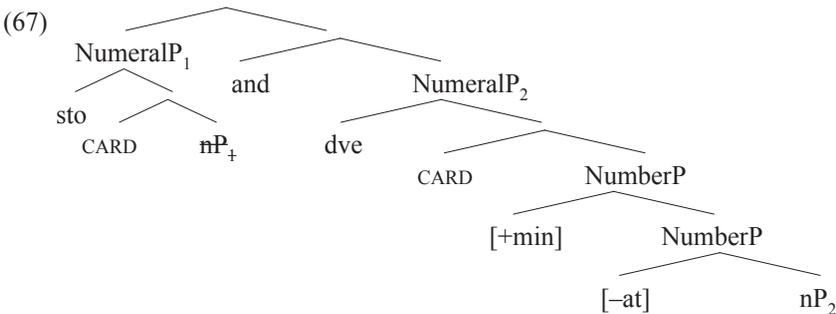
Crucially, if this is the case, then case assignment to nouns by numerals have to be effected, at least sometimes, by phrases, not just heads – e.g., *šagov* will need to be assigned case by (*primerno*) *četyre tysjači*. This means that the only remaining argument of Ionin and Matushansky against the constituency of multiplicative numerals does not stand.<sup>26</sup>

Moving on now to additive numerals, an enriched version of structures such as those in (43) is necessary. Consider (66), for (36)a, following Ionin and Matushansky quite closely:

25. It's clear from the semantics that *primerno* cannot attach just to *četyre*: the approximation is to 4,000, not to 4.  
 26. An issue that remains to be addressed is the grammatical number of the noun in examples such as (53). The special case we see in this example raises complex questions that I am not prepared to address here (for more on this issue, see, e.g., Franks 1994).

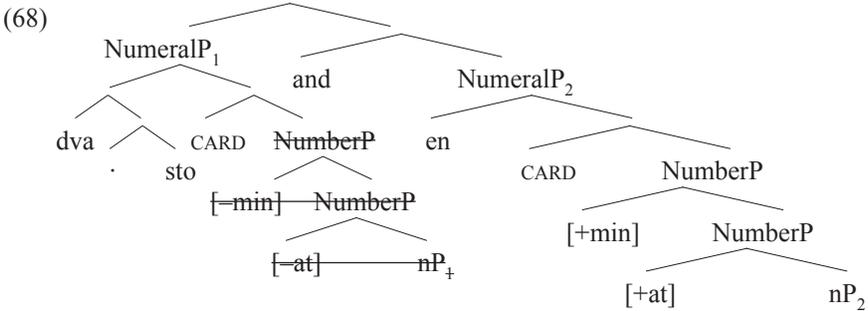


In this structure, two NumeralPs are generated, one for each of *sto* and *dve*. Ionin and Matushansky’s *and* in (44) is used. Both numeral words project a NumeralP here because the ellipsis envisaged by Ionin and Matushansky is noun ellipsis (recall (43)), so space for two nouns is needed. Ellipsis then proceeds to delete  $nP_1$  and the two NumberPs above it, producing (36)a, with dual marking on the noun because that is the number marking of the surviving noun in (66). Such an analysis requires noun ellipsis to occur even when the elided material is not fully identical to its antecedent, obviating the different Number features of  $nP_1$  and  $nP_2$ .<sup>27</sup> If this is not desired, one may assume the alternative in (67), where  $nP_1$  is generated without any NumberP, and where noun ellipsis occurs in the context of a fully identical antecedent:



It is easy to account for complex numerals that mix the multiplicative and the additive strategies, such as *dva-sto-en* ‘two hundred and one’, as in (68) (if we choose (66) for *sto-dve*):

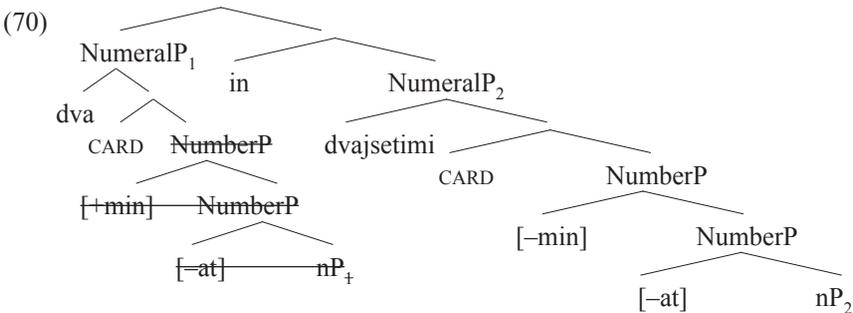
27. Eliding nouns which are not fully identical to their antecedents isn’t in itself a problem, as it is very common cross-linguistically, e.g., *I have one cat and you have two cats*. Thanks to Klaus Abels for discussion of this point.



(68) correctly predicts (69):

- (69) Dva-sto-en                    **banana**  
 two-hundred-one.NOM    banana.FEM.NOM.SG  
 ‘Two hundred and one bananas’

Complex numerals smaller than one are all additive in Ljubljana Slovenian. (35) receives the analysis in (70). (70) correctly predicts that the noun in (35) with take the plural form:



The analysis of Ljubljana Slovenian complex numerals proposed here maintains the spirit of the decompositional approach to numerals from Ionin and Matushansky’s work while at the same time integrating the approach to numerals and grammatical number from sections 2 and 3. Ljubljana Slovenian is indeed an example of predicted pattern 1, but the syntax and semantics of its complex numerals is such that those above 100 that end in 1 or 2 take the singular or dual form of the noun, respectively.

A final question before closing this section pertains not so much to Slovenian, but to some of the other languages we saw earlier: if the analysis of (69) is as in (68), why are *\*two hundred and one banana* or *\*twenty one banana* ungrammatical in English – that is, why must the noun there be in its plural form? Likewise, why is the noun in the Yimas example in (26), repeated here, not in the dual form if the complex numeral *namarawt muntakn prpal* ‘twenty-two’ contains the numeral *prpal* ‘two’?

(71) *Yimas*

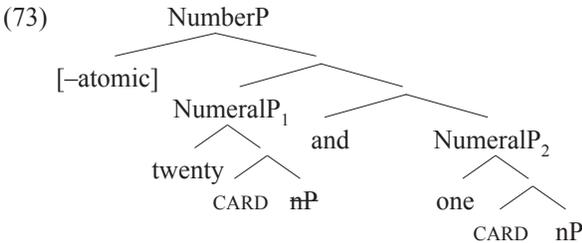
**Tan-pat** namarawt munta-k-n p-rpal  
 Bone-VII.PL person whole-IRR-I.SG VB-two  
 ‘Twenty-two bones’

And why is the noun in the Hopi example in (30), also repeated here, not in the dual form if the complex numeral *pakwt lööq siikya* ‘*ytaqam* ‘twelve’ contains the numeral *lööq* ‘two’?

(72) *Hopi*

Pakwt lööq siikya ‘*ytaqam* **pahaana-m** (Hill et al. 1998: 382)  
 Ten two.ACC plus Anglo-NOM.PL  
 ‘Twelve Anglos’

To understand why combinations such as \**two hundred and one banana* or \**twenty one banana* are ungrammatical in English, consider the structure of English *twenty one N* in (73) (cf. (43)):



Recall that Martí hypothesizes that English is a [ $\pm$ atomic] language with  $\text{NumberP} \gg \text{NumeralP}$  (Table 2). Importantly, with additive numerals this means that  $\text{NumberP}$  is above the coordination structure hypothesized by Ionin and Matushansky. Crucially, [ $-$ atomic], but not [ $+$ atomic], yields a grammatical result in (73), since the denotation of the constituent the number feature operates on is a set of individuals each of which is of numerosity 21 – that is, a set of non-atoms. And [ $-$ atomic] gives rise to a plural-marked noun, which correctly predicts the number marking on the noun with this and any other complex numeral in English. That in English additive numerals always take plural-marked nouns might be taken as evidence that (73), and, thus, the system in Table 2, is the correct analysis for English (as opposed to that in Table 6, where  $\text{NumeralP}$  dominates  $\text{NumberP}$ ). In other words, number marking of nouns with complex numerals is a potential source of independent evidence for the relationship that is taken to hold between  $\text{NumeralP}$  and  $\text{NumberP}$  in a particular language, a relationship that is taken by the theory proposed here to potentially vary from one language to another and for which there is a need of language-particular evidence.

In other cases, such as *Yimas* and *Hopi*, it is possible that complex numerals are syntactically decomposed in a way not too dissimilar to the way they are decom-

posed in Ljubljana Slovenian, but noun ellipsis targets a different site; that is, the correct analysis of (71) might be *tanpat namarawt muntakn tanpt prpal*, where it is the dual marked noun that is elided. And there will most likely be other particularities in a given language that might interfere here.

Thus, all in all, it is possible to maintain the Ljubljana Slovenian indeed instantiates predicted pattern 1. It has been possible to do that and incorporate important aspects of the analysis of complex numerals in Ionin & Matushansky (2006, 2018). While the nouns numerals combine with are not taken by default to be sets of atomic individuals in my approach, the only aspect of their analysis that required modification was the analysis of multiplicative numerals, where a  $\cdot$  operator and a different constituent structure was found to be necessary.<sup>28</sup>

### 5.2. *Imere*<sup>29</sup>

In Imere, dual marking on nouns doesn't appear at all in the numeral+noun construction: all numerals greater than one, including the numeral two, combine with nouns marked for plural. This is neither pattern 1 nor pattern 2. In this section I argue that in Imere the dual marker is not just the spell out of the number feature combination [+minimal, -atomic], that marker also spells out D. As such, we do not expect it to be able to combine with numerals. Thus, Imere is, despite appearances, argued to instantiate pattern 1 in what follows.

Imere is a language that displays a singular-dual-plural system on its non-pronominals, as shown in Table 11 (Clark 1975, 1998, 2002/2011; Martí 2019):

**Table 11.** Some Imere nouns and their number

singular	dual	plural	translation
te-sea	ruu-sea	a-sea	chair
te-manu	ruu-manu	a-manu	bird
te-soa	ruu-soa	a-soa	friend
te-ngata	ruu-ngata	a-ngata	snake

Imere uses prefixes on nouns to express grammatical number. These prefixes attach to nouns that belong to the native vocabulary, though not all native nouns

28. In several Arabic dialects, up to the numeral ten the pattern is as in Predicted Pattern 1, but numerals eleven and higher combine with singular-marked nouns (see Hurford 2001: 10757; Ouwayda 2014; Zabbal 2005). More work is needed to understand whether this pattern is problematic for the theory presented here.

29. Imere is a Polynesian language spoken in Vanuatu. Early work on the language includes Clark (1975, 1998, 2002/2011). All Imere data not attributed to a source is from my own fieldwork. Spelling follows Clark (1975, 1998, 2002/2011), with some modifications from van Urk (2018). The letter j corresponds to [tʃ], k is variably realized as [k] or [ɣ] intervocalically, ñ and ̃ are labio-velars.

can take them. Verbs display subject agreement prefixes that are sensitive to the grammatical number on the noun in subject position.<sup>30</sup>

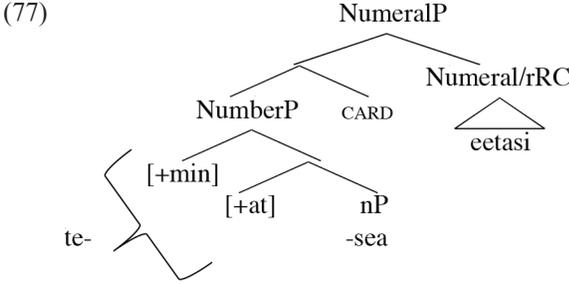
Regarding the numeral+noun construction, the facts in Imere are as follows (data from my own fieldwork):

- (74) **Te-sea** ee-tasi  
 SG-chair 3SG.NFUT-one  
 ‘One chair’
- (75) a. **Ruu-sea** (??ee-rua)  
 DU-chair 3SG.NFUT-two
- b. **A-sea** ee-rua  
 PL-chair 3SG.NFUT-two  
 ‘Two chairs’
- (76) **A-sea** ee-toru  
 PL-chair 3SG.NFUT-three  
 ‘Three chairs’

All other numerals use the plural prefix on the noun.<sup>31</sup> That is, the numeral *eetasi* ‘one’ combines with nouns that necessarily bear the prefix *te-* ((74)), which indicates singular number; numerals greater than one necessarily combine with nouns that bear the plural prefix *a-* ((76)); curiously, the numeral *eerua* ‘two’ is incompatible with dual number marking on the noun ((75)a) and plural marking must be used there too ((75)b). This is an unexpected pattern from the perspective of the theory in section 3.

Before proceeding with the argument, it’s important to notice that (non-borrowed) numerals in Imere, as shown in (74)-(75), take verbal morphology (compare *ee-tasi* with *roo-tasi* ‘one’, with the future marker *roo-*; Clark 2002/2011: 684). This state of affairs is not unheard of cross-linguistically, as discussed earlier in section 4.1 (Ionin & Matushansky 2018: 69-71). I will follow Ionin and Matushansky in assuming that Imere (non-borrowed) numerals project reduced relative clauses/participles, an analysis that is supported by the fact that regular relative clauses in Imere are postnominal (Clark 2002/2011: 686). Thus, *te-sea eetasi* ‘one chair, lit. SG-chair be.one’ would be analyzed as what in English could perhaps be rendered with ‘chair [which is one]’. Its structure would be as follows (‘rRC’ stands for ‘reduced relative clause’; I do not explore here what the internal structure of that relative clause would be):

30. Clark (1975, 1998, 2002/2011) proposes that Imere makes more number distinctions, including what look like paucals or greater plurals. However, I have not been able to attest the presence of paucals or greater plurals in Imere. Speculatively, it may be that in a previous stage of the language the grammatical number system was more complex than a singular-dual-plural system.
31. For numerals greater than 9 or 10, English borrowings are used and the English pattern for the noun, that is, plural number marking, is followed.



Proceeding now with the argument that Imere is not a counterexample to the theory presented in section 3, the status of the dual prefix *ruu-* and of the plural or singular prefixes is not equal in this language. While it is feasible to analyze *te-* and *a-* as the spell out of number features only, as Marti (2019) does, there is evidence that *ruu-* spells out not only dual number morphology, but is also a determiner. Its status as determiner, I suggest, prevents it from combining with the numeral *eerua* ‘two’ ((75)a). A first indication that *ruu-* is set apart from *te-* and *a-* in Imere is that, whereas there are (morphophonological) constraints on which nouns can take *te-* and *a-*, with some nouns taking neither, other nouns taking one prefix, and yet others taking both, all (native) nouns can take *ruu-*. Table 12 illustrates this phenomenon (data from my own fieldwork):

Table 12. Some Imere nouns and their number

singular	dual	plural	translation
te-fine	ruu-fafine	fafine	woman
tangata	ruu-taangata	taangata	man
funumui	ruu-funumui	funumui	girl
lotoo	ruu-lotoo	lotoo	car
te-kori	ruu-kori	kori	dog

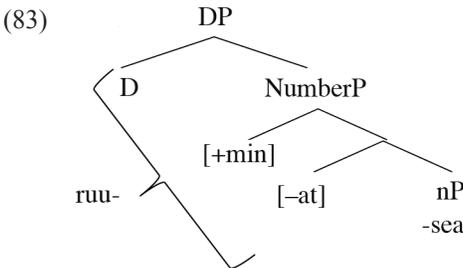
An argument that, in addition, *ruu-* is actually a determiner, and not just a number prefix, is that, whereas *te-* and *a-* are compatible with demonstratives and quantifiers, *ruu-* isn’t. Consider the examples in (78)-(82) (data from my own fieldwork):

(78) **Te-fare**    ǃoulapa-raa  
 SG-house    big-DEM  
 ‘That big house’

(79) **A-fare**    ǃwoulapa-raa  
 PL-house    big-DEM  
 ‘Those big houses’

- (80) a. **A-ngata** toope  
 PL-snake many  
 ‘Many snakes’  
 b. **\*Ruu-ngata** toope  
 DU-snake many
- (81) a. **A-ngata** eewji  
 PL-snake all/every  
 ‘All (the) snakes’  
 b. **\*Ruu-ngata** eeweji  
 DU-snake all/every
- (82) a. **A-ngata** afaru  
 PL-snake some  
 ‘Some snakes’  
 b. **\*Ruu-ngata** afaru  
 DU-snake some

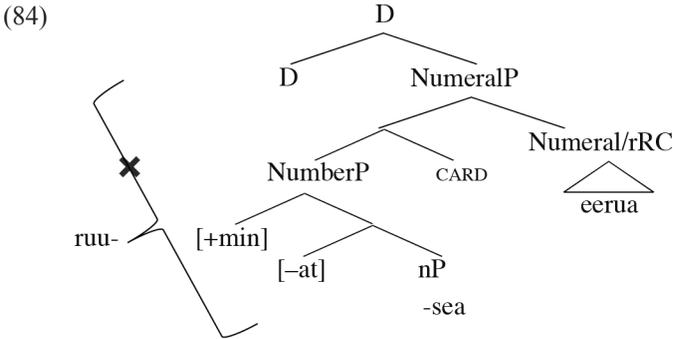
Consider that there is nothing in principle wrong with quantifying over two-somes: it is possible to talk about many, all, or some pairs of snakes – that is, the impossibility of (80)b, (81)b, and (82)b cannot be blamed on a semantic ill-formedness. The ungrammaticality of these examples can be understood if *ruu-* sits in D, in addition to spelling out number morphology, on the assumption that demonstrative *-raa* and quantifiers such as *toope* ‘many’, *eeweji* ‘all/every’ or *afaru* ‘some’ also occupy this position.<sup>32</sup> The syntax that we can thus assume for *ruu-* is as follows:



The explanation I propose for ??*ruu-sea eerua* ((75)a) is that, if it is true that *ruu-* is a determiner and also spells out number features in NumberP, D and NumberP

32. Demonstratives and quantifiers are incompatible with the definite article in other languages: *\*this/that/these/those the*, *\*the this/that/these/those*, *\*every/many the*, *\*the every/many*. *Many/all/some of the* is possible in English, but the presence of *of* is indicative of a more complex structure (*all* might not be a quantifier in English anyway, see Brisson 2003, among others). In languages such as Spanish, noun phrases such as *el chico ese* ‘that boy (pejorative), lit. the boy that’ are possible, but only if the demonstrative appears phrase-finally, which is plausibly indicative of a different structure (cf. Brugè 2002).

must be close enough to each other in the structure; that is, an intervening (c-commanding) NumeralP would disrupt that close relationship, as shown in (84):<sup>33</sup>



A question that arises in this analysis is how the numeral two can combine with a plural-marked noun in a singular-dual-plural system. I would like to consider here the possibility that plural forms in Imere are ambiguous between an exclusive semantics (the one we've been assuming all along) and an inclusive semantics, which can be observed in (85) and (86) (data from my own fieldwork):

- (85) Au seia kee **a-ngata**.  
 I see not PL-snake  
 'I didn't see any snakes'/'I didn't see the snakes'

- (86) A: Lekina **a-tama**?  
 exist PL-child  
 'Do you have children?'

- B: Ai, eetasi  
 yes 3SG.NFUT-one  
 'Yes, one'

If *angata* 'snakes' or *atama* 'children' couldn't be understood inclusively, that is, pertaining to one or more snakes/children, (85) would be true if I had seen one snake, and (86)A would be a question about pluralities of children, and thus not answerable as in (86)B, contrary to fact. In Martí (2020b), I analyse inclusive plurals as lacking NumberP altogether – the absence of NumberP translates into plural morphology in languages that have inclusive plurals (see also footnote 5). That is, the analysis of inclusive and exclusive plurality is one of ambiguity: exclusive plurals are analysed just as we have done so far (see section 2), and inclusive plurals have an inclusive semantics and lack NumberP<sup>34</sup>. If the latter possibility is available in a language,

33. An alternative analysis might be that *ruu-* is actually the spell out of both the numeral *eerua* and [+minimal, -atomic]. I will not pursue this possibility further here.

34. Recall footnote 5.

as it is in Imere, then plural-marked nouns can combine with the numeral two, a possibility that is exploited by Imere *eerua* because, as I've argued above, nouns marked with *ruu-* cannot combine with it for syntactic reasons (*eetasi* 'one' is not allowed to make use of this possibility, \**angata eetasi*, because *te-* is available, so *a-* is blocked).

## 6. Conclusion

In this paper I have explored some of the implications for the combination of Harbour's number feature theory with Scontras' approach to numerals in languages that distinguish singular, dual and plural number on nouns. I have hypothesized that the syntactic relation between NumberP, where number features reside, and NumeralP, where numerals reside, might vary from one language to another. The theory that results from these assumptions leads to a very restricted set of predictions regarding the number marking on nouns in the numeral+noun construction.

I argued that both Yimas and Hopi constitute straightforward confirmation that predicted pattern 1 is attested. I also argued that Ljubljana Slovenian and Imere instantiate the same pattern, but additional grammatical properties of their complex numerals and the grammar of D make that confirmation more difficult to establish.

I showed that Ljubljana Slovenian conforms to predicted pattern 1, even when complex numerals greater than one are taken into account, once their complex syntax and semantics are properly understood, something that became possible once certain ideas in Ionin & Matushansky (2006, 2018) about the semantics and composition of numerals were adapted for our purposes. Imere duals also seemed to pose a problem initially but I argued that the dual prefix *ruu-* can reasonably be taken to be the spell out of an article in addition to spelling out number morphology, which would prevent it from combination with the numeral two, for which case plural-marked nouns are used.

Much remains to be explored. To begin with, it is at present unknown to me whether there are any languages in which dual-marked nouns combine with numerals greater than two (predicted pattern 2), but this possibility is predicted by the theory presented here. Certain assumptions that were necessary to make, such as the variable syntactic relation between NumberP and NumeralP, remain to be justified empirically. But the most important underlying issue here is that, descriptively, we know little about what is possible and what is impossible in the numeral+noun construction in languages with duals, despite the efforts of Plank (1995). I hope that the mostly theoretical exploration I have undertaken in this paper will at least serve to motivate us to fill this important empirical gap in our knowledge.

## References

- Alexiadou, A. 2019. Morphological and Semantic Markedness Revisited: The Realization of Plurality across Languages. *Zeitschrift für Sprachwissenschaft* 38: 123-154.  
<<https://doi.org/10.1515/zfs-2019-0004>>

- Bale, A., Gagnon, M. & Khanjian, H. 2011. Cross-linguistic Representations of Numerals and Number Marking. *Proceedings of SALT 20*: 582-598.  
<<http://dx.doi.org/10.3765/salt.v20i0.2552>>
- Bylinina, L. & Nouwen, R. 2018. On 'Zero' and Semantic Plurality. *Glossa: a Journal of General Linguistics* 3(1), 98: 1-23.  
<<http://doi.org/10.5334/gjgl.441>>
- Borer, H. 2005. *Structuring Sense: In Name Only*. Oxford: Oxford University Press.
- Brisson, C. 2003. Plurals, 'all', and the Nonuniformity of Collective Predication. *Linguistics and Philosophy* 26: 129-184.  
<<https://doi.org/10.1023/A:1022771705575>>
- Brugè, L. 2002. The Positions of Demonstratives in the Extended Nominal Projection. In G. Cinque (ed.). *Functional Structure of DP and IP. The Cartography of Syntactic Structures*, vol. 1, 15-54. Oxford: Oxford University Press.
- Clark, R. 1975. Mele Notes. *Auckland University Working Papers in Anthropology, Archaeology, Linguistics and Maori Studies*, 40.
- Clark, R. 1998. *A Dictionary of the Mele language (Atara Imere), Vanuatu*. The Australian National University: Pacific Linguistics.  
<<https://doi.org/10.15144/PL-C149>>
- Clark, R. 2002/2011. Ifira-Mele. In J. Lynch, M. Ross & T. Crowley (eds.). *The Oceanic Languages*, 681-693. London: Routledge.
- Corbett, G. 2000. Number. Cambridge: Cambridge University Press.
- Derganc, A. 2003. The Dual in Slovenian. In J. Orešnik & D. D. Reindl (eds.). *Slovenian from a Typological Perspective*, 165-181. Berlin: Akademie Verlag.
- Dvorak, B. & Sauerland, U. 2006. The Semantics of the Slovenian Dual. *Proceedings of FASL 14*: 98-112.
- Farkas, D. & de Swart, H. 2010. The Semantics and Pragmatics of Plurals. *Semantics and Pragmatics* 3: 1-54.  
<<http://dx.doi.org/10.3765/sp.3.6>>
- Foley, W. 1991. *The Yimas Language of New Guinea*. Stanford: Stanford University Press.
- Franks, S. 1994. Parametric Properties of Numeral Phrases in Slavic. *Natural Language and Linguistic Theory* 12: 597-674.  
<<https://doi.org/10.1007/BF00992929>>
- Giusti, G. 1991. The Categorial Status of Quantified Nominals. *Linguistische Berichte* 136: 438-452.
- Giusti, G. 1997. The Categorial Status of Determiners. In L. Haegeman (ed.). *The New Comparative Syntax*, 94-113. Cambridge: Cambridge University Press.
- Grimm, S. 2012. Plurality is Distinct from Number-Neutrality. *Proceedings of NELS 41*
- Harbour, D. 2011. Descriptive and Explanatory Markedness. *Morphology* 21: 223-245.  
<<https://doi.org/10.1007/s11525-010-9167-0>>
- Harbour, D. 2014. Paucity, Abundance and the Theory of Number. *Language* 90: 158-229.  
<<https://doi.org/10.1353/lan.2014.0003>>
- Herrity, P. 2015. *Slovene: A Comprehensive Grammar*. Abingdon: Routledge.
- Heycock, C. & Zamparelli, R. 2005. Friends and Colleagues: Plurality, Coordination, and the Structure of DP. *Natural Language Semantics* 13: 201-270.  
<<https://doi.org/10.1007/s11050-004-2442-z>>

- Hill, K., Sekaquaptewa, E., Black, M. E., Malotki, E. & Lomatuway'ma, M. 1998. *Hopìikwa Lavàytutuveni: A Hopi Dictionary of the Third Mesa Dialect with an English-Hopi Finder List and a Sketch of Hopi Grammar*. The Hopi Dictionary Project, Tucson: Bureau of Applied Research in Anthropology, University of Arizona.
- Hurford, J. 1975. *The Linguistic Theory of Numerals*. Cambridge: Cambridge University Press.
- Hurford, J. 2001. Numeral Systems. In N. J. Smelser & P. B. Baltes (eds.). *International Encyclopedia of the Social and Behavioral Sciences*, 10756-10761. Amsterdam: Pergamon.
- Ionin, T. & Matushansky, O. 2006. The Composition of Complex Cardinals. *Journal of Semantics* 23: 315-360.  
<<https://doi.org/10.1093/jos/ffl006>>
- Ionin, T. & Matushansky, O. 2018. *Cardinals. The Syntax and Semantics of Cardinal-containing Expressions*. Boston: MIT Press.
- Ivlieva, N. 2013. *Scalar Implicatures and the Grammar of Plurality and Disjunction*. PhD dissertation, MIT.
- Kayne, R. S. 2003. Silent Years, Silent Hours. In L.-O. Delsing, C. Falk, G. Josefsson & H. Á. Sigurðsson (eds.). *Grammar in Focus: Festschrift for Christer Platzack*, 209-226. Lund: Wallin and Dalholm.
- Kayne, R. S. 2007. On the Syntax of Quantity in English. In J. Bayer, T. Bhattacharya & M.T. Hany Babu (eds.). *Linguistic Theory and South Asian Languages: Essays in honour of K. A. Jayaseelan*, 73-105. Linguistik Aktuell/Linguistics Today, 102.
- Kiparsky, P. & Tonhauser, J. 2012. Semantics of Inflection. In C. Maienborn, K. von Heusinger & P. Portner (eds.). *Handbook of Semantics*, 2070-2097. Berlin: de Gruyter.
- Krifka, M. 1989. Nominal Reference, Temporal Constitution and Quantification in Event Semantics. In R. Bartsch, J. van Benthem & P. van Emde Boas (eds.). *Semantics and Contextual Expression*, 75-115. Dordrecht: Foris.
- Krifka, M. 1995. Common Nouns: A Contrastive Analysis of Chinese and English. In G. Carlson & J. Pelletier (eds.). *The Generic Book*, 398-411. Chicago: Chicago University Press.
- Laserson, P. 1998. Plurality, Conjunction, and Events. *Studies in Linguistics and Philosophy* 55, Springer.
- Laserson, P. 2011. Mass Nouns and Plurals. In K. von Heusinger, C. Maienborn & P. Portner (eds.). *Semantics: An International Handbook of Natural Language Meaning*, vol. 2, 1131-1153. Berlin: De Gruyter.
- Link, G. 1983. The Logical Analysis of Plural and Mass Terms: A Lattice-Theoretical Approach. In R. Bäuerle, C. Schwarze & A. von Stechow (eds.). *Meaning, Use and Interpretation of Language*, 302-323. Berlin: de Gruyter.
- Martí, L. 2019. The Semantics of Noun Prefixes in Imere.
- Martí, L. 2020a. Numerals and the Theory of Number. *Semantics and Pragmatics* 13(3).  
<<http://dx.doi.org/10.3765/sp.13.3>>
- Martí, L. 2020b. Inclusive Plurals and the Theory of Number. *Linguistic Inquiry* 51(1): 37-74.  
<[https://doi.org/10.1162/ling\\_a\\_00330](https://doi.org/10.1162/ling_a_00330)>

- Martí, L. under review. 'Zero N': Number Features and  $\perp$ . <[https://www.researchgate.net/publication/319059774\\_Zero\\_N\\_number\\_features\\_and](https://www.researchgate.net/publication/319059774_Zero_N_number_features_and)>.
- Marušič, L. & Žaucer, R. to appear. Case Study: Slovenian Dual. In P. Cabredo Hofherr & J. Doetjes (eds.). *Handbook of Grammatical Number*. Oxford: Oxford University Press.
- Nelson, D. & Toivonen, I. 2000. Counting and the Grammar: Case and Numerals in Inari Sami. In D. Nelson & P. Foulkes (eds.). *Leeds Working Papers in Linguistics* 8: 179-192.
- Neuskaya, I. 2005. Inclusive and Exclusive in Turkic languages. In E. Filimonova (ed.). *Clusivity: Typology and Case Studies of the Inclusive–Exclusive Distinction*, 341-358. Amsterdam/Philadelphia: John Benjamins.
- Nevins, A. 2011. Marked Targets vs. Marked Triggers and Impoverishment of the Dual. *Linguistic Inquiry* 42: 413-444.  
<[https://doi.org/10.1162/LING\\_a\\_00052](https://doi.org/10.1162/LING_a_00052)>
- Noyer, R. 1992. *Features, Positions and Affixes in Autonomous Morphological Structure*. PhD dissertation, MIT.
- Ouwayda, S. 2014. *Where Number Lies: Plural Marking, Numerals, and the Collective-Distributive Distinction*. PhD dissertation, University of Southern California.
- Plank, F. 1995. Domains of the Dual, in Maltese and in General. *Rivista di Linguistica* 8: 123-140.
- Ritter, E. 1991. Two Functional Categories in Noun Phrases: Evidence from Modern Hebrew. In *Perspectives on Phrase Structure, Syntax and Semantics*, 37-62. New York: Academic Press.
- Rothstein, S. 2013. A Fregean Semantics for Number Words. *Proceedings of the 19th Amsterdam Colloquium*, 179-186.
- Rothstein, S. 2016. Counting and Measuring: A Theoretical and Crosslinguistic Account. *Baltic International Yearbook of Cognition, Logic, and Communication* 11, 1-49.
- Rothstein, S. 2017. *The Semantics of Counting and Measuring*. Cambridge: Cambridge University Press.
- Rubino, C. 1997. *A Reference Grammar of Ilocano*. PhD Dissertation, University of California at Santa Barbara
- Sauerland, U. 2003. A New Semantics for Number. *Proceedings of SALT*, 13: 258-275.  
<<http://dx.doi.org/10.3765/salt.v13i0.2898>>
- Sauerland, U, Anderssen, J., & Yatsushiro, K. 2005. The Plural is Semantically Unmarked. In S. Kepser & M. Reis (eds.). *Linguistic Evidence*, 409-430. Berlin: de Gruyter.
- Scha, R. 1981. Distributive, Collective and Cumulative Quantification. In J. A. G. Groenendijk, T. M. V. Janssen & M. B. J. Stokhof (eds.). *Formal Methods in the Study of Language (part 2)*, 483-512. Amsterdam: Mathematisch Centrum.
- Scontras, G. 2014. *The Semantics of Measurement*. PhD dissertation, Harvard University.
- Sigler, M. 1997. *Specificity and Agreement in Standard Western Armenian*. PhD dissertation, MIT.
- Spector, B. 2007. Aspects of the Pragmatics of Plural Morphology: on Higher-Order Implicatures. In U. Sauerland & P. Stateva (eds.). *Presuppositions and Implicatures in Compositional Semantics*, 243-281. New York: Palgrave MacMillan.

- Toporišič, J. 2000. *Slovenska Slovnica*. Maribor: Obzorja.
- Yatsushiro, K., Sauerland, U. & Alexiadou, A. 2017. The Unmarkedness of Plural: Crosslinguistic Data. *Proceedings of BUCLD 41*: 753-765.
- Zabbal, Y. 2005. *The Syntax of Numeral Expressions*. Manuscript, University of Massachusetts Amherst.
- Zamparelli, R. 1995. *Layers in the Determiner Phrase*. PhD dissertation, University of Rochester.
- Zamparelli, R. 2002. Definite and Bare Kind-denoting Noun Phrases. In C. Beyssade, R. Bok-Bennema, F. Drijkoningen, & P. Monachesi (eds.). *Romance Languages and Linguistic Theory 2000*, 305-342. Amsterdam: John Benjamins.
- Zweig, E. 2006. Nouns and Adjectives in Numeral NPs. *Proceedings of NELS 35*: 663-675.
- Zweig, E. 2009. Number-Neutral Bare Plurals and the Multiplicity Implicature. *Linguistics and Philosophy* 32: 353-407.  
<<https://doi.org/10.1007/s10988-009-9064-3>>