

Inclusive plurals and the theory of number¹

Luisa Martí
Queen Mary University of London
luisa.marti@qmul.ac.uk
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Comments welcome!

Abstract. I argue that an account of both inclusive plurals (Dvorak and Sauerland 2006, Farkas and de Swart 2010, Grimm 2012, Ivlieva 2013, Krifka 1989, 1995, Mayr 2015, Lasersohn 1998, 2011, Sauerland 2003, Sauerland, Anderssen and Yatsushiro 2005, Spector 2007, Yatsushiro, Sauerland and Alexiadou 2017, Zweig 2009) and the cross-linguistic typology of grammatical number (Harbour 2014) requires the postulation of a [-atomic] feature (or something very much like it) in the structure of exclusive plural DPs. When combined with the only theory we currently have that accounts for the cross-linguistic typology of number, Harbour (2014), theories in which the exclusive plural DPs of a language with inclusive plurals are [-atomic]-less undergenerate or overgenerate with respect to that typology. These problems disappear as soon as the structure of exclusive plural DPs contains a component that generates exclusive plural interpretations, either Harbour's [-atomic] feature (added to a system with a second, [-atomic]-less structure, a proposal compatible with, e.g., Farkas and de Swart 2010), or a predicate-level exhaustivity operator (building on Mayr 2015).

Keywords: grammatical number, inclusive plurals, dual, paucal, typology of number

1 Introduction: semantics of plural count nouns

The problem of inclusive plurals is illustrated in (1)-(2): plural forms of nouns in English, such as *tomatoes*, introduce into the interpretation² only pluralities (or plural, or non-atomic individuals³) in examples such as (1)⁴, but both singularities (or singular, or atomic individuals) and pluralities in examples such as (2) (from Sauerland 2003):

- (1) *English*
Lina harvested tomatoes

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² I use the term *interpretation* in the broadest possible sense, without making a commitment as to what mechanisms (syntactic, pragmatic, semantic) are involved in generating it.

³ See Link (1983) and much subsequent work.

⁴ At the very least when the example is interpreted purely episodically, not generically. The issue of genericity/kinds is briefly taken up in section 4.1.

- (2) *English*
Lina didn't harvest tomatoes

For (1) to be true, Lina has to have harvested at least two tomatoes and is thus concerned with tomato pluralities each of which is constituted of two or more tomato atoms. However, the negation of this sentence, in (2), requires Lina not to have harvested any tomatoes at all—neither one (a singularity) nor more than one (a plurality). If the plural form *tomatoes* in (2) introduced pluralities only, the sentence would be true in situations in which Lina harvested only one tomato (which does not constitute a plurality), contrary to fact. Plural forms such as *tomatoes* in (2) are known as inclusive plurals, since they include both singular and plural individuals. Exclusive plurals are plural forms that introduce only plural individuals. The issue is: what is the denotation of plural noun forms? Are plural forms always inclusive semantically? Are they ambiguous between an inclusive and an exclusive semantics? These questions, their answers, and their consequences have received a lot of attention in the literature (see Dvorak and Sauerland 2006, Farkas and de Swart 2010, Grimm 2012, Ivlieva 2013, Krifka 1989, 1995, Lasersohn 1998, 2011, Mayr 2015, Sauerland 2003, Sauerland, Anderssen and Yatsushiro 2005, Spector 2007, Yatsushiro, Sauerland and Alexiadou 2017, Zweig 2009, and Kiparsky and Tonhauser 2012 for an overview).

Harbour (2014) proposes a compositional theory of number that derives the cross-linguistic typology of grammatical number, that is, all and only the possible number systems in the languages of the world, from a small set of semantic and syntactic primitives. In his system, plural forms are unambiguously exclusive, and the problem of inclusive plurals arises. The main argument of this paper is that a proposal to solve the inclusive plurals problem that postulates unambiguously inclusive plural forms has problems of under- or overgeneration when considered together with Harbour's proposal. Indeed, authors such as Dvorak and Sauerland (2006), Ivlieva (2013), Krifka (1989, 1995), Lasersohn (1998, 2011), Sauerland (2003), Sauerland, Anderssen and Yatsushiro (2005), Spector (2007), Yatsushiro, Sauerland and Alexiadou (2017), or Zweig (2009) have proposed that plural-marked DPs are semantically inclusive only, and argue that exclusive plural interpretations arise as a byproduct of independent, DP-unrelated mechanisms (sometimes, these are grammar-unrelated mechanisms as well) (I will call such systems *inclusive-only systems* from now on). The undergeneration problem arises in languages that have number values such as dual or paucal, number values that are compositionally built on the semantically contentful, DP-structural feature [-atomic] in Harbour's system. An inclusive-only approach to inclusive plurals predicts that such languages cannot have inclusive plurals, contrary to fact. Certain versions of the inclusive-only account are shown to have the opposite problem, a problem of overgeneration, whereby unattested number systems, such as one that distinguishes only singular from dual, are incorrectly predicted to exist.

An alternative solution is to assume that plural forms are ambiguous between an exclusive and an inclusive semantics, as argued for, for example, in Farkas and de Swart (2010). Combined with Harbour, this type of approach entails that a [-atomic] feature in the structure of exclusive plural DPs is responsible for exclusivity, and, I suggest, absence of number (NumP) in the structure of inclusive plural DPs is responsible for inclusivity. An advantage of this approach is that inclusive plurals can be subsumed under general number, a number distinction that some languages express overtly as a separate number category, as shown in Corbett (2000), thus removing part of the stipulative nature of Farkas and de Swart's proposal. Because this solution retains the

mechanism for the generation of dual and paucal number values, namely, [-atomic], and an independent solution to the inclusive plurals problem is provided, the under- and overgeneration problems of the inclusive-only approaches disappear. Another way to avoid these problems is to use a predicate-level exhaustivity operator, instead of [-atomic], in the structure of exclusive plural DPs, as proposed in Mayr (2015).

The empirical focus of the paper is on the semantics of common, count nouns (more specifically, bare plurals). Of course, pronouns, and other categories that go beyond the nominal domain, such as verbs, may also display grammatical number (see Corbett 2000 for many illustrations, in many languages). Pronouns are special, since, typically, languages display grammatical number on them, and Harbour's theory of number draws heavily on pronominal paradigms. While nothing in what I say here suggests that pronouns should be excluded from consideration, reasons of space and of access to native speakers of the relevant languages prevent me from systematically studying their interpretation in this paper. For example, I will not draw firm conclusions about the existence of inclusive plural pronoun forms (but see Harbour 2016: 149-152 for some discussion).

My argument is independent of the particular mechanism that inclusive-only approaches might use to derive exclusive plural interpretations (e.g., Maximize Presupposition, DP-unrelated exhaustivity operators/higher-order implicatures, etc.), and the status of number information in the semantics of features (presupposition vs. entailment). While the proper explanation of certain well-known, recalcitrant problems in the inclusive plurals literature (such as the problem of non-monotonic environments, e.g., *Exactly one student read books*) might be an issue for some theories that do use DP-structural means for the derivation of exclusive plural interpretations, these issues are orthogonal to the argument presented in this paper. For example, some inclusive-only approaches, such as Spector (2007), have solutions for the problem of non-monotonic environments but are subject to the criticism presented here. On the other hand, some non-inclusive-only approaches, such as Farkas and de Swart (2010), do not have a solution for the problem of non-monotonic environments but are not subject to the criticism presented here. My goal here is to bring to light ways in which the cross-linguistic typology of grammatical number may inform the debate on the correct account of inclusive plurals.

The paper is organized as follows. Section 2 introduces the basics of Harbour (2014). Section 3 discusses the problem of inclusive plurals as it arises in this theory and provides arguments against solving it by postulating that exclusive plural DPs in languages with inclusive plurals are not exclusive semantically. Section 4 shows that ambiguity approaches, that is, those in which plural DPs are ambiguous between an exclusive, [-atomic] semantics and an inclusive semantics, do not suffer from these problems as a matter of principle. Neither does replacing [-atomic] with Mayr's (2015) predicative-level exhaustivity operator. Section 5 concludes.

2 Harbour (2014)

It is well-known that languages make grammatical number distinctions that go beyond singular and plural: one can find number inflection for dual, trial, minimal, augmented, paucal, or greater plural, among others, as discussed in Corbett's (2000) seminal typological study of number systems. I will illustrate here with languages that contain duals and/or paucals in addition to singular and plural, as these will be the most

relevant for us later on. The reader is referred to Corbett (2000) and Harbour (2011, 2014) for detailed discussion of other number values.

Consider Ljubljana Slovenian, a dialect of Slovenian spoken in and around Ljubljana. As shown in the (partial⁵) paradigm of noun inflection in **Table 1**, Ljubljana Slovenian distinguishes singular, dual and plural. These distinctions are most noticeable in the masculine declension, with a significant amount of syncretism of the dual with the plural in the feminine and neuter declensions (Rok Žaucer, p.c.; for standard Slovenian, see Derganc 2003, Herrity 2016, Marušič and Žaucer to appear, Toporišič 2000):

		NOM	ACC	GEN	LOCATIVE	DATIVE	INSTRUMENTAL
MASC <i>stol</i> 'chair'	SING	stol	stol	stola	pri stolu	Stolu	s stolom
	DUAL	stola	stola	stolov	pri stolih	stolom(a)	s stoloma/s stoli
	PLURAL	stoli	stole	stolov	pri stolih	stolom	s stoli
FEM <i>hiša</i> 'house'	SING	hiša	hišo	hiše	pri hiši	hiši	s hišo
	DUAL	hiše	hiše	hiš	pri hišah	hišam(a)	s hišama/s hišami
	PLURAL	hiše	hiše	hiš	pri hišah	hišam	s hišami
NEUT <i>mesto</i> 'town'	SING	mest	mest	mesta	pri mestu	mestu	z mestom
	DUAL	mesta	mesta	mest	pri mestih	mestom(a)	z mestoma/z mesti
	PLURAL	mesta	mesta	mest	pri mestih	mestom	z mesti

Table 1 Ljubljana Slovenian nouns

The dual is being lost in southern dialects of Slovenian, though it is still robust in central and northern dialects (see Marušič and Žaucer to appear for more discussion). Signs that the dual is robust in Ljubljana Slovenian are that it is part of the regular inflectional paradigm of nouns (i.e., it is not restricted to just a few nouns) and that it displays its own dual agreement patterns with other elements (adjectives, verbs, etc.)^{6,7}.

Some languages have a grammatical number value of paucal. Paucal forms are used when the number of real-world entities concerned is small in number. Consider the number system of Bayso, a Cushitic language spoken in Ethiopia, whose nouns distinguish singular, paucal and plural (Corbett 2000, 2012: 224-33, Corbett and Hayward 1978, Hayward 1979)(in addition to general number, discussed in section 4):

⁵ There is a second declension for feminine nouns in (Ljubljana) Slovenian which is not shown here.

⁶ The plural-syncretic nominative dual forms trigger obligatory dual subject-verb agreement, as shown in (i), so, featurally, they are separate dual forms (Rok Žaucer, p.c.):

(i) *Ljubljana Slovenian*

Dve rože cvetita/*cvetijo
Two.NOM.FEM.DU flower.NOM.FEM.DU blossom.3DU/blossom.3PL
'(The) two flowers are blossoming'

(ii) *Ljubljana Slovenian*

Tri rože cvetijo
Three.NOM.FEM.PL flower.NOM.FEM.PL blossom.3PL
'(The) three flowers are blossoming'

⁷ Key to abbreviations in glosses: 1 = first person; 2 = second person; 3 = third person; ACC = accusative case; ANIM = animate; AUX = auxiliary; DAT = dative case; DEF = definite; DEM = demonstrative; DU = dual; FEM = feminine; GEN = genitive case; GENERAL = general number; INANIM = inanimate; INDEF = indefinite; INTRAN = intransitive; MASC = masculine; NEG = negation; NEUT = neuter; NOM = nominative case; PAST = past tense; PAUC = paucal; PL = plural; POSS = possessive; PREP = preposition; PRES = present; PRON = pronoun; PTC = participle; Q = question operator; SG = singular; TRAN = transitive.

	SINGULAR	PAUCAL	PLURAL
<i>lion</i>	lubántiti	lubanjaa	lubanjool
<i>bull</i>	áartiti	aaraajaa	aaraar
<i>sister</i>	abbati	abbajaa	abbalaal
<i>bird</i>	kimbírtiti	kimbirjaa	kimbirjool
<i>ear</i>	nebeti	nebejaa	nebebboo

Table 2 Bayso nouns

Paucal forms, such as *lubanjaa* ‘lion.PAUC’ in (3)b, indicate that a small number of lions is involved, from two to about six (Corbett 2000: 22) (verbal agreement for the paucal is in the plural; this agreement pattern is found with plural pronouns as well):

- (3) *Bayso*
- a. Lubán-titi hudure
lion-SG sleep.MASC.SG.PAST
‘A single/particular lion slept’
- b. Luban-jaa hudureene
lion-PAUC sleep.PL.PAST
‘A few lions slept’
- c. Luban-jool hudure
lion-PL sleep.MASC.SG.PAST
‘Lions slept’

Paucal is an approximative number. This means that how many lions are said to be sleeping in an example like (3)b may vary slightly from speaker to speaker or from situation to situation (e.g., for some speakers, the upper bound may not be six but five, etc.; cf. English *a few*).

Consider also Biak, an Austronesian language spoken in Indonesia, which distinguishes singular, dual, paucal and plural on verbal agreement markers, determiners, demonstratives, and possessive pronouns, as shown in Dalrymple and Mofu (2013). **Table 3** shows the number distinctions made on (proximal) demonstratives and definite determiners in this language:

	SINGULAR	DUAL	PAUCAL	PLURAL (ANIM)	PLURAL (INANIM)
<i>Proximal demonstrative</i>	ine	suine	skoine	sine	na(i)ne
<i>Definite determiner</i>	i/ya	sui/suya	skoi/skoya	si/sya	na

Table 3 Biak demonstratives and definite determiners

Even though Biak nouns themselves do not (overtly) mark these distinctions, elements that accompany them in the noun phrase do. (4) provides some examples (from Dalrymple and Mofu 2013: 45)(the range of the paucal starts at three and may go up to about ten; Mary Dalrymple, p.c.):

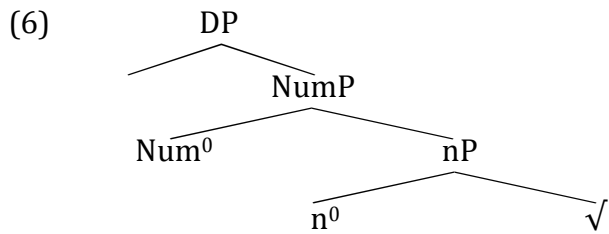
- (4) *Biak*
- | | | |
|--------------------------------------|---------------|------------------|
| a. Rum | ine | i-wawa |
| house | DEM.SG | 3SG-shake |
| ‘This house is shaking’ | | |
| b. Rum | suine | su-wawa |
| house | DEM.DU | 3DU-shake |
| ‘These (two) houses are shaking’ | | |
| c. Rum | skoine | sko-wawa |
| house | DEM.PAUC | 3PAUC-shake |
| ‘These (several) houses are shaking’ | | |
| d. Rum | nane | na-wawa |
| house | DEM.PL.INANIM | 3PL.INANIM-shake |
| ‘These (many) houses are shaking’ | | |

In addition to the systems here exemplified, the cross-linguistic typology of number includes languages with no number (Pirahã, Everett 1986: 217, Corbett 2000: 50-1; Dëne Sų́iné, Wilhelm 2008), singular-dual-lesser paucal-greater paucal-plural systems (e.g., Sursurunga, Corbett 2000: 26-30; cf. Hutchisson 1986), singular-dual-trial-paucal-plural systems (e.g., Marshallese), minimal-augmented systems (e.g., Winnebago), and others (for the latter two, see Harbour 2014 and references cited there). However, there are no attested number systems that distinguish, for example, just singular from dual, or paucal from plural, or trial from plural, or trial from paucal. The full set of cross-linguistic generalizations is in (5) (cf. Greenberg 1966):

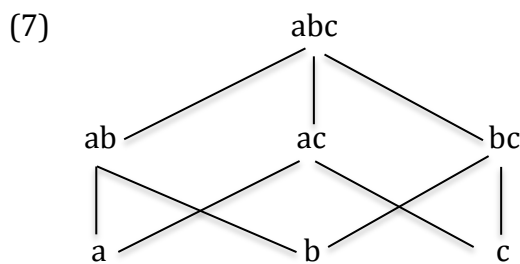
- (5) Trial requires dual
 Dual requires singular
 Singular requires plural
 Plural requires singular or minimal
 Unit augmented requires augmented
 Minimal requires augmented or plural
 Augmented requires minimal
 Greater paucal requires (lesser) paucal
 Paucal requires plural
 Greater (and global) plural requires plural or augmented

The challenge for a theory of number whose goal is to account for the cross-linguistic expression of number is to explain the important fact that, as (5) shows, not all logically possible number value combinations constitute possible number systems. Harbour’s (2014) theory postulates the smallest number of primitives/features that derive the possible number systems while explaining why the impossible systems are impossible, that is, that derive the generalizations in (5). It also provides the basis on which to explain the morpho-phonological and morpho-syntactic realization of features in different languages. His main assumptions are as follows: (a) NumP takes nP as complement, as in (6), (b) n^0 assigns roots to the category of nouns and structures them into semilattices, (c) only three features can appear in Num⁰: [\pm additive], [\pm atomic], [\pm minimal], as in (6), (d) these features operate on the lattices provided by nP, (e) the repetition of a particular feature in Num⁰ may or may not be allowed in a language, and (f) the semantic range of the [\pm additive] cut is subject to social convention. We will consider assumptions (a)-(d) and (f) in what follows (assumption (e) is necessary to

derive number values like minimal, augmented, unit augmented, trial, lesser and greater paucals, and others; see Harbour 2011, 2014 for more details). Assumptions (a), (b) and (d) are quite commonly made in the literature:⁸



Assuming a simplified model with just three individuals in it, a, b and c, what n^0 is taken to do to roots is to structure them into the join semilattice in (7):



Equivalently:

(8) $[[nP]] = \{a, b, c, ab, ac, bc, abc\}$

The semantics for the number features is assumed to be as follows⁹:

(9) $[[+atomic]] = \lambda P.\lambda x. P(x) \ \& \ atom(x)$
 $[[−atomic]] = \lambda P.\lambda x. P(x) \ \& \ \neg atom(x)$

(10) $[[+minimal]] = \lambda P.\lambda x. P(x) \ \& \ \neg \exists y P(y) \ \& \ y \sqsubset x$
 $[[−minimal]] = \lambda P.\lambda x. P(x) \ \& \ \exists y P(y) \ \& \ y \sqsubset x$

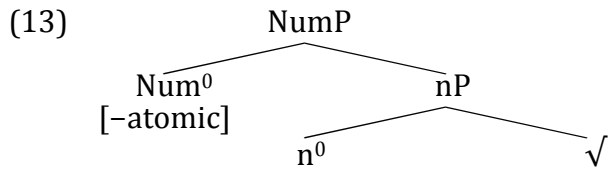
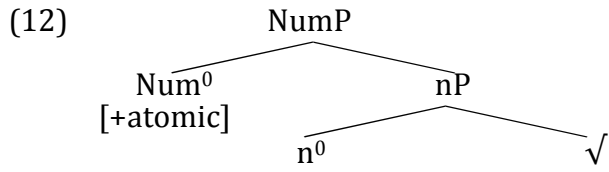
(11) $[[+additive]] = \lambda P.\lambda x. Q(x) \ \& \ Q \sqsubset P \ \& \ \forall y Q(y) \rightarrow Q(x \sqcup y)$
 $[[−additive]] = \lambda P.\lambda x. Q(x) \ \& \ Q \sqsubset P \ \& \ \neg \forall y Q(y) \rightarrow Q(x \sqcup y)$

$[\pm Atomic]$ is sensitive to atoms/singularities ($[[+atomic]]$) vs. non-atoms/pluralities ($[[−atomic]]$). $[\pm Minimal]$ is sensitive to elements with parts ($[[−minimal]]$) vs. elements without parts ($[[+minimal]]$). $[\pm Additive]$ is concerned with whether the output set contains, for any two of its members, their join ($[[+additive]]$) (a property also known as cumulativity; cf. Krifka 1989) or not ($[[−additive]]$).

⁸ Other syntactic projections inside DP are of course possible, but they are irrelevant here.

⁹ I deviate from Harbour in that I treat the contribution of the number features to be entirely made up of entailments, whereas for him some of their content is presupposed. Nothing of what I say here depends on this. $[\pm Atomic]$ is of type $\langle e, t \rangle$, not $\langle et, et \rangle$, in his proposal, but, again, the difference is not important here. Q is a free variable, \sqcup is the join operation, \sqsubset is the proper subpart relation. Lower case variable names range over both atomic and non-atomic individuals.

To see how this works, let's start by considering a simple singular-plural system. Such a system allows only (12) and (13), that is, the only features that can appear in Num⁰ are [\pm atomic]:



(14) gives rise to a singular semantics, and (15), to a strictly plural semantics^{10, 11}:

$$(14) \quad [[(12)]] = [[\text{NumP}]] = [[+atomic]]([[nP]]) = \lambda x. [[nP]](x) \ \& \ \text{atom}(x)$$

$$(15) \quad [[(13)]] = [[\text{NumP}]] = [[-atomic]]([[nP]]) = \lambda x. [[nP]](x) \ \& \ \neg \text{atom}(x)$$

Importantly, the structure that gives rise to (15), i.e., to exclusive plural interpretations, contains a [$-$ atomic] feature. In English, [$+$ atomic] is not morphologically realized overtly, but [$-$ atomic] is, as $-s$.

As Harbour (2011) observes, the same result is obtained if a system allows just [\pm minimal] in Num⁰ (and does not allow repetition of features, (e)), since the set of elements in (7) that have no subparts ([$+$ minimal]) coincides with the set of atoms ([$+$ atomic]), and the set of elements in (7) that have subparts ([$-$ minimal]) coincides with the set of non-atoms ([$-$ atomic]). Thus, there might be cases where it is not possible to distinguish [\pm minimal] from [\pm atomic]. However, there are cases in which the two do come apart. One such case is provided by systems with dual number, such as Ljubljana Slovenian, which are argued to use both [\pm atomic] and [\pm minimal] in Num⁰. Consider the following feature combinations (cf. Noyer 1992, Harbour 2011):

¹⁰ Given the semantics of [\pm atomic], it will not be possible to repeat this feature, as per (e), since nothing can satisfy (i):

$$(i) \quad [[+atomic]]([[-atomic]]([[nP]])) = [[-atomic]]([[+atomic]]([[nP]])) = \lambda x. [[nP]](x) \ \& \ \neg \text{atom}(x) \ \& \ \text{atom}(x)$$

Footnotes 12 and 13 provide some detail into the workings of assumption (e).

¹¹ Harbour is not explicit as to how van Benthem's problem (van Benthem 1986) might be addressed in his system. The problem can be seen to arise in e.g., (i):

$$(i) \quad [[A \text{ dog is barking}]] = 1 \text{ iff } \exists x \text{ dog}(x) \ \& \ \text{atom}(x) \ \& \ \text{is_barking}(x)$$

If (i) is correct and all there is to say about the English sentence *A dog is barking*, then that sentence is predicted to be compatible with a situation in which many dogs are barking and equivalent to *One or more dogs are barking*, which does not seem intuitively correct. This suggests that either the denotation of indefinites is more involved than mere existential quantification would suggest, or that there are post-compositional processes at work that exclude the unwanted situations. The problem will arise for nouns marked for numbers other than plural. I cannot decide this matter here.

- (16) a. $[[+minimal]]([[+atomic]]([[nP]])) =$ (singular)
 $= \lambda x. [[nP]](x) \& \text{atom}(x) \& \neg \exists y \text{atom}(y) \& y \sqsubset x$
- b. $[[+minimal]]([[-atomic]]([[nP]])) =$ (dual)
 $= \lambda x. [[nP]](x) \& \neg \text{atom}(x) \& \neg \exists y \neg \text{atom}(y) \& y \sqsubset x$
- c. $[[−minimal]]([[-atomic]]([[nP]])) =$ (plural)
 $= \lambda x. [[nP]](x) \& \neg \text{atom}(x) \& \exists y \neg \text{atom}(y) \& y \sqsubset x$
- d. $\#[[-minimal]]([[+atomic]]([[nP]])) =$
 $= \lambda x. [[nP]](x) \& \text{atom}(x) \& \exists y \text{atom}(y) \& y \sqsubset x$

The feature combination in (16)a yields the singular number value. Both (16)b and (16)c will be crucial for us: (16)b yields the dual number value (informally, $[-atomic]$ eliminates the atoms, and $[+minimal]$ chooses the bottommost layer of the lattice after that, which is constituted by all the pluralities constituted of two atoms). (16)c yields plural (for more than two referents). Since nothing can satisfy (16)d (atoms do not have atoms as proper parts), (16)d does not give rise to a number value.^{12, 13}

This decompositional analysis of the dual into $[-atomic]$ and $[+minimal]$ is attractive for a number of reasons. First, there is no need to postulate a primitive feature $[DUAL]$. Instead, the derivation of this number value is achieved by features, $[+minimal]$ and $[-atomic]$, that are justified separately elsewhere (for more on $[+minimal]$, see Harbour 2011 and footnotes 12 and 13). This in turn means that the implicational universals in (5) concerned with the dual follow from the fact that the feature $[-atomic]$ is used. Those universals say that there is no language with a dual that doesn't also have singular and plural. If $[-atomic]$ is used for the dual, then other numbers that make use of this feature value, such as plural, must also be present in the system, and if $[-atomic]$ is used, then $[+atomic]$ is used too, which is involved in the singular. Patterns of morphological realization and agreement in different languages can also be explained (see Noyer 1992 and Harbour 2014 for examples). That dual is mastered later than plural in first language acquisition, and that it can be lost without losing the plural, also follow in this approach (see Nevins 2011 for more discussion). The compositional account of these generalisations within Harbour's system will play an important role in my arguments in section 3.

¹² Another such case is provided by systems that make a distinction between first person inclusive (the combination of speaker and hearer) and first person exclusive (just the speaker). In these systems, $[+minimal](P) \neq [+atomic](P)$, for the combination of speaker and hearer is not an atom but constitutes the most minimal element that can be chosen from the speaker-hearer combination. Minimal-augmented systems like that of Winnebago, a Siouan language spoken in the US (Noyer 1992, Harbour 2011), and minimal-unit augmented systems like that of Rembarrnga, a Northern Australian language (Corbett 2000: 166, Harbour 2011, McKay 1978), make use of $[\pm minimal]$, and Rembarrnga allows its repetition ((e)).

¹³ Consider also the trial. This is a number value that arises in systems that use both $[\pm minimal]$ and $[\pm atomic]$, and where $[\pm minimal]$ is allowed to repeat (assumption (e)). Such a system gives rise to four well-formed feature combinations and two ill-formed ones. The four well-formed combinations yield singular, dual, trial and plural. Trial is derived as follows:

(i) $[[+minimal]]([[-minimal]]([[-atomic]]([[nP]]))) =$
 $= \lambda x. \neg \text{atom}(x) \& \exists y [\neg \text{atom}(y) \& y \sqsubset x] \& \neg \exists y' \exists y'' [\neg \text{atom}(y') \& y' \sqsubset y'' \& y'' \sqsubset x]$

(i) is the set of all elements x for which all subelements y'' of subelements y' are atomic—this is only satisfied for elements x that are constituted of exactly three atoms, and trial number is derived. The fact that trial requires dual ((5)) follows from the fact that the dual is generated with a subset of the features used for the trial ($[+minimal]$ and $[-atomic]$, as in (16)b).

Paucals are derived using the feature [\pm additive], which is subject to the additional constraint ((f) above) that its semantic range is subject to social convention. Let's consider the simplest system that contains a paucal, a [\pm additive, \pm atomic] system, exemplified by Bayso above:

- (17) a. $[[[-\text{additive}]]([[+\text{atomic}]]([[nP]])) =$ (singular)
 $= \lambda x. Q(x) \ \& \ Q \sqsubset [[+\text{atomic}]]([[nP]]) \ \& \ \neg \forall y \ Q(y) \rightarrow Q(x \sqcup y)$
- b. $[[[-\text{additive}]]([[-\text{atomic}]]([[nP]])) =$ (paucal)
 $= \lambda x. Q(x) \ \& \ Q \sqsubset [[-\text{atomic}]]([[nP]]) \ \& \ \neg \forall y \ Q(y) \rightarrow Q(x \sqcup y)$
- c. $[[[+\text{additive}]]([[-\text{atomic}]]([[nP]])) =$ (plural)
 $= \lambda x. Q(x) \ \& \ Q \sqsubset [[-\text{atomic}]]([[nP]]) \ \& \ \forall y \ Q(y) \rightarrow Q(x \sqcup y)$
- d. $\#[[+\text{additive}]]([[+\text{atomic}]]([[nP]])) =$
 $= \lambda x. Q(x) \ \& \ Q \sqsubset [[+\text{atomic}]]([[nP]]) \ \& \ \forall y \ Q(y) \rightarrow Q(x \sqcup y)$

[\pm Additive] is defined with reference to a proper subset Q of the characteristic set of the function denoted by its input. (17)a yields singular number. It denotes the set of atomic elements x in Q such that for not all combinations of x with other elements y is it the case that their join is in Q. Constraint (f) is not particularly evident in this feature combination because [+atomic] alone already characterizes the set of atoms. But it is more in evidence in (17)b, which yields paucal number. (17)b denotes the set of non-atomic elements x in Q such that for not all combinations with other elements y is it the case that their join is in Q. The semantic range of the [-additive] cut is subject to social convention, and this means that the size of Q might vary from speaker to speaker (or from community of speakers to community of speakers). This is as it should be, for paucal number is an approximative number, not an exact number—its approximative nature is well documented in the literature (see Corbett 2000 for more). If the cut for this feature is relatively low, the paucal thus generated will be concerned with a small number of real-world entities, perhaps between two and five. Not all speakers of this language might agree, as per (f), and some may set the upper limit at, e.g., six. (17)c yields plural number (more on the semantics of the plural in languages with paucals in section 4.2). (17)d yields no number value, as a set of atoms cannot be cumulative. Paucal number is not postulated as a primitive [PAUCAL]. This again has the advantage of allowing us to explain universals about paucal number. For example, there is no language that has paucal number without also having plural number—this follows from the fact that the feature [-atomic] is used in deriving both the plural and the paucal, but the paucal requires an additional ingredient, [-additive]¹⁴.

Consider, finally, the possibility that a language might make use of the three features [\pm additive], [\pm minimal] and [\pm atomic]. Such a system gives rise to the following number distinctions:

- (18) a. $[[[-\text{additive}]]([[+\text{minimal}]]([[+\text{atomic}]]([[nP]])))] =$ (singular)
 $= \lambda x. Q(x) \ \& \ Q \sqsubset [[+\text{minimal}]]([[+\text{atomic}]]([[nP]])) \ \& \ \neg \forall y \ Q(y) \rightarrow Q(x \sqcup y)$
- b. $[[[-\text{additive}]]([[+\text{minimal}]]([[-\text{atomic}]]([[nP]])))] =$ (dual)
 $= \lambda x. Q(x) \ \& \ Q \sqsubset [[+\text{minimal}]]([[-\text{atomic}]]([[nP]])) \ \& \ \neg \forall y \ Q(y) \rightarrow Q(x \sqcup y)$

¹⁴ Cuts for [\pm additive] that are relatively high will give rise to other approximative number values, such as greater plurals. The feature [\pm additive] is argued in Harbour (2014: 196-7) to be subject to further constraints, e.g., only horizontal cuts of certain kinds are allowed.

- c. $[[[-\text{additive}]]([[[-\text{minimal}]]([[[-\text{atomic}]]([[nP]]))]]))=$ (paucal)
 $= \lambda x. Q(x) \ \& \ Q \sqsubseteq [[[-\text{minimal}]]([[[-\text{atomic}]]([[nP]]))]] \ \& \ \neg \forall y \ Q(y) \rightarrow Q(x \sqcup y)$
- d. $[[[+\text{additive}]]([[[-\text{minimal}]]([[[-\text{atomic}]]([[nP]]))]]))=$ (plural)
 $= \lambda x. Q(x) \ \& \ Q \sqsubseteq [[[-\text{minimal}]]([[[-\text{atomic}]]([[nP]]))]] \ \& \ \forall y \ Q(y) \rightarrow Q(x \sqcup y)$

Indeed, Biak, as described in section 1, is such a number system (feature combinations not shown in (18) yield no number values), with the cut for $[\pm\text{additive}]$ conventionally set to low. A difference between Biak and other number systems we've seen before is that the locus of the morpho-phonological realization of number features is not on nouns but on other elements in this language, in the noun phrase or elsewhere.

Additional possible and impossible number values and number systems follow from the basics of the theory as presented here.

Importantly, we have seen that in this theory $[-\text{atomic}]$ is used not only in the derivation of plurals but also in the derivation of duals and paucals (in addition to trials, see footnote 13). Plural number here is always at least $[-\text{atomic}]$, and sometimes a combination of $[-\text{atomic}]$ with other features. This entails variation in the range of the plural—e.g., in a singular-dual-plural system, plural number arises from $[-\text{minimal}, -\text{atomic}]$ and is thus for three or more real-world entities. In a language in which plural number is just $[-\text{atomic}]$, that is, in a singular-plural system, the plural is predicted to be concerned with *two* or more real-world entities. While it is in fact empirically the case that not all plurals are created equal, the semantic range of the plural goes beyond what is predicted by Harbour, as in some languages and in some contexts, plurals can even be concerned with *one* or more real-world entities. It is to this issue that we now turn.¹⁵

3 No $[-\text{atomic}]$ for exclusive plurals

Let us consider (1) and (2) again, repeated here:

- (19) *English*
 Lina harvested tomatoes

- (20) *English*
 Lina didn't harvest tomatoes

Inclusive plurals occur not only in contexts such as (20) or (21), but also in other downward-entailing contexts, such as (22) (restriction of *no* or *few*), (23) (*if*-clause) or (24) (restriction of a universal quantifier), and in questions, as in (25). Further examples of English exclusive plurals are provided in (26):

- (21) *English*
 a. I don't have children
 b. Dogs are not barking outside

- (22) *English*
 Few/no students came to the party

¹⁵ Rothstein (2010) argues that atomicity is context dependent, as can be seen from the fact that what counts as a single fence, twig, or line may vary. Harbour does not build context-dependent atomicity in his account, but this could be done via a head embedded in nP, or via n itself, which introduces a function that is sensitive to Rothstein's *counting context*.

(23) *English*

[Directed at one person:]¹⁶

If you spot horses in this picture, you will get a prize

(24) *English*

Every house with windows overlooking the ocean is overpriced

(25) *English*

[Directed at one person:]

a. Have you ever seen horses in this meadow? (Farkas and de Swart 2010)

b. Did you eat apples today?

(26) *English*

a. I have children

b. Dogs are barking outside (Carlson 1977)

Inclusive plurals do not occur just in non-episodic, generic, or law-like sentences, such as (21)a, (24) or (25)a—they also occur in plain episodic sentences such as (20), (21)b, (22), (23), or (25)b.¹⁷

These facts have been taken to show that plural forms in English are, semantically, not exclusive but inclusive, as in Dvorak and Sauerland (2006), Krifka (1989, 1995), Ivlieva (2013), Lasersohn (1998, 2011), Sauerland (2003), Sauerland, Anderssen and Yatsushiro (2005), Spector (2007), Yatsushiro, Sauerland and Alexiadou (2017) or Zweig (2009). The basic structure of the explanation in inclusive-only accounts contains three ingredients: (a) an inclusive, number-neutral semantics for common count plural nouns and DPs (e.g., as in (27) for the noun *cats*), (b) a singular semantics for singular nouns and DPs (e.g., as in (28)), and (c) a post-compositional mechanism that derives exclusive plural meanings on the basis of (a) and (b):

(27) $[[\text{cats}]] = \lambda x. \text{cat}(x)$

¹⁶ With a singular addressee, we stay away from issues of dependent plurality (cf. Ivlieva 2013, Zweig 2009).

¹⁷ In other languages, plurals in sentences of the form of (21)a, (24) or (25)a receive *exclusive*, not inclusive, interpretations:

(i) *Turkish* (Görgülü 2012)

Çocuk-lar-ın var mı?
child-PL-GEN exist Q
'Do you have two or more children?'

(ii) *Western Armenian* (Bale *et al.* 2011, Bale and Khanjian 2014)

Bəzdig-ner unis?
child-INDEF.PL have.2SG.PRES
'Do you have two or more children?'

(iii) *Brazilian Portuguese* (Martí 2008, Müller 2002)

O João não tem filhos
DEF João NEG have.3SG.PRES child.PL
'João does not have (two or more) children'

The claims about the interpretation of plural forms in these languages are not uncontroversial though (see Renans *et al.* 2017 and Sağ 2017 for Turkish, for example).

(28) $[[\text{cat}]] = \lambda x. \text{cat}(x) \ \& \ \text{atom}(x)$

In these accounts, nothing in the structure of plural DPs, (27), is responsible for exclusive plural interpretations. The details of the post-compositional mechanism vary by account, but, at its most basic, the mechanism relies on competition between (a) and (b). Consider a negative context such as (21)a. An inclusive-only system straightforwardly assigns the proposition that the speaker doesn't have any children to (21)a—and that is indeed the interpretation of the plural form in this example. Exclusive interpretations can be explained by appealing to pragmatic competition between (a) and (b). The proposition assigned to a sentence such as (26)a, an upward-entailing context, by an inclusive-only system is the proposition that the speaker has one or more children. This proposition is less informative than/entailed by the proposition that results from the use of the singular form, namely, that the speaker has exactly¹⁸ one child. Given Gricean competition, since the speaker didn't choose the more informative proposition, the hearer concludes that the weaker proposition is false (i.e., the speaker doesn't have one child and s/he has more than one)—that's the exclusive interpretation that we find in (20).^{19, 20} The important ingredient of inclusive-only accounts for the argument that follows is that the only semantic option for plural forms is (a). Other details, such as the particular nature of (c), are independent of my argument.

In this section I consider, and argue against, two possible modifications to Harbour's system that are intended to solve the inclusive plurals problem. The two modifications involve dispensing with semantic plurality, that is, with [-atomic], to different degrees, so as to preserve the inclusive-only type of account. According to the first modification, discussed in section 3.1, languages with inclusive plurals are number systems that dispense entirely with [-atomic]. My argument against this solution is that it predicts that languages with inclusive plurals and [-atomic]-based number values such as dual or paucal are predicted not to exist, contrary to fact. According to the second modification, discussed in section 3.2, languages with inclusive plurals are number systems that dispense with [-atomic] only for inclusive plurals. My argument is that the cross-linguistic typology of number that Harbour's theory is designed to capture is no longer captured if the theory is modified in this way.

3.1 No [-atomic] at all

The first version of the inclusive-only approach to the inclusive plurals problem involves the following claim: languages with inclusive plurals do not make use of a feature [-atomic] at all for count nouns. The basic idea is that the denotations of singular and plural forms in a language like English are as follows:

(29) a. $[[\text{cat}]] = [[+\text{atomic}]]([[n\text{P}]]]) = \lambda x. x \text{ is a cat} \ \& \ \text{atom}(x)$ (singular)
 b. $[[\text{cats}]] = [[n\text{P}]] = \lambda x. x \text{ is a cat}$ (plural)

¹⁸ As per Spector (2007).

¹⁹ This impressionistic explanation of the phenomenon is not quite right. What Gricean competition delivers, as has often been pointed out (see Chierchia, Fox and Spector 2012), is the weaker proposition that the speaker doesn't believe that s/he has one child.

²⁰ Questions, as in (25), are not, strictly speaking, downward-entailing (though NPIs are licensed in questions; Ladusaw 1996, Guerzoni and Sharvit 2007) and are, implicitly or explicitly, put aside in all accounts of inclusive plurals (though see Grimm 2012).

(29)a assigns an atomic semantics to singular DPs, and (29)b assigns a number-neutral semantics to plural DPs. There is no [–atomic] feature at all in this number system. This solution involves modifying Harbour’s theory so that the features [+atomic] and [–atomic] do not necessarily go together in a given number system. More specifically, it involves the claim that the presence of [+atomic] in a number system does not entail the presence of [–atomic]. Languages not making use of [–atomic] would be those with inclusive plurals, like English. Languages making use of [–atomic] would be those that do not have them, their plurals being always exclusive instead (recall footnote 17). Krifka (1989, 1995), Ivlieva (2013), Lasersohn (1998, 2011), Sauerland (2003), Sauerland, Anderssen and Yatsushiro (2005), Spector (2007), Yatsushiro, Sauerland and Alexiadou (2017) and Zweig (2009) are implementable within Harbour’s theory in this manner.

The logic of my argument against it is as follows. If systems that dispense with [–atomic] altogether are allowed in Harbour’s theory, then a language that has inclusive plurals must be one such system. Harbour’s theory of number then predicts that such a language should not make use of [–atomic] elsewhere in the system: that is, it should not distinguish number values that make use of [–atomic], such as dual or paucal. However, this prediction is wrong, since languages with [–atomic]-based number values and inclusive plurals exist. I argue that Ljubljana Slovenian and Biak are examples of such languages.

Let’s consider Slovenian first. Dual inflection is present on verbs, adjectives, cardinal numerals, nouns and various kinds of pronouns in Ljubljana Slovenian (Derganc 2003, Herrity 2015, Marušič and Žaucer to appear, Toporišič 2000)(recall section 2). Initial examples of the dual are as follows:

(30) *Ljubljana Slovenian*

Midva	rada	planinariva.
We.NOM.MASC.DU	willing.MASC.DU	hike.1DU

‘The two of us like to hike’

(31) *Ljubljana Slovenian*

Na betonski	pingpong	mizi	sta	fanta
on concrete	ping-pong	table	AUX.DU	boy.NOM.MASC.DU
igrala	pingpong			
play.PTC.MASC.DU	ping-pong			

‘(The) two boys played ping-pong on the concrete ping-pong table’

Example (30) shows a dual form of the 1st person pronoun in subject position, with agreeing elements in the dual. (31) shows a dual noun also in subject position, with the auxiliary and the verb in agreement. As shown in (31), dual number is compatible with both definite or indefinite interpretations.²¹

²¹ More support seems needed from the context in order to fully license the indefinite interpretation in this case, e.g., an enumeration context in which the speaker is describing the people who were in the park earlier and what they were doing. Dvorak and Sauerland (2006) and Marušič and Žaucer (to appear) discuss this issue further, with Dvorak and Sauerland proposing that the dual is presuppositional—a statement that is too strong, given the availability of indefinite, non-presuppositional interpretations in this and other examples in this paper. With personal pronouns, as in (30), only definite interpretations are possible, personal pronouns themselves being definite.

Importantly, Ljubljana Slovenian has inclusive plurals. Given the amount of syncretism between dual and plural forms in the feminine and the neuter in this language (recall **Table 1**), the best nouns to use to show this are masculine nouns in either Accusative or Nominative case, since then the dual is clearly different from the plural there. With this in mind, consider (32) and (33). In (32), seeing just one horse in the meadow already wins you the prize, and question (33)A can be answered as in (33)B, which also indicates an inclusive plural interpretation (recall the parallel English examples above):

(32) *Ljubljana Slovenian*

Kdor	prvi	zagleda	konje	na tem travniku,	dobi
who	first	see	horse.ACC.MASC.PL	on this meadow	win
nagrada					
prize					
'Whoever first sees horses on this meadow wins a prize'					

(33) *Ljubljana Slovenian*

A:	Ali	ima	Peter	otroke?
	Q	have	Peter	child.ACC.MASC.PL
'Does Peter have children?'				
B:	Ja.	Ima	enega	
	Yes	has	one	
'Yes, he has one'				

In certain cases in even the masculine declension, the plural and dual forms are syncretic, so *fantom* in an example such as (34), while receiving an inclusive plural interpretation, is either the dual or the plural form:

(34) *Ljubljana Slovenian*

Do	danés	fantom	(še)	nisem	pomagal
until	today	boy.DAT.MASC.DU/PL	(yet)	NEG.AUX.1SG	help.PTC.SG
'Until today I didn't help boys'					

Making the noun unambiguously dual, however, as in (35), brings out an interpretation in which the dual is negated:

(35) *Ljubljana Slovenian*

Do	danés	fantoma	nisem	pomagal
until	today	boy.DAT.MASC.DU	NEG.AUX.1SG	help.PTC.SG
'Until today I didn't help (the) two boys'				

Since such a negated dual interpretation is absent in (34), the claim that (34) involves the use of an inclusive plural seems correct, with (negated) dual interpretations arising only when the form is unambiguously dual, as in (35). In the Nominative case, nouns in the feminine declension also show syncretism, but it is possible to disambiguate by combining them with agreeing verbs, as in (36) (recall footnote 6):²²

²² Thanks to Christina Sevdali for asking about this example.

(36) *Ljubljana Slovenian*

Rože ne cvetijo
flower.NOM.FEM.PL NEG blossom.3PL
'(The) flowers aren't blossoming'

The form *rože* may be either dual or plural, but in (36), the agreeing verb indicates that it is the plural version that is chosen. (36) receives an inclusive plural interpretation. Consider also (37) and (38):

(37) *Ljubljana Slovenian*

Nimam otrok.
NEG.have.1SG child.GEN.MASC.DU/PL
'I don't have children'

(38) *Ljubljana Slovenian*

Ne vidim konjev na travniku.
NEG see horse.GEN.MASC.DU/PL on meadow
'I didn't see horses in the meadow'

Even verbs that normally take Accusative objects must take Genitive ones in the context of negation in (Ljubljana) Slovenian, a phenomenon, well-known in the context of Slavic languages, known as Genitive of Negation. Since the dual and the plural are always syncretic in Genitive case (recall **Table 1**), it is not possible to tell which of the dual or plural form is being used in (37) and (38). As before, however, (37) and (38) are interpreted inclusively and are not ambiguous between an inclusive plural reading and a negated dual reading. For the latter, unambiguously dual forms are needed, as in (39) and (40), where the numeral *dveh* 'two' requires dual:

(39) *Ljubljana Slovenian*

Nimam dveh otrok.
NEG.have.1SG two.GEN.MASC.DU child.GEN.MASC.DU
'I don't have two children'

(40) *Ljubljana Slovenian*

Ne vidim dveh konjev na travniku.
NEG see two.GEN.MASC.DU horse.GEN.MASC.DU on meadow
'I didn't see (the) two horses in the meadow'

Inclusive plural interpretations also arise in the restriction of universal quantifiers, another downward-entailing context, as shown in (41):

(41) *Ljubljana Slovenian*

Vsaka hiša ki ima okna s pogledom
every house.NOM.FEM.SG which has window.ACC.NEUT.DU/PL with view
na morje je precejena
on sea is overpriced
'Every house which has windows with a view of the sea is overpriced'

Example (34), with the plural form in a negative environment, contrasts with an example like (42), where the plural form is in an upward-entailing environment and is interpreted exclusively (the number of students that got run over is three or more):

(42) *Ljubljana Slovenian*

En	avtomobil	je	povozil
One.NOM.MASC.SG	car.NOM.MASC.SG	AUX.SG	run.over.PTC.MASC.SG
študente			
student.ACC.MASC.PL			
'A car ran over students'			

Example (41) contrasts with (43), where the plural form *okna* 'windows' is no longer in a downward-entailing environment and is interpreted exclusively (we are now considering a house with three or more windows):²³

(43) *Ljubljana Slovenian*

Ena	hiša	ki	ima okna	s
one NOM.FEM.SG	house.NOM.FEM.SG	which has	window.ACC.NEUT.DU/PL	with
pogledom	na morje	je	precejna	
view	on sea	is	overpriced	
'One house which has windows with a view of the sea is overpriced'				

A proposal to deal with the inclusive plurals of Ljubljana Slovenian that does not use [-atomic] at all for this language predicts that its number system should not have a dual number value, since [-atomic] wouldn't be available to derive the dual. However, Ljubljana Slovenian is a singular-dual-plural system on nouns. In other words, if Harbour's theory is modified so as to allow languages with inclusive plurals to be [-atomic]-less systems, then the resulting theory predicts that languages with inclusive plurals should have no dual (or any other number value based on [-atomic]), contrary to fact.

It is possible to make the same argument with languages that have other number values based on [-atomic], such as Biak, the Indonesian language discussed in section 2, with the caveat that the locus of the expression of number features is not on nouns in this language: in addition to demonstratives and determiners, Biak uses subject agreement verbal prefixes to express number distinctions. Examples (44) and (45) illustrate agreement with singular and plural bare subjects:

(44) *Biak*

lkak	(oso)	d-arek	i
snake	one	3SG-bite	PRON.3SG
'A snake bit him'			

(45) *Biak*

lkak	s-arek	i
snake	3PL.ANIM-bite	PRON.3SG
'Snakes bit him' (at least four snakes)		

²³ In (42) and (43), some speakers report that an inclusive interpretation is possible if the example is interpreted "in a sort of generic way". This is not at all unexpected in languages with inclusive plurals; something similar happens in English. For more on this, see footnote 26.

Bare dual and paucal nouns cannot serve as subjects for independent reasons in Biak (see Dalrymple and Mofu 2013: 49-50), but non-bare ones show the corresponding verbal agreement, as shown in (46) and (47):

(46) *Biak*
 lkak *(suya) su-arek i
 snake DEF.3DU 3DU-bite PRON.3SG
 ‘The two snakes bit him’

(47) *Biak*
 lkak *(skoya) sko-arek i
 snake DEF.3PAUC 3PAUC-bite PRON.3SG
 ‘The three/several snakes bit him’

In Harbour’s terms, as we saw, Biak is [\pm additive, \pm minimal, \pm atomic], with duals and paucals, that is, with number values built with [$-$ atomic]. Yet, Biak has inclusive plurals, as argued for in Dalrymple and Mofu (2013):

(48) *Biak*
 lkak (ono) s-arek i ba
 snake INDEF 3PL.ANIM-bite PRON.3SG NEG
 ‘Snakes did not bite him/no snakes bit him’

(49) *Biak*
 lkak (ono) s-arek i ke?
 snake INDEF 3PL.ANIM-bite PRON.3SG Q
 ‘Did snakes bite him?’

Example (48), with sentential negation, is interpreted inclusively, and so is (49). A positive answer to (49) informs that one or more snakes bit him; with a negative one, that no snakes did. Again, a solution to the inclusive plurals problem that assumes just an inclusive semantics for plural DPs, coupled with Harbour’s decompositional account of duals and paucals, predicts that Biak should not have inclusive plurals, contrary to fact.

3.2 [$-$ Atomic] sometimes²⁴

A second version of the inclusive-only approach to inclusive plurals involves the following claim: languages with inclusive plurals do not use [$-$ atomic] for plural DPs, but may use [$-$ atomic] elsewhere, e.g., for dual DPs. Consider a language with a singular-dual-plural number system and inclusive plurals, such as Ljubljana Slovenian. According to this version, we would have:

(50) a. $[[\text{stol}]] = [[+\text{minimal}]]([[+\text{atomic}]]([[n\text{P}]]))$ (singular)
 = $\lambda x. x$ is a chair & $\text{atom}(x) \ \& \ \neg \exists y \text{ atom}(y) \ \& \ y \sqsubset x$
 b. $[[\text{stola}]] = [[+\text{minimal}]]([[-\text{atomic}]]([[n\text{P}]])) =$ (dual)
 = $\lambda x. x$ is a chair & $\neg \text{atom}(x) \ \& \ \neg \exists y \neg \text{atom}(y) \ \& \ y \sqsubset x$

²⁴ Thanks to an anonymous reviewer for suggesting this possibility.

c. $[[\text{stoli}]] = [[\text{nP}]] = \lambda x. x \text{ is a chair}$ (plural)

The basic idea is that duals (or paucals) are *not* built of the same building blocks as plural forms. Because the denotation of plural forms needs to be inclusive, [-minimal] is not used in (50)c, and thus perhaps not at all for Ljubljana Slovenian.²⁵

Theories such as Dvorak and Sauerland (2006), Krifka (1989, 1995), Ivlieva (2013), Lasersohn (1998, 2011), Sauerland (2003), Sauerland, Anderssen and Yatsushiro (2005), Spector (2007), Yatsushiro, Sauerland and Alexiadou (2017) or Zweig (2009) are implementable within Harbour's theory in this manner. In fact, Dvorak and Sauerland (2006), following Sauerland (2003), develop this approach for the particular case of Slovenian. Dvorak and Sauerland posit three number features for Slovenian, [SINGULAR], [DUAL], and [PLURAL]. Their semantic effect is just as in (50), with three differences: (a) the content of [SINGULAR] and [DUAL] is stipulated, not compositionally derived (so their end effect is as in (50)a and (50)b, respectively, but this is not achieved by using the features [+minimal] and [\pm atomic]), (b) the singularity and duality import of [SINGULAR] and [DUAL] is presuppositional, not in terms of entailments, and (c) the head that contains such features is generated above DP, not DP-internally, so its semantic type is different. Difference (b) determines the pragmatic principle that Dvorak and Sauerland invoke to generate exclusive plural interpretations: it is Heim's Maximize Presupposition, as in Sauerland (2003) and others, a principle which is very close to the pragmatic competition account described in section 3.1. Note that [PLURAL] in Dvorak and Sauerland denotes just an identity function, without presuppositions.

An implementation of this second version of the inclusive-only approach does not need to commit itself to a particular view on (b) (i.e., the nature of the semantic import of the features: entailments vs. presuppositions) and is also in principle independent of (c) (i.e., the semantic type assigned to the number features). My criticism of this second version begins with a specific criticism of Dvorak and Sauerland's assumption (a), and then develops into a general argument against it.

Dvorak and Sauerland predict that languages with duals and inclusive plurals can, in fact, exist. This is the case for any approach that pursues the second version: since, by definition, [-atomic] (or [-minimal]) is not used for plural forms, inclusive plural forms are entirely possible. Hence, the undergeneration problem discussed in section 3.1. does not arise in this approach. Crucially, however, assumption (a) stipulates the semantics of the dual as a primitive, and that *does* create a significant problem: if [DUAL] is a primitive feature, what prevents [TRIAL], [PAUCAL], [GREATER PLURAL], [MINIMAL], etc. from being primitives as well? Since nothing would stop us from positing these features, nothing prevents any logically possible, but unattested, number system from being generated, e.g., one with the features [SINGULAR] and [TRIAL], but no [DUAL] or [PLURAL]. This is an overgeneration problem. Clearly, this is not a desirable solution for the inclusive plurals problem as it arises in Harbour's theory.

Do matters improve if [DUAL] is not stipulated, but derived as in (50)b? (50)b uses the combination of [+minimal] and [-atomic], so, strictly speaking, the semantics of the dual is composed, not directly stated. Matters, in fact, do not improve, for the explanatory power of Harbour's theory relies on certain number values being generated

²⁵ It is likely that the complete omission of [-minimal] from such a system will create problems not too dissimilar from the undergeneration problem of the first version, discussed in section 3.1, but I leave the exploration of the consequences of positing [-minimal]-less systems for another time.

using the *same* feature. In the particular case at hand, whereas dual forms would use [-atomic], plural forms wouldn't. As Nevins (2011) has argued, the formal link between duals and plurals, pioneered by Noyer (1992) and adopted by Harbour (2011, 2014), is crucial in the account of the cross-linguistic typology of number. For example, because both duals and plurals make use of the feature [-atomic], the prediction is that no language should exist with dual but no plural—this is the correct prediction, as we know (see section 2). Related to this is that dual is lost before plural in the course of language change, never the other way around, a fact that a decompositional account of the dual is designed to explain. Consider the decompositional analysis of singular-dual-plural systems in (16), repeated in (51), where there are three possible paths of loss: either the feature [±minimal] is lost, the feature [±atomic] is lost, or both features are lost. If both features are lost at the same time, the language would become a language with no grammatical number. More interesting is the loss of the feature [±minimal], which results in the singular-plural system in (52), with (52)b and (52)c now equivalent (on the assumption that, since the dual meaning is lost with the loss of [+minimal], the form that used to spell out that meaning is lost):

- (51) a. $[[+minimal]]([[+atomic]]([[nP]])) =$ (singular)
 $= \lambda x. [[nP]](x) \ \& \ \text{atom}(x) \ \& \ \neg \exists y \ \text{atom}(y) \ \& \ y \sqsubset x$
 b. $[[+minimal]]([[-atomic]]([[nP]])) =$ (dual)
 $= \lambda x. [[nP]](x) \ \& \ \neg \text{atom}(x) \ \& \ \neg \exists y \ \neg \text{atom}(y) \ \& \ y \sqsubset x$
 c. $[[\text{-minimal}]]([[-atomic]]([[nP]])) =$ (plural)
 $= \lambda x. [[nP]](x) \ \& \ \neg \text{atom}(x) \ \& \ \exists y \ \neg \text{atom}(y) \ \& \ y \sqsubset x$
- (52) a. ~~$[[+minimal]]([[+atomic]]([[nP]])) =$~~ (singular)
 ~~$= \lambda x. [[nP]](x) \ \& \ \text{atom}(x)$~~
 b. ~~$[[+minimal]]([[-atomic]]([[nP]])) =$~~ (dual)
 ~~$= \lambda x. [[nP]](x) \ \& \ \neg \text{atom}(x) =$~~
 c. ~~$[[\text{-minimal}]]([[-atomic]]([[nP]])) =$~~ (plural)
 ~~$= \lambda x. [[nP]](x) \ \& \ \neg \text{atom}(x)$~~

The loss of [±atomic] results in a [±minimal] system, possibly also a singular-plural system, with (53)a and (53)b now equivalent:

- (53) a. $[[+minimal]](\text{~~[[+atomic]]~~}([[nP]])) =$ (singular)
 $= \lambda x. [[nP]](x) \ \& \ \neg \exists y \ [[nP]](y) \ \& \ y \sqsubset x =$
 b. $[[+minimal]](\text{~~[[\text{-atomic}]]~~}([[nP]])) =$ (dual)
 $= \lambda x. [[nP]](x) \ \& \ \neg \exists y \ [[nP]](y) \ \& \ y \sqsubset x$
 c. $[[\text{-minimal}]](\text{~~[[\text{-atomic}]]~~}([[nP]])) =$ (plural)
 $= \lambda x. [[nP]](x) \ \& \ \exists y \ [[nP]](y) \ \& \ y \sqsubset x$

In other words, in Harbour's system, it is not possible to lose [-atomic] in the plural without also losing it in the dual, and losing [-atomic] in the dual entails losing the dual (likewise, it is not possible to lose [+minimal] in the singular without also losing it in the dual, and losing [+minimal] in the dual entails losing the dual). That dual is acquired by children after plural also follows from the decompositional account of the dual, as Nevins (2011) explains in more detail. According to the second version of the inclusive-only approach, however, losing (50)c does not entail losing (50)b, since they have no features in common. This means that according to this version, languages with dual but

no plural are possible—an overgeneration problem again. The approach also predicts that the plural can be lost before the dual in the course of language change, and that the dual can be acquired before the plural. Problems of this very nature will arise in any system with inclusive plurals and any other number values based on [-atomic], such as paucals, exemplified above for Biak and Bayso.

4 [-Atomic] or exhaustive exclusive plurals

4.1 Ambiguity accounts

The basic structure of an ambiguity account of inclusive plurals contains three ingredients: (a) an inclusive, number-neutral semantics for common count plural forms, (b) an additional, exclusive, strictly plural semantics for the same forms, and (c) a post-compositional mechanism that chooses between (a) and (b). In Farkas and de Swart (2010), (c) is the Strongest Meaning Hypothesis (from Dalrymple *et al.* 1998):

(54) The Strongest Meaning Hypothesis: when an expression is assigned a set of interpretations ordered by entailment, choose the strongest element of this set that is compatible with the context

(a) and (b) in this account give rise to interpretations that are in an asymmetric entailment relation. For example, with a sentence such as (19), repeated here as (55), if it is true that Lina harvested two or more tomatoes (exclusive interpretation), then it is necessarily true that Lina harvested one or more tomatoes (inclusive interpretation):

(55) *English*
Lina harvested tomatoes

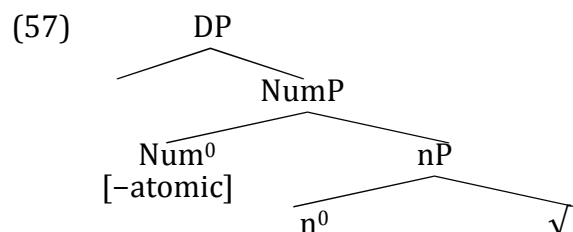
If Lina harvested one or more tomatoes (inclusive interpretation), however, it doesn't necessarily follow that Lina harvested two or more tomatoes (exclusive interpretation)—she could have harvested an atomic individual tomato. In these circumstances, and everything else being equal, the Strongest Meaning Hypothesis applies and chooses the strongest, exclusive interpretation. In downward-entailing environments, such the negative sentence in (20), repeated as (56), antecedents of conditionals, or restrictions of universal quantifiers, entailment relations are reversed:

(56) *English*
Lina didn't harvest tomatoes

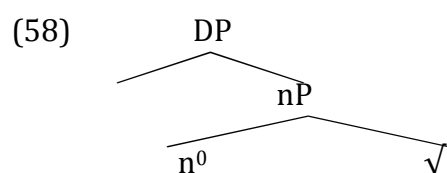
In (56), the proposition that Lina harvested neither one nor more tomatoes (inclusive interpretation) asymmetrically entails and is thus stronger than the proposition that Lina didn't harvest two or more tomatoes (exclusive interpretation). Thus, the result is that, everything else being equal, inclusive plurals occur in downward-entailing environments (and in questions; recall footnote 19), and exclusive plurals occur in upward-entailing environments, as desired. From the perspective of the argumentation in this paper, the important difference between the inclusive-only accounts of section 3 and the ambiguity account just presented is that, semantically, the ambiguity account postulates not one but two lexical entries for plural count nouns. The mechanisms assumed in the former to derive exclusive interpretations and in the latter to choose

between competing interpretations are not the same, but the differences here are independent of my argument.²⁶

In the featural account of Harbour (2014), the implementation of the ambiguity account is not concerned with lexical entries but with the denotation, and presence, I suggest, of NumP. From this perspective, the idea is that plural count noun forms have two options with respect to NumP. The first option, for exclusive interpretations, involves for, e.g., English, the feature [-atomic] in Num⁰ (recall (13)):



The second option, for inclusive interpretations, involves, for the same language, DPs with no NumP:



Without NumP, the interpretation of the plural form contains both atoms and non-atoms and is, thus, inclusive. The Strongest Meaning Hypothesis, or whatever else one

²⁶ As shown by Farkas and de Swart, the Strongest Meaning Hypothesis predicts that there are contexts in which the entailing proposition might not be chosen—as long as the entailed proposition is the strongest in that particular context. This is confirmed in examples such as (i), where *children* is in upward-entailing environment but interpreted inclusively, or the Ljubljana Slovenian example in (ii):

- (i) *English*
 [Speaker walks into unknown house, notices toys littering the floor, has no way of telling how many children there are in the house]:
 There are children in this house

- (ii) *Ljubljana Slovenian*
 [Speaker walks into unknown house, notices toys littering the floor, has no way of telling how many children there are in the house]:
 Poglej vse te igrače – v hiši so otroci.
 look all DEM.PL toy.PL in house.DAT.FEM.SG AUX.PL child.NOM.MASC.PL
 ‘Look at all these toys—there are children in the house’

The strongest meaning compatible with the knowledge state of the speaker is the inclusive meaning. Without information about the knowledge of the speaker, it is likely that speakers will make default assumptions, such as, for example, that the speaker is knowledgeable. Cases of downward-entailing environments with exclusive interpretations also exist (Chierchia, Fox and Spector 2012: 2318):

- (iii) John may have read *one* book, but I don’t think he has read books

Other accounts discussed here can also handle these examples. Biak examples such as (45) should be able to receive an inclusive interpretation in the right context, e.g., if the number of snakes that bit the relevant person is irrelevant, a prediction which remains to be verified.

postulates for (c), will do the rest. In this account, plural forms in a language with inclusive plurals happen to spell out two different structures, (57) or (58).

The proposal just sketched does not run into the problems pointed out earlier for inclusive-only approaches. Languages with [-atomic]-based number values, such as dual (Ljubljana Slovenian) or paucal (Biak), and inclusive plurals are indeed predicted to be possible languages. Their account is just as in Harbour (see section 2), with three crucial additions: plural forms in these languages can also spell out (58), languages have mechanisms that allow them to choose between (57) and (58) (e.g., the Strongest Meaning Hypothesis), and languages without inclusive plurals do not make use of (58). There are also no overgeneration problems of the kind discussed in section 3.2. Because plural forms and dual and paucal forms share the feature [-atomic], as in Harbour, the paths of acquisition and loss that Harbour explains can still be explained now. For example, languages with duals but no plurals are still predicted not to be possible, since they both use [-atomic].²⁷

There are at least two important questions to answer at this point. The first is whether it is sensible to postulate (58) in Harbour's system. The second question is whether other ambiguity-based approaches would also work. The remainder of this section answers these questions.

(58) is in fact one possibility considered in Harbour (2014) for languages that make no grammatical number distinctions at all, such as Pirahã or Dëne Sų́iné.²⁸ The more interesting question is whether there is independent evidence that (58) is a possibility even in languages that do make grammatical distinctions. I argue that (58) is in fact a very plausible analysis for general number, a number value attested in languages such as the Fouta Jalon dialect of Fula (a Niger-Congo language spoken in Guinea), as well as Bayso, discussed above, which can co-exist with other grammatical number distinctions (Corbett 2000, 2012).

Both Bayso and Fouta Jalon Fula make a singular-plural distinction, with Bayso having, in addition, a paucal number value, as we saw in section 2. In both languages, singular and plural (and paucal) are expressed via dedicated suffixes. They also have general number, expressed via bare stems. General number has the semantic import of number neutrality, as evidenced for Bayso in (59)a (Corbett 2000, 2012, Corbett and Hayward 1987, Hayward 1979) (recall (3))(for Fouta Jalon Fula, see Corbett 2000:12 and Koval' 1979):²⁹

	GENERAL	SINGULAR	PLURAL
<i>toad</i>	toti	totii-ru	totii-ji
<i>cat</i>	nyaari	nyaarii-ru	nyaarii-ji
<i>hen</i>	gerto	gerto-gal	gerto-đe
<i>egg</i>	boofu	woofu-nde	boofu-đe
<i>bottle</i>	biini	biinii-ri	biinii-ji

Table 4 Nouns in the Fouta Jalon dialect of Fula

²⁷ Harbour (2016: 149-152) briefly entertains a solution to the inclusive plurals problem that makes use of a function which, operating on the set of non-atoms provided by NumP, accesses the atoms that constitute them. This is another possible version of the ambiguity account. This version does not allow inclusive plurals to be subsumed under general number, since there would be no justification for using this procedure in the case of languages without grammatical number, such as Pirahã or Dëne Sų́iné.

²⁸ One can alternatively assume for these languages that NumP is generated as part of DPs, but these languages have no number features to generate in Num. It doesn't seem like this choice has consequences for the argumentation in this paper, and I leave it unexplored here.

²⁹ I haven't been able to find Koval' (1979).

(59) *Bayso*

- a. *Lúban* *hudure*
lion.GENERAL sleep.MASC.SG.PAST
'Lions/A lion slept'
- b. *Lubán-titi* *hudure*
lion-SG sleep.MASC.SG.PAST
'A single/particular lion slept'
- c. *Luban-jaa* *hudureene*
lion-PAUC sleep.PL.PAST
'A few lions slept'
- d. *Luban-jool* *hudure*
lion-PL sleep.MASC.SG.PAST
'Lions slept'

In Bayso, as Corbett (2012) shows, nouns in their general number form trigger patterns of verbal agreement that distinguish them from paucal and plural nouns. All paucal-marked nouns agree with the verb in the plural. Nouns that belong to the class of *lúban* 'lion' agree in masculine singular³⁰ when in the singular, general number and plural forms, as can be seen from (59)a, (59)b and (59)d. General number and singular are then distinguished by the morphology on the noun and their respective semantics, as can be seen in the contrast between (59)a and (59)b. Nouns that belong to a separate class that includes *kimbír* 'bird' agree with the verb in the feminine singular when in the singular and the general number form and in masculine singular when in the plural form. A third class that includes *baal* 'feather/leaf' agrees in masculine singular when in the singular and the general form, but in plural when in the plural form, and so on. Thus, a number category beyond singular-paucal-plural is necessary in Bayso.

Even though general number in Bayso or Fouta Jalon Fula is not discussed explicitly by Harbour, the analysis for them in his system is clear: both languages allow NumP to be absent, though they don't force it to be so. When NumP is not generated as part of the structure of DP, nouns are interpreted as number-neutral or inclusive. Morphologically, the absence of NumP in these languages is realized as absence of number morphology. Semantically, general number forms are number-neutral, in the sense that the set denoted by nP, not further operated on by Num⁰, contains both atomic and non-atomic individuals (recall (7) and (8)). Thus, a language like Bayso can naturally be thought of in Harbour's system as a [\pm additive, \pm atomic] system with optional NumP. If this correct, then more languages than appear at first sight make use of the treatment of NumP that we find in Bayso or Fouta Jalon Fula, with one difference: languages may make use of an already existing form to spell out (58). In particular, languages may use their plural forms to do so. English, Ljubljana Slovenian and Biak would be examples of such languages.^{31, 32}

³⁰ The basic agreement patterns in Bayso are determined on the basis of 3rd person pronoun subject agreement. There is a three-way distinction here, with *úsu* the masculine singular form (with corresponding verbal agreement as in, e.g., *hudure* 'sleep.PAST.MASC.SG'; cf. (59)), *ése* the feminine singular form (verbal agreement as in *hudurte* 'sleep.PAST.FEM.SG'), and *íso* the plural form (verbal agreement as in *hudureene* 'sleep.PAST.PL') (Corbett 2012: 226, Corbett and Hayward 1987: 12).

³¹ The question arises, as Gabi Danon points out (p.c.), as to how subject-verb agreement works with general number if English has general number. One answer is that plural agreement is the elsewhere case: singular subjects agree in singular, and every other subject (plural, general number), in plural.

³² Another question is whether forms other than plural forms may also spell out (58)/be inclusive. Pereltsvaig (2014) and Martí (2017) argue that inclusive plurals and inclusive singulars are two sides of

Notice that combining this proposal for general number with the Strongest Meaning Hypothesis does not produce ill results for languages like Bayso.³³ In particular, because the Strongest Meaning Hypothesis is formulated with respect to expressions (“when an *expression* is assigned a set of interpretations ordered by entailment...”, my emphasis), this principle has nothing to say about the choice of general number forms vs. other forms when these forms are different. In other words, general number forms such as *lúban* are never in competition with singular (*lubántiti*), paucal (*lubanjaa*) or plural forms (*lubanjool*) according to the Strongest Meaning Hypothesis. This is as it should be, at least from what we know about Bayso, since in upward-entailing contexts such as (59)a, general number forms give rise to inclusive, not exclusive, meanings.^{34, 35, 36, 37}

Other versions of the ambiguity approach that avoid the problems of inclusive-only approaches are possible, but they are not without other problems.

Grimm (2012) defends an alternative ambiguity-based approach to the problem of inclusive plurals. He proposes that plural forms in English are lexically ambiguous between an exclusive and an inclusive interpretation. The inclusive interpretation, however, is not simply stipulated—it is derived from kind interpretations. Starting with the kind DOG, for example, the set of instantiations of the kind is derived as the

the same phenomenon. The proposal defended here predicts that there should be languages which choose a form different from the plural to spell out NumP-less DPs. Sağ (2016, 2017) and Martí (2017) argue that, despite appearances, Turkish bare singulars are not a case in point (cf. Corbett 2000). Brazilian Portuguese might be such a language, at least if Ferreira (2010) is right, but this possibility needs to be further evaluated within the context of the rich literature that exists on the topic of Brazilian Portuguese bare noun semantics, to which I cannot do justice here (see, among others, Cyrino and Espinal 2015, Müller 2002, Pires de Oliveira and Rothstein 2011, Schmidt and Munn 2005). Whether yet other forms, such as duals or paucals, may also be inclusive remains to be explored.

³³ Thanks to an anonymous reviewer for raising this issue.

³⁴ The proposal predicts that plural DPs in Bayso are not ambiguous, and hence never give rise to inclusive plural interpretations. This prediction remains to be verified.

³⁵ The proposal is compatible with there being other reasons that force a choice between the inclusive and the exclusive interpretation, e.g., if there are grammatical principles that are sensitive to the presence of atoms. Pereltsvaig (2014) argues that Russian inclusive plurals (general number plurals in the analysis in the text) are syntactically selected in a number of grammatical constructions.

³⁶ On the other hand, this could prove problematic for the pragmatic mechanisms that are postulated as part of inclusive-only approaches (see section 3), since at least some of them allow competition of meanings that arise from different expressions (such as singular vs. semantically inclusive plural). I leave the development of this argument for future research.

³⁷ Corbett (2000: 12) observes that in languages that have general number forms, these are used “when number is irrelevant”. That contexts of number irrelevance favor the use of general number forms suggests that, besides speaker ignorance (cf. footnote 26), number irrelevance should also play a role in the account of inclusive plurals if indeed these are general number forms. This seems to be the case:

(i) *English*

[The speaker works for the town hall and is going around the neighbourhood distributing leaflets about childcare options. She is fully informed of the number of children residing in 82a and 82c Bethune Road; in fact, she is looking at the list with information extracted from the census and knows that one child resides in 82a, and three children reside in 82c]:

There are children in 82a. There are children in 82c. But there are no children in 82b

The plural form *children* is interpreted inclusively in the first sentence of (i), or else the fact that only one child resides in 82a should make the first sentence false. The speaker is fully informed of the exact number of children residing in each house, but what is important in the context is not the exact number of children, but whether there are any children at all residing at a particular address. As long as the number of children residing at an address is at least one, childcare leaflets are called for at that address.

denotation of the plural form *dogs* (cf. Carlson 1977, Krifka 1995, Chierchia 1998b). This leads to a number-neutral, inclusive interpretation, since both atomic and non-atomic dog individuals count as instantiations of the kind *DOG*. The distribution of exclusive and inclusive interpretations is, he argues, sensitive to the episodic-generic distinction: inclusive, kind-based interpretations occur in kind/generic environments, and exclusive interpretations occur in episodic environments.

Because this approach does postulate the existence of (what in Harbour’s system would be) [-atomic] exclusive plurals, it does not suffer from the under- or overgeneration problems of inclusive-only approaches and is thus consistent with the thesis defended in this paper. One important problem from our perspective, however, is that kind interpretations cannot be the (only) source of inclusive plurals. In English, bare plurals like *parts of this machine* or *pieces of that puzzle* never denote kinds, and as such cannot be the subject of a kind predicate, as shown in (60) (Carlson 1977), yet inclusive interpretations are possible for them (Chierchia 1998b: 373, van Geenhoven 2000: 234), as shown in (61):

(60) *English*
 ?? Parts of this machine are widespread

(61) *English*
 John didn’t see parts of this machine

Whether (61) allows wide scope (“there are parts of this machine such that John didn’t see them”) in addition to narrow scope (“it is not the case that John saw any parts of this machine”) is debatable (see van Geenhoven 2000), but it is clear that (61) has a narrow scope interpretation, and that that interpretation is an inclusive interpretation. Furthermore, a kind analysis is not an option for languages where nouns cannot denote kinds by themselves, such as Spanish, Italian, Hungarian, or Arabic, even though these languages allow bare nouns in argument position (to different degrees) (see Doron 2003, Dobrovie-Sorin, Blean and Espinal 2006 and references cited there). Yet, these languages may have inclusive plurals. Consider, for example, Spanish (Laca 1996: 262, McNally 2004: 118):

(62) *Spanish*

a. En	la	India	se	están	extinguendo los	
in	the.FEM.SG	India	SE	be.3PL.PRES	extinguishing the.MASC.PL	
	tigres					
	tiger.PL					
	‘Tigers are becoming extinct in India’					
b. *En	la	India	se	están	extinguendo	tigres
in	the.FEM.SG	India	SE	be.3PL.PRES	extinguishing	tiger.PL

The subject of the predicate *extinguirse* ‘to become extinct’ is kind-denoting, and (62)b is ungrammatical (note that bare plural subjects are normally allowed in postverbal position in Spanish, as in (63) and (64) below). (62)a, where the plural form is accompanied by the definite article, is, on the other hand, grammatical. Thus, plural forms in Spanish by themselves cannot produce a kind denotation. Yet, Spanish has bare inclusive plurals, as in (63) (cf. (64))(Laca 1996: 262, Martí 2008, McNally 2004: 118):

(63) *Spanish*

A la reunión no asistieron profesores
to the meeting NEG attend.3PL.PAST professor.PL
'The meeting was not attended by any professors'

(64) *Spanish*

A la reunión asistieron profesores
to the meeting attend.3PL.PAST professor.PL
'The meeting was attended by professors'

A further alternative ambiguity-based approach claims that the source of inclusive plural interpretations is not kinds but noun incorporation (see Baker 1988 and Mithun 1984, 1986, among others, for early analyses of incorporation). This version of the ambiguity account would maintain (what in Harbour are) [-atomic] exclusive plurals, like Grimm (2012), but would claim that the source of the number-neutral, inclusive interpretation of inclusive plurals is incorporation. Incorporated nominals tend to be interpreted number neutrally (Carlson 2006 and Dayal 2015). van Geenhoven (1998) hypothesized that, parallel to morpho-syntactic incorporation, there is a corresponding rule of interpretation where a verb may introduce existential quantification over its (property-denoting) object. Since van Geenhoven assumes that nouns contain both atoms and non-atoms in their denotation, number neutrality results. Indeed, van Geenhoven (2000) and McNally (2004) extend the use of semantic incorporation to bare plurals in English and Spanish, respectively, explicitly hypothesizing that application of the rule of semantic incorporation need not be accompanied by the morpho-syntactic rule. A semantic incorporation analysis of inclusive plurals would say that plural forms undergo semantic incorporation in downward-entailing contexts (and questions); singular forms would not be subject to this rule at all (given, e.g., **I have child*). Because this ambiguity-based account would keep [-atomic] exclusive plurals, no under- or over-generation problems arise, as before. The main problem with this proposal is different, and it is that it does not constitute a real solution to the problem of inclusive plurals. This is because the rule of semantic incorporation does not *per se* introduce number neutrality—its semantic import follows from assumptions about the semantics of the *nouns* that undergo the rule. In fact, in languages where plural forms undergo morpho-syntactic (pseudo-)incorporation, such as Hungarian (Farkas and de Swart 2003), these forms are interpreted exclusively, not inclusively.^{38, 39, 40}

³⁸ Dayal (2011, 2015) argues that Hindi plural forms that pseudo-incorporate do give rise to number-neutral interpretations, but only in atelic or habitual contexts, but not in telic ones. She defends an analysis where atelicity—and not nominal number—enables number neutrality. Atelicity is not a factor in the examples we have considered here, as can be seen, e.g., in the telic examples in (20), (22) or (25) for English, or (34) and (38) for Ljubljana Slovenian, all of which are examples of inclusive plurals.

³⁹ English and Spanish have been argued to have syntactically restricted versions of incorporation (for weak definites in Carlson and Sussman 2005, Carlson 2006 or Aguilar-Guevara and Zwarts 2011; for implicit indefinite objects in Martí 2015; for certain Spanish, and Catalan, bare singulars by Espinal 2010)—but this doesn't explain the data we are after.

⁴⁰ It will not do to postulate that English is a [+atomic]-only language, while Slovenian uses [\pm atomic] (in addition to [\pm minimal]). That is, it will not do to combine an inclusive-only account for some languages with an ambiguity account for others. That's because, if [+atomic]-only systems are allowed, then the prediction is that there should exist number systems with only one number value, namely, singular, contrary to fact. Thanks to an anonymous reviewer for raising this issue.

4.2 Replacing [-atomic] with an exhaustivity operator⁴¹

The basic structure of this type of account has the following ingredients: (a) an inclusive semantics for plural forms, (b) a predicate-level, individual-sensitive, DP-internal exhaustification operator, and (c) a constraint (or constraints) to regulate the distribution of (b) so that exclusive and inclusive plural interpretations are generated in the correct contexts. Because this type of approach essentially replaces [-atomic] with (a), the exhaustivity operator, it is in principle implementable within Harbour's system and not liable to the same criticism that inclusive-only approaches suffer from. The exhaustification operator is a syntactic object, just like [-atomic]. Mayr (2015) develops precisely this type of account. He makes crucial use of a predicate-level exhaustification operator for exclusive plural interpretation generation.

Mayr's proposal is compatible with a [+atomic] feature for morphologically singular DPs. In order to make comparison easy with earlier claims above, we can assume that, similarly to inclusive-only accounts, we have the following:⁴²

- (65) a. $[[\text{cat}]] = [[+\text{atomic}]]([[n\text{P}]])) = \lambda x. x \text{ is a cat \& atom}(x)$ (singular)
 b. $[[\text{cats}]] = [[n\text{P}]] = \lambda x. x \text{ is a cat}$ (plural)

Exclusivity is the result of the predicative exhaustivity operator in (67), which makes use of alternatives, together with the Strength Requirement on Plural Marking in (68). Mayr also assumes a propositional exhaustivity operator, in (66) (following Fox 2007, Ivlieva 2013, Spector 2007, Zweig 2009, among many others):

$$(66) [[\text{Exh1}]]^w = \lambda p_{st}. p(w) = 1 \ \& \ \forall q \in \text{Alt} [p \not\subseteq q \rightarrow q(w) = 0]$$

$$(67) [[\text{Exh2}]] = \lambda f_{et}. \lambda x. f(x) = 1 \ \& \ \forall g \in \text{Alt} [f \not\subseteq g \rightarrow g(x) = 0]$$

(68) Strength Requirement on Plural Marking

Given a sentence ϕ with a plural form π in it, $[[\phi]]^w \neq [[\psi]]^w$, where ψ is just like ϕ except that π is replaced with its singular form unless $[[\phi]]^w$ is the strongest possible interpretation

Exh1 asserts a proposition and negates all non-weaker alternatives to it. Exh2 applied to a predicate returns true for individuals which make the predicate true and all non-weaker alternatives to it false. Plural forms ((65)b) are stipulated to require embedding under one exhaustivity operator. Singular and plural are alternatives to each other from the perspective of these operators. They are also in competition in (68). Consider now the familiar English sentences in (69) and (70):

(69) *English*

Lina harvested tomatoes

(70) *English*

Lina didn't harvest tomatoes

⁴¹ Many thanks to Jacopo Romoli for suggesting this option and for discussing it with me.

⁴² Mayr assumes that plural morphology delivers the inclusive interpretation in (65)b, since he assumes it corresponds to Link's (1983) *-operator. In Harbour's framework, such interpretations are always available as the denotation of nP, without the need for the *-operator.

For (69), the following two LFs obtain, depending on which exhaustivity operator is used (Mayr assumes a silent existential generalized quantifier, ‘indef’, and D is a distributivity operator, familiar from the literature on distributivity):

(71) [indef [Exh2 tomatoes]] [D [3 [Lina harvested t_3]]]

(72) [Exh1 [indef tomatoes [D [3 [Lina harvested t_3]]]]]

Applying Exh2 to the nP *tomatoes* (cf. (65)b) in (71) yields the set of non-atomic tomato individuals (because these individuals are tomato individuals and they are not atomic, as Exh2 and competition with the alternative singular, atomic-only, form *tomato* request), and is thus equivalent to the effect that [-atomic] would have here. Indef then existentially quantifies over one of these non-atomic individuals, yielding, as desired, an exclusive plural reading for (69). That is, (71) predicts that (69) is incompatible with Lina having harvested just one tomato. (72) delivers a weaker, inclusive interpretation, blocked by the Strength Requirement in (68). In a downward-entailing environment such as (70), however, Exh1 will deliver the stronger interpretation, so that (74) is chosen over (73):

(73) [not [indef [Exh2 tomatoes]] [D [3 [Lina harvested t_3]]]

(74) [Exh1 [not [indef tomatoes [D [3 [Lina harvested t_3]]]]]

(74) yields an inclusive plural interpretation, that Lina didn’t harvest an atomic or a non-atomic tomato (the proposition that Lina didn’t harvest one atomic tomato is weaker than the proposition that Lina didn’t harvest an atomic or a non-atomic tomato, so it does not get negated by Exh1).

Given that Exh2 does the work of [-atomic] in the account of (69) and (70), Exh2 would need to also do the work of [-atomic] in other places where Harbour uses it, e.g., in the generation of duals and paucals. Otherwise, Mayr’s account would run into the overgeneration problem of some inclusive-only accounts. For the purposes of the Strength Requirement on Plural Marking, let us assume that dual or paucal are not competitors for the plural, just the singular is⁴³. For a language which, like Ljubljana Slovenian, has plurals and duals, this proposal would yield the LFs in (76) and (77) for the sentence in (34), repeated as (75), with a plural form:

(75) *Ljubljana Slovenian*

Do	danés fantóm	(še)	nisem	pomagál
until	today boy.DAT.MASC.DU/PL	(yet)	NEG.AUX.1SG	help.PTC.SG
	‘Until today I didn’t help boys’			

(76) [not [indef [[-minimal [Exh2 boys]]] [D [3 [I helped t_3]]]]]

(77) [Exh1 [not [indef boys [D [3 [I helped t_3]]]]]

(77) is the chosen representation, as desired. (76) yields the interpretation that there isn’t a plurality of three or more boys that I helped ([-minimal [Exh2 boys]] denotes a set of plural individuals each of which consists of three or more atoms). This is weaker than the interpretation that (77) yields, that I didn’t help an atomic or a non-atomic boy

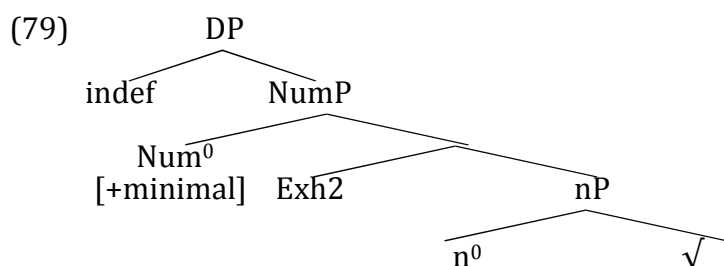
⁴³ This is to avoid infinite regress: if plural and dual/paucal both make use of Exh2, and are competitors of each other for the purposes of resolving their Exh2, then their Exh2 never gets resolved.

(cf. (74)), so (68) blocks the former. In upward-entailing contexts, the LF with Exh2 delivers the exclusive plural interpretation (i.e., the more than two boys interpretation)(cf. (71)):

(78) [indef [[-minimal [Exh2 boys]]] [D [3 [I helped t₃]]]]

The account of exclusive and inclusive plural interpretations is then very similar to the one for English above.

In this system, we can also think of the dual as compositionally built number value, as in Harbour. The building blocks would be [+minimal] plus an additional ingredient that plays a role with plurals, namely, Exh2. The proposal for the structure of a DP with a dual-marked noun can then be as follows:



(79) gives rise to the meaning we are after for the dual: [+minimal] selects the minimal individuals, the twosomes, from an exhausted set, that is, a set that does not contain atoms. I assume that both [+minimal] and Exh2 are involved in the morphological spell out of the dual, so that dual forms require the presence of both⁴⁴. This makes the right predictions for sentences in which the dual is negated, as in (35), repeated as (80):

(80) *Ljubljana Slovenian*

Do	danés	fantoma	nisem	pomagal
until	today	boy.DAT.MASC.DU	NEG.AUX.1SG	help.PTC.SG

'Until today I didn't help (the) two boys'

(81) [not [indef [[+minimal [Exh2 fantoma]]] [D [3 [I helped t₃]]]]]

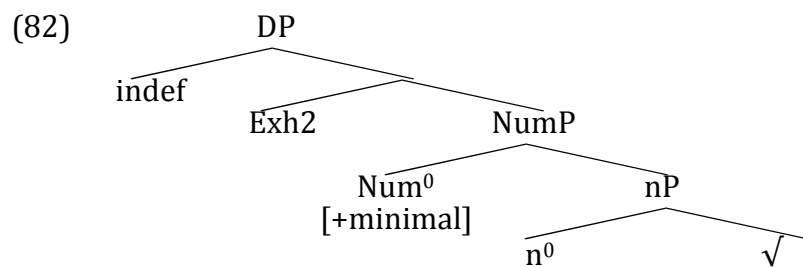
(81) yields the interpretation that there isn't a duality of boys that I helped (I could have helped, one, or more than two), as desired.

The question arises as to whether it is sensible, from Harbour's perspective, to postulate that [-atomic] may be replaced by Exh2 in at least some languages. Presumably, singular-plural languages without inclusive plurals would still make use of [±atomic], so the Mayr-based account of the inclusive plurals problem would need to state that either [±atomic] or [+atomic]/Exh2 systems (and those built of these) are possible (the latter, with associated assumptions as above). While this state of affairs is indeed a possibility, it nevertheless constitutes a departure from the reasonable hypothesis that the features that are paired are those whose meanings are counterparts of each other (the way Harbour's +/- valued features are).

In addition to this, the attachment possibilities of Exh2, given that a number of attachment sites are now available for it in the structure of DP, remain an important

⁴⁴ This assumption, while not attractive, corresponds to the assumption that only plural forms (not duals, paucals, etc.) can be inclusive in the ambiguity account (which is correct, as far as I know).

issue as well. (82), for example, yields the wrong result for the dual, since it predicts that a DP with a dual-marked noun could be interpreted as singular, contrary to fact:



In number systems with, in addition, the feature $[\pm\text{additive}]$, or which allow repetition of features, additional possible attachment sites are available, but possibly not all of them yield correct results. Finally, if Exh2 is used elsewhere in the theory to generate scalar implicatures (which is the purpose of postulating exhaustivity operators in the first place), the cross-linguistic typology of number and inclusive plurals would be intimately tied to, superficially at least, quite disparate phenomena, with potentially far-reaching consequences for language acquisition and change. This is, in principle an attractive possibility, but a possibility that needs to be properly established.

Be this as it may, incorporating Mayr's Exh2 into Harbour's theory to do the work of $[-\text{atomic}]$ avoids, like ambiguity approaches, the under- and overgeneration problems pointed out earlier for inclusive-only accounts. That's because it is still the case that one of the ingredients of the dual (or the paucal), Exh2, is involved in the account of plural forms. The ambiguity of plural forms of ambiguity accounts translates in this account into the possibility to combining them either with Exh1 (for inclusive interpretations) or with Exh2 (for exclusive interpretations). Without Exh2 (see, e.g., Spector 2007), it is no longer possible to compositionally build duals or paucals (since predicate-level features such as $[\pm\text{minimal}]$ cannot operate on what results from applying Exh1, and it is difficult to see how a system with propositional-level number features would work), and thus the overgeneration problem of section 3.2 resurfaces.

5 Conclusion

In this paper I have defended the thesis that an account of both inclusive plurals and the cross-linguistic typology of grammatical number requires the postulation of a [-atomic] feature (or something very much like it, such as Mayr's Exh2) in the structure of exclusive plural DPs. The argument was divided into two main parts. First, I showed that accounts of inclusive plurals that derive exclusive plurals without [-atomic] suffer from important under- and overgeneration problems. I argued against two versions of the [-atomic]-less exclusive plurals view. If languages with inclusive plurals never make use of [-atomic], we wrongly predict that languages with [-atomic]-based number values such as dual or paucal should not have inclusive plurals, a problem of undergeneration. If languages with inclusive plurals use [-atomic] for some number values, just not the plural, these accounts over-generate with respect to the cross-linguistic typology of number, as languages with duals or paucals and no plurals are predicted to exist, contrary to fact. Then, I showed that accounts of inclusive plurals that postulate a [-atomic] feature or Mayr's predicate-level Exh2 in the structure of exclusive plural DPs do not suffer from these problems.

I have focused exclusively on the semantics of bare plurals in simple contexts. However, it is well-known that the proper explanation of the behavior of plural-marked DPs more generally is by no means trivial (see, e.g., Mayr 2015 for an attempt to explain the behavior of definite plural DPs, and Ivlieva 2013 and Zweig 2009 for attempts to explain dependent plurality). The most natural next step for the line of inquiry investigated above consists, in my view, in exploring how (well) it can be integrated in the account of more complex phenomena involving plural DPs.

The argument proposed here suggests that the accounts of seemingly fully independent phenomena, such as the typology of grammatical number and the distribution of exclusive and inclusive plural DPs, are actually intimately related.

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