

Numerals and the theory of number¹

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Abstract. I begin by discussing empirical and theoretical shortcomings of Bale, Gagnon and Khanjian's (2011a) account of grammatical number in the numeral+noun construction in Turkish, Western Armenian and English. I then show that Scontras' (2014) account of the data, while a substantial improvement, can be improved further by deriving his *ad hoc* semantics for the Turkish and Western Armenian singular feature from Harbour's (2011, 2014) feature [+minimal]. Following Martí (2017a, b), this requires rethinking the role of Sauerland's (2003) plural feature in Scontras' account. I propose a Scontras-based system that accounts for the data with a uniform semantics for numerals, an empirically justified semantics for Turkish and Western Armenian nouns, and an adequate understanding of exclusive and inclusive plurality within Harbour's theory. The number marking on nouns in this construction is viewed as a result of the principled interplay of the spell out of number features, their place, and that of numerals, in the syntactic structure of noun phrases, and their compositional semantics. The account uncovers a new domain where the effects of [±minimal] can be detected (cf. Harbour 2011), and demonstrates that a Sauerland-style view of plurality is not necessary in the account of the data.

1 Introduction

This paper is concerned with the morphology and compositional semantics of the numeral²+noun construction in plural-marking languages. At least three types of languages must be recognized, depending on the number marking that appears on the noun accompanying the numeral. In the first type of language, exemplified by English, Spanish or German, the numeral *one* obligatorily combines with morphologically singular nouns, and any numeral greater than 1, with morphologically plural nouns:³

- (1) One **boy**/***boys**
- (2) Two/three...etc. **boys**/***boy**

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² By 'numeral', in this paper I mean 'cardinal numeral'.

³ Actually, a more accurate description, as discussed for example in Krifka (1989) and Borer (2005), is that numerals other than morphologically singular *one* in English combine with morphologically plural nouns: **zero boy* vs. *zero boys*, *1.0 boys* vs. **1.0 boy*. I put aside decimal numbers and fractions in what follows. For more on *zero*, see Martí (2017c).

In the second type, exemplified by Turkish (Bale, Gagnon and Khanjian 2011a), Finnish (Nelson and Toivonen 2000), or Hungarian (Farkas and de Swart 2010), all numerals combine with morphologically singular nouns, even numerals greater than 1:^{4,5}

(3) *Turkish*
 Bir **çocuk**/***çocuk-lar**
 one boy.SG/boy-PL
 ‘One boy’

(4) *Turkish*
 İki **çocuk**/***çocuk-lar**
 two boy.SG/*boy-PL
 ‘Two boys’

In the third type, exemplified by Western Armenian (Bale, Gagnon and Khanjian 2011a, Donabédian 1993, Sigler 1997) or Miya (for its inanimate nouns, as discussed in Schuh 1989, 1998), plural marking on the noun is optional for numerals greater than 1:⁶

(5) *Western Armenian*
 Meg **dəgha**/***dəgha-ner**
 one boy.SG/boy-PL
 ‘One boy’

(6) *Western Armenian*
 Yergu **dəgha**/**dəgha-ner**
 two boy.SG/boy-PL
 ‘Two boys’

These patterns are summarized in Table 1:⁷

⁴ Abbreviations in glosses are as follows: 1 = first person; 2 = second person; 3 = third person; ABL = ablative case; ABSOLUTE = absolutive case; ACC = accusative case; AOR = aorist; DAT = dative case; CLASS = classifier; DEF = definite determiner; ERG = ergative case; EVID = evidential; GEN = genitive case; HAB = habitual; IMP = imperfective; INDIC = indicative; LOC = locative case; NEG = negation; NOM = nominative case; PASS = passive; PAST = past tense; PL = plural; PRES = present; PROG = progressive; SG = singular.

⁵ The plural marker in Turkish is the suffix *-lar*, subject to vowel harmony (see Kornfilt 1997: 268). In Hungarian, it is the suffix *-(V)k* (see Farkas and de Swart 2003).

⁶ The most productive strategy for pluralization in Miya adds *-a-C-aw* to the noun, where C is the final consonant of the noun stem. The plural marker in Western Armenian is the suffix *-(n)er*. For semantic differences between the two versions of (6), see section 3.2.

⁷ Languages that have no inflectional plural marking to begin with, such as Japanese (cf. Nakanishi and Tomioka 2004 for the argument that *-tati* is not an inflectional plural marker but a marker of associativity), are not part of the current study. More complex patterns are attested in other languages (see, e.g., Corbett 2000: 210-6 and Franks 1995 on Slavic languages, Mittendorf and Sadler 2005 and Sadler 2000 on Welsh). I also do not consider the case of pluralized numerals (see Danon 2012 and references cited there), or of complex numerals (see Ionin and Matushansky 2006) in this paper, among other issues. I do think that the proposal developed in this paper is compatible with Ionin and Matushansky’s view of complex numerals as syntactically complex.

	Type 1	Type 2	Type 3
<i>One N</i>	morphologically singular N	morphologically singular N	morphologically singular N
<i>Two, etc. N</i>	morphologically plural N	morphologically singular N	morphologically singular or plural N
Example languages	English, Spanish, German	Hungarian, Turkish, Finnish	Western Armenian, Miya

Table 1 The three language types

Bale, Gagnon and Khanjian (2011a) argue for an account of these patterns where both the semantics of numerals and the semantics of nouns may vary from one language type to another: numerals in different languages may have either subsective or intersective semantics, the numeral *one* may or may not have the same kind of denotation as other numerals within the same language, and morphologically singular nouns may also have a different semantics in different languages (singular in English, number neutral in Turkish or Western Armenian). On the other hand, Scontras (2014) assumes a single semantics for all numerals (including *one*) and a single, singular semantics for morphologically singular nouns—in his account, the observed variation results from a different semantics for the feature [SINGULAR] in different languages.⁸

I show in this paper that the assumptions Bale, Gagnon and Khanjian (2011a) make concerning the semantics of morphologically singular nouns in Turkish and Western Armenian are not empirically justified (cf. Martí 2017b, Sağ 2016, 2017). Given that Bale, Gagnon and Khanjian also assume that numerals have different semantics in different languages, and, sometimes, as I show, within the same language, Scontras' treatment is both empirically and theoretically superior to theirs.

However, Scontras' explanation relies entirely on a stipulative claim, namely, that languages of types 2 and 3 use a singular feature that is sensitive to elements without minimal parts, not, as is standard, to atoms. I improve Scontras' account by appealing to Harbour's (2011, 2014) theory of grammatical number, where the source of sensitivity to minimal parts is the feature [\pm minimal], different from [\pm atomic]. This is an improvement because the compositional semantics of the number features that are needed in Scontras' explanation is now justified independently of the data at hand.

Embedding Scontras' account within Harbour's theory of number, however, cannot be done without changing Scontras' assumptions about plurality. Scontras builds his account on Sauerland (2003), where singular features are semantically contentful but plural features are semantically empty. Martí (2017a, b), however, demonstrates that this approach to plurality is not compatible with Harbour's theory of number, but that an ambiguity account, on the other hand, is. My proposal has three key ingredients: Martí's account of plurality, Harbour's features, and Scontras' idea about the interaction between the semantics of number features and numerals. With these ingredients, I derive the variation in Table 1 on principled grounds. I demonstrate that neither presuppositions nor a semantically vacuous plural feature are necessary in Scontras' account. Like its predecessors, the proposal defended here can be viewed as an

⁸ A third type of account of the contrast between type 1 and type 2 languages can be found in Farkas and de Swart (2010). Theirs is an optimality-theoretic account that I don't discuss in the text, since I'm interested in demonstrating that a compositional semantics account works. Note that a different part of Farkas and de Swart's (2010) analysis, regarding the distribution of exclusive and inclusive plurality, is compatible with the account I propose in section 6 though.

alternative to taking the variation in Table 1 to be the result of morphological agreement patterns independent of semantics.

The organization of the paper is as follows. In section 2, I present Bale, Gagnon and Khanjian's (2011a) analysis of the data. In section 3, I discuss its empirical shortcomings for Turkish and Western Armenian. In section 4, I present Scontras' (2014) analysis. I then show in section 5 how Harbour's (2011, 2014) minimality can help to make Scontras' account less stipulative, but that in order to do so, Sauerland (2003) must be abandoned. Section 6 presents my proposal. Section 7 is the conclusion.

2 Bale, Gagnon and Khanjian (2011a)

For Bale, Gagnon and Khanjian (2011a), there are two possible denotations for numerals: the subsective semantics in (7), or the intersective semantics in (8):⁹

$$(7) \quad [[\text{two}_S]] = \lambda P_{pl}. \lambda x. x \in P_{pl} \ \& \ |\{y: y < x \ \& \ \text{atom}(y)\}| = 2$$

$$(8) \quad [[\text{two}_I]] = \lambda x. |\{y: y < x \ \& \ \text{atom}(y)\}| = 2$$

In (7), the input argument to the numeral is constrained to be only sets containing both atoms and non-atoms. In an intersective semantics like (8), the numeral is a cardinality predicate. Similar remarks can be made for the numeral *one* (though Bale, Gagnon and Khanjian do not discuss it), with the difference that the constraint subsective *one* imposes on its argument is that it be a set of atoms (P_{sg}):¹⁰

$$(9) \quad [[\text{one}_S]] = \lambda P_{sg}. \lambda x. x \in P_{sg} \ \& \ |\{y: y < x \ \& \ \text{atom}(y)\}| = 1$$

$$(10) \quad [[\text{one}_I]] = \lambda x. |\{y: y < x \ \& \ \text{atom}(y)\}| = 1$$

For a language like English, morphologically singular nouns are semantically singular and numerals are taken to be uniformly subsective. Assuming a universe with just three boys, Louis, Daniel and George, we have:

$$(11) \quad [[\text{boy}]] = \{L, D, G\}$$

$$(12) \quad [[\text{boys}]] = \{L, D, G, L+D, L+G, L+D+G\}$$

$$(13)$$

$$a. \quad [[\text{two}_S \text{ boys}]] = \lambda x. x \in [[\text{boys}]] \ \& \ |\{y: y < x \ \& \ \text{atom}(y)\}| = 2 \quad \rightarrow \text{two boys}$$

⁹ A predicate P is of type pl iff $\forall x, y \in P \ x+y \in P$. (7) and (8) are simplified versions of Bale, Gagnon and Khanjian's numeral semantics. Their official semantics is in (i) and (ii), with auxiliary definitions in (iii) and (iv) (though a definition for part is never provided):

(i) $[[\text{two}_S]] = \lambda P_{pl}. \{x: x \in P_{pl} \ \& \ \exists Y (Y \in \text{part}(x) \ \& \ |Y| = 2 \ \& \ \forall z (z \in Y \rightarrow z \in \text{min}(P_{pl})))\}$

(ii) $[[\text{two}_I]] = \{x: \exists Y (Y \in \text{part}(x) \ \& \ |Y| = 2 \ \& \ \forall z (z \in Y \rightarrow \text{atom}(z)))\}$

(iii) $\text{min}(P)$ is defined iff $\forall x, y ((x, y \in P \ \& \ \neg \exists z (z \in P \ \& \ (z < y \vee z < x))) \rightarrow x \wedge y = 0)$. When defined $\text{min}(P) = \{x: x \in P \ \& \ \neg \exists z (z < x)\}$

(iv) $\text{atom}(x) = 1$ iff $x \in D \ \& \ \neg \exists z (z \in D \ \& \ z < x)$

Their min and atom foreshadow the notions of minimality and atomicity that are crucial in Scontras' and my account, though in their case they are part of the semantics of numerals, not of number features, and as such they don't produce the same effects.

¹⁰ A predicate P is of type sg iff $\forall x, y \in P \ x+y \notin P$. All numeral denotations in this paper derive *at least* readings. I assume *exactly* readings are derived by implicature, as in Horn (1972) and much subsequent literature, an analysis which has not, of course, remain unchallenged. An ambiguity approach like that in Geurts (2006) is also compatible with the proposal here. Cf. Kennedy (2015) and references cited there.

- b. #[[two_S boy]] → ~~two boy~~
 c. [[one_S boy]] = $\lambda x. x \in [[\text{boy}]] \ \& \ |\{y: y < x \ \& \ \text{atom}(y)\}| = 1$ → *one boy*
 d. #[[one_S boys]] → ~~one boys~~

Two boy ((13)b) is predicted to be impossible in English because *two_S* cannot combine with a semantically singular noun like *boy*: *two_S* requires its input to denote a set of atoms and non-atoms, and *boy* does not denote such a set ((11)). *Two_S*, on the other hand, can combine with a morphologically plural noun like *boys* ((13)a) because the set of atoms and non-atoms that *boys* denotes ((12)) does satisfy that requirement. *One_S* cannot combine with *boys* ((13)d) because *one_S* requires its input to denote a set of atoms, and *boys* does not denote such a set. *Boy* does, however, which is why *one boy* ((13)c) is grammatical. Turkish uses a subsective semantics for any numeral greater than 1, an intersective semantics for 1, and a different semantics for nouns:

(14) [[çocuk]] = {L, D, G, L+D, L+G, L+D+G}

(15) [[çocuklar]] = {L+D, L+G, L+D+G}

(16)

- a. [[iki_S çocuk]] = $\lambda x. x \in [[\text{çocuk}]] \ \& \ |\{y: y < x \ \& \ \text{atom}(y)\}| = 2$ → *iki çocuk*
 b. #[[iki_S çocuklar]] → ~~iki çocuklar~~
 c. [[bir_I çocuk]] = $\lambda x. |\{y: y < x \ \& \ \text{atom}(y)\}| = 1 \ \& \ [[\text{çocuk}]](x)$ → *bir çocuk*
 d. #[[bir_I çocuklar]] → ~~bir çocuklar~~

Given (14), a subsective semantics for numerals greater than 1 gives a different result from English. The combination of such numerals with morphologically singular nouns is predicted to be grammatical, and with the desired semantics, as in (16)a (for *iki* ‘two’). Their combination with morphologically plural nouns, (16)b, is correctly predicted to be ungrammatical—such numerals require their input to denote a set of atoms and non-atoms, and (14) does not denote such a set. Using *bir_S* ‘ones’, however, would wrongly predict that this numeral cannot combine with morphologically singular nouns, as (14) does not denote a set of atoms. Thus, *bir_I* ‘one_I’ is used instead, and the rest of the Turkish pattern is predicted, (16)c/(16)d. As for Western Armenian, its noun semantics is proposed to be like that in Turkish, but its numerals are always intersective:

(17)

- a. [[yergu_I dəgha]] = $\lambda x. |\{y: y < x \ \& \ \text{atom}(y)\}| = 2 \ \& \ [[\text{dəgha}]](x)$ → *yergu dəgha*
 b. [[yergu_I dəghaner]] = $\lambda x. |\{y: y < x \ \& \ \text{atom}(y)\}| = 2 \ \& \ [[\text{dəghaner}]](x)$ → *yergu dəghaner*
 c. [[meg_I dəgha]] = $\lambda x. |\{y: y < x \ \& \ \text{atom}(y)\}| = 1 \ \& \ [[\text{dəgha}]](x)$ → *meg dəgha*
 d. #[[meg_I dəghaner]] → ~~meg dəghaner~~

The intersective numeral semantics of *yergu_I* ‘two_I’ does not impose constraints on the denotation of the noun it combines with, so both (17)a, *yergu dəgha* ‘two boy’, and (17)b, *yergu dəghaner* ‘two boys’, are grammatical and have the desired semantics. However, *meg_I* ‘one_I’ cannot combine with a noun that denotes a set of non-atoms, as a set of non-atoms intersected with a set of individuals constituted exactly of 1 atom is empty. Hence, the only restriction we observe in Western Armenian is that *meg* cannot combine with plural nouns ((17)d).

Thus, according to Bale, Gagnon and Khanjian, nouns can vary in their denotation from one language to another (English vs. Turkish/Western Armenian), as can the

semantics of numerals (subsective in English/Turkish, intersective in Western Armenian) and the semantics of numerals within the same language (numerals greater than 1 vs. *bir* ‘one’ in Turkish). This state of affairs is in itself not desirable. However, it is also the case that their assumptions about the semantics of Turkish and Western Armenian nouns are not empirically justified, as I now proceed to show.

3 The semantics of nouns in Turkish and Western Armenian

Bale, Gagnon and Khanjian (2011a) assume that morphologically singular nouns in Turkish and Western Armenian are semantically number-neutral. Following Sağ (2016, 2017) and Martí (2017b), however, I argue that Turkish morphologically singular nouns are semantically singular in non-incorporated positions and number-neutral only when (pseudo-)incorporated, and that there are no reasons to think that nouns are (pseudo-)incorporated in the numeral+noun construction. In Western Armenian, morphologically singular nouns are either singular count nouns or naturally atomic mass nouns (in the sense of Bale and Barner 2009, Landman 2011, Rothstein 2010a, b, among others)—singular count nouns in the numeral+noun construction.

The denotation of morphologically plural nouns is also assumed to be different in English vs. Turkish and Western Armenian in Bale, Gagnon and Khanjian’s analysis. English has inclusive plurals (that is, morphologically plural forms that denote sets of atoms and non-atoms)(see Farkas and de Swart 2010, Grimm 2012, Ivlieva 2013, Kiparsky and Tonhauser 2012, Krifka 1989, 1995, Lasersohn 1998, 2011, Martí 2017a, Mayr 2015, Sauerland 2003, Sauerland, Anderssen and Yatsushiro 2005, Spector 2007, Yatsushiro, Sauerland and Alexiadou 2017, Zweig 2009). Turkish and Western Armenian morphologically plural forms have been argued by some to be only exclusive (that is, to denote sets of non-atoms only) (Bale and Khanjian 2008, 2014, Bale, Gagnon and Khanjian 2011a, b, Görgülü 2012 and Martí 2017b)—however, as we will see, this is not uncontroversial, at least for Turkish (see Renans *et al.* 2017 and Sağ 2017).

3.1 Turkish noun semantics

Morphologically singular nouns in Turkish are usually taken to be number neutral semantically (Acquaviva 2005, Bale, Gagnon and Khanjian 2011a, Bliss 2004, Corbett 2000, Göksel and Kerslake 2005, Görgülü 2012, Walter 2014):

(18) *Turkish*

Kitap al-dı-m
book buy-PAST-1SG
‘I bought a book/books’

(19) *Turkish*

Ali-yi **arı** sok-tu
Ali-ACC bee sting-PAST
‘Bees stung Ali’/‘Ali got bee-stung’

(20) *Turkish*

Çocuk gel-miş

child come-EVID
 'There was one or more children coming'

In (18)-(20), the highlighted nouns receive a number neutral interpretation. One reason why that might be is that, as hypothesized in (14), the nouns in these sentences have a number neutral denotation. However, it is well known, as discussed in Cabredo Hofherr (to appear a, and references cited there), that number neutrality can have sources other than noun phrase semantics. In particular, Sağ (2016, 2017), and Martí (2017b) after her, shows that the number neutrality of Turkish morphologically singular nouns is attested only in pseudo-incorporation contexts, when morphologically singular nouns appear in non-argument position. This being so, it is likely that the source of the number neutrality we observe in (18)-(20) is due to the semantics of pseudo-incorporation (see Carlson 2006 and Dayal 2015 for overviews on the semantics of (pseudo-)incorporation). In turn, this calls into question a number-neutral semantics for nouns in the numeral+noun construction in Turkish.

Let us go through the details of the argument. Knecht (1986), Kornfilt (1995, 2003) and Mithun (1984) argue that Turkish has noun incorporation. Öztürk (2009), on the basis of developments in Massam (2001) (for Niauxean; for Hindi pseudo-incorporation, see Dayal 2011), argues that the more appropriate description is that Turkish has noun pseudo-incorporation (given that the relationship between the noun and the verb is less constrained in Turkish than in languages traditionally considered to have incorporation), of both themes and agents. Lack of pseudo-incorporation in Turkish is recognizable from Case marking, syntactic position and intonation, as argued for Öztürk (2009) (also Kan 2010). Importantly, as Sağ and Martí note, when pseudo-incorporation does not occur, i.e., when the nouns in question are forced into argument positions, morphologically singular nouns in Turkish are semantically singular. For example, consider (21), a minimal pair for (18) (note that Turkish has no definite article):

(21) *Turkish*
Kitab-ı al-dı-m
 book-ACC buy-PAST-1SG
 'I bought the book'

Accusative Case marking in Turkish induces definiteness effects, as is well known (Enç 1991, von Heusinger and Kornfilt 2005, among others). Adding it to (18), as in (21), has two effects, however: one is the expected definiteness of the noun; the other, more important for us, is that the noun is now unambiguously interpreted as singular. The latter effect is fully expected if nouns in Turkish can undergo pseudo-incorporation with the verb, but not when Case marked. Lack of adjacency between the noun and the verb also prevents pseudo-incorporation, and, again, a semantically singular interpretation is the only possible interpretation in that case, as the minimal pair (19)/(22) shows:

(22) *Turkish*
Ari Ali-yi sok-tu
 bee Ali-ACC sting-PAST
 'The bee stung Ali'

If the noun-verb connection is disrupted by other means, such as a pause introduced between the noun and the verb ((23)), or stress on the verb ((24)), the singular interpretation arises again (cf. (19) and (20), where stress is on *çocuk*, respectively):

(23) *Turkish*
 Ali-yi **arı** [] sok-tu
 Ali-ACC bee sting-PAST
 'The bee stung Ali'

(24) *Turkish*
Çocuk gel-miş
 child come-EVID
 'The child came'

Finally, if a second noun is the one that undergoes pseudo-incorporation, then the first noun can only be interpreted as semantically singular (cf. (18)):

(25) *Turkish*
Çocuk kitap oku-du
 child book read-PAST
 'The child did book-reading'/'The child read one or more books'

Thus, when the conditions for pseudo-incorporation are not met, as in (21)-(25), semantically singular (definite) interpretations arise in Turkish, which suggests that the number neutrality of examples in (18)-(20) is not due to the semantics of the nouns, but to the semantics of (pseudo-)incorporation.¹¹

The above singular interpretations cannot be blamed on Case, the syntactic position of the noun or intonation, since plural forms get semantically plural readings in these cases, as shown in (26), with Accusative Case marking on the noun and with stress on the verb (Ketrez 2003). (26) is interpreted as plural, not singular:

(26) *Turkish*
 Ayşe **kitap-lar-ı** oku-du
 Ayşe book-PL-ACC read-PAST
 'Ayşe read the books'

Regarding morphologically plural nouns in Turkish, it's important to note that, in addition to its function as a marker of standard plurality, exemplified in (26), *-lar* can give rise to plurality of events and plurality of kinds readings (Ketrez 2003). These interpretations arise in examples such as (27), where there is no Case marker and where stress is on *-lar* (cf. (26)):

(27) *Turkish*
 Ayşe **kitap-lar** oku-du
 Ayşe book-PL read-PAST
 'Ayşe engaged in multiple events of book-reading', or
 'Ayşe read different types of books'

¹¹ As expected, these nouns can only take narrow scope. See Öztürk (2009).

That the plural marker can give rise to these different readings might call into question the idea that the Turkish number system is a singular-plural number system. It's important to note that plurality of events or plurality of types readings cannot be the source of plurality of individual readings, since the plurality of individuals reading is available in (26), but the plurality of events and plurality of types readings we observe in (27) aren't. As matters stand, it is reasonable to think that *-lar* can lead to a number of distinct readings, one of which is the plurality of individuals reading, and that only Case marking/definiteness can bring about that reading. An account of semantic plurality is necessary that is independent of event and kind plurality.

An important question is whether morphologically plural nouns in Turkish are inclusive (denoting sets of both atoms and non-atoms) or exclusive (sets of non-atoms) in the plurality of individuals reading. Görgülü (2012) argues that Turkish plural nouns are only exclusive. On the other hand, Sağ (2016: 10, 2017) argues that Turkish morphologically plural nouns can indeed give rise to inclusive readings. (28)B', not (28)B, should be an acceptable answer to (28)A if Turkish morphologically plural nouns only had an exclusive semantics:

(28) *Turkish*

- A: Orman-da **ayı-lar-a** rastla-dı-nız mi?
 forest-LOC bear-PL-DAT come.across-PAST-2PL Q
 'Did you come across bears in the forest?'
- B: Evet, bir tane gör-dü-k
 yes one CL see-PAST-1PL
 'Yes, we saw one'
- B': # Hayır, bir tane gör-dü-k
 no one CL see-PAST-1PL
 'No, we saw one'

(29), with negation, is false if there is one child playing ball in the street, but it should be true in that situation if plural forms in Turkish had only an exclusive semantics:

(29) *Turkish*

- Çocuk-lar** sokak-ta top oyna-mı-yor
 child-PL street-on ball play-NEG-PROG
 'Children are not playing ball on the street'

Renans *et al.* (2017) provide experimental evidence that supports the availability of inclusive readings for Turkish plural forms, though such forms seem to be less available than they are in languages like English. I am not able to settle this issue at this point. However, I demonstrate in section 6 that my proposal works whether type 2 languages have inclusive plurals or not.¹²

The discussion above establishes that there is a distinction in Turkish between the semantic number of morphologically singular nouns in argument positions vs. that in non-argument positions. The next question is whether nouns in the numeral+noun construction in Turkish are pseudo-incorporated or not. To maintain Bale, Gagnon and Khanjian's hypothesis that nouns in this construction are number neutral, it would have

¹² Turkish *-lar* can also be a marker of associative plurality (Lewis 1967, Sebüktekin 1971, Göksel and Kerslake 2005, Görgülü 2011). Görgülü (2011) argues that this is a separate use. Cf. also footnote 7.

to be the case that such nouns pseudo-incorporate into the numeral. The main problem with this proposal is that, as it currently stands, it would serve no purpose other than to facilitate the analysis of Turkish in terms of a number-neutral semantics for its nouns. We know that numerals may be syntactic heads, taking the noun (or a projection of the noun) as complement (Borer 2005, Cardinaletti and Giusti 2006, Danon 2012, Giusti 1997, Ionin and Matushansky 2006, Longobardi 2001, Shlonsky 2004, Danon 2012), or phrases, which function as specifiers (Cinque 2005, Corver and Zwarts 2006, Danon 2012, Franks 1994, Giusti 1997, 2002, Kayne 2010, among others), and there are other distinctions and patterns that the rich literature on numerals and the numeral+noun construction recognizes, but there isn't one that would independently justify a pseudo-incorporation relationship between numerals and nouns.¹³

If Turkish morphologically singular nouns are in fact semantically singular, the account of Turkish defended in Bale, Gagnon and Khanjian is no longer justified, a point made in Sağ (2016, 2017). The analysis for *bir çocuk*/**çocuklar* need not change: *bir* 'one' can still be intersective, and the desired pattern and semantics are derived. However, the subsective denotation of *iki* no longer combines with that of *çocuk* in (30), since it is no longer the case that the denotation of its input argument contains both atoms and non-atoms:

$$(30) [[\text{çocuk}]] = \{L, D, G\}$$

An intersective semantics also would not work, since (8) does not felicitously combine with (30). Sağ (2016, 2017) argues that what is needed is the privative numeral semantics of Ionin and Matushansky (2006), where numerals combine with noun denotations containing only atoms to return sets of plural individuals, as in (31), with auxiliary definitions in (32) and (33) (cf. Higginbotham 1981: 110; Gillon 1984; Verkuyl & van der Does 1991; Schwarzschild 1994):

$$(31) [[\text{two}_P]] = \lambda P_{et}.\lambda x.\exists S_{et} \prod(S)(x) \ \& \ |S|=2 \ \& \ \forall s \in S \ P(s)$$

$$(32) \prod(S)(x) = 1 \ \text{iff } S \text{ is a cover of } x, \ \text{and } \forall z, y \in S \ [z=y \vee \neg \exists a \ [a \leq z \ \& \ a \leq y]]$$

(33) A set of individuals C is a cover of a plural individual X iff X is the sum of all members of C ($X = \sqcup C$)

S is a partition (\prod) of an entity x if it is a cover of x and its cells don't overlap (so that no element is counted more than once). Applying two_P to a set of atoms returns a set of twosomes each of which is composed of exactly two non-overlapping atoms. One could use such a privative interpretation for just numerals greater than 1, or for all numerals (the latter option would mean that all numerals in Turkish have a uniform interpretation). Either way, this undermines much of the motivation for Bale, Gagnon and Khanjian's argument that numerals cannot have privative interpretations, which forms the basis of their attempt to provide an alternative semantics to Ionin and

¹³ The only remaining facts which still point to a number neutral semantics for morphologically singular nouns in these languages is their predicative uses, which are possible in both Turkish and Western Armenian (see Bale, Gagnon and Khanjian 2011a). One question is, of course, whether predicative positions are argumental positions, an issue I cannot address here (see Williams 1983 and much subsequent literature). Given the evidence in the text, an analysis involving predicate distribution seems more plausible, which Bale, Gagnon and Khankian do not exclude (p. 588, ft. 5).

Matushanksy's for Turkish numerals. But, more importantly, it is unclear what the range of variation in numeral meanings there can be, and, thus, ultimately, whether the typology in Table 1 can now be predicted in a principled way.

3.2 Western Armenian noun semantics

While Western Armenian morphologically singular nouns are plausibly analyzed as naturally atomic mass nouns (in the sense of Bale and Barner 2009, Landman 2011, Rothstein 2010a, b, among others) in examples such as (34)-(35), which directly gives rise to number neutrality, this cannot be their interpretation in the numeral+noun construction (examples from Sigler 1997):

(34) *Western Armenian*

Maro-n **tuz** g-ude
 Maro-DEF fig IMP-eat.3SG
 'Maro eats one or more figs'

(35) *Western Armenian*

Տեղան-ե-ն **ֆի** ing-av
 table-ABL-DEF bottle fall.AOR-3SG
 'From the table one or more bottles fell'

Sigler argues that Western Armenian does not have noun (pseudo-)incorporation. Mohanan (1995), in her discussion of Hindi incorporation (pseudo-incorporation according to Dayal 2011), shows that Hindi incorporated objects are interpreted differently from their non-incorporated counterparts. Consider the ambiguous (36) (Mohanan 1995: 91):

(36) *Hindi*

Mohan chuttiyō-me **vækylum** **kliinar** bectaa t^haa
 Mohan.NOM holidays-in vacuum cleaner.NOM sell.HAB be.PAST
 'Mohan was selling vacuum cleaners during the holidays' or
 'Mohan was doing vacuum-cleaner-selling during the holidays'

In the first reading in (36), the object *vækylum kliinar* 'vacuum cleaner' is not incorporated and is a regular syntactic object. The second reading arises from (pseudo-)incorporation of the noun into the verb. Only the latter is compatible with the continuation in (37):

(37) *Hindi*

Usne do mahine-me ek b^hii **vækylum** **kliinar** nahî becii
 He.ERG two month-in one even vacuum cleaner.NOM NEG sell
 'He didn't even sell one vacuum cleaner in two months'

Parallel examples in Western Armenian show that the bare nouns of interest here do not (pseudo-)incorporate. (39) sounds contradictory as a continuation for (38):

- (38) *Western Armenian*
 Yerp Ani-n Beirut gə-pənage-r **kork** gə-dʒaxe-r
 when Ani-DEF Beirut IMP-live-PAST.3SG carpet IMP-sell-PAST.3SG
 'When Ani lived in Beirut she sold carpets'
 #'When Ani lived in Beirut she did carpet-selling'
- (39) *Western Armenian*
 ...# payc ayn yerek dar-va əntack.i.n nuynisg meg had
 but that three year-GEN during not.even one class
 kork čə-dʒaxe-c
 carpet NEG-sell-AOR.3SG
 'But she didn't sell a single carpet in those three years'

The equivalent examples from Turkish behave like those in Hindi, as expected. (40) is well-formed:

- (40) *Turkish*
 Anu Beirut-ta yaşa-r-ken **halı** sat-ar-dı.
 Anu Beirut-LOC live-AOR-when carpet sell-AOR-PAST
 Fakat Anu o üç yıl boyunca tek bir halı sat-ma-dı.
 But Anu it three year during single one carpet even
 'When Anu lived in Beirut, she did carpet-selling. But she didn't sell a single carpet in those three years.'

A more plausible explanation for the number-neutral interpretations in (34)-(35) is that morphologically singular nouns like *fif* 'bottle' or *tuz* 'fig' are mass nouns, as argued by Bale and Khanjian (2008) and Sigler (1997), more specifically, mass nouns with naturally atomic parts, like *luggage*, *furniture*, or *mail* in English (Bale and Barner 2009, Landman 2011, Rothstein 2010a, b, among others; for Sigler, they are typical mass nouns like English *water*). If the bare nouns in (34)-(35) can be interpreted as naturally atomic mass, then what looks like a number neutral interpretation can actually be the same type of interpretation of nouns like *furniture* or *luggage*:

- (41) I bought **furniture** for the living room
 (42) I carried **luggage** up the stairs

According to (41), I bought one or more pieces of furniture, and according to (42), I carried one or more pieces of luggage upstairs. These nouns allow for a cumulative interpretation in Western Armenian, as suggested by the following example, which makes them compatible with a mass denotation (cf. Link 1983):

- (43) Maro-n **ator** kənets, jes **ator** kənets-i, menk
 Maro-DEF chair buy.PAST, I chair buy.PAST-1SG, we
ator kənets-ink
 chair buy.PAST-1PL
 'Maro bought a chair, I bought a chair, we bought a chair'

It seems quite plausible then that the number neutral semantics we observe in examples

(34)-(35) is due to the systematic availability of naturally atomic mass denotations for morphologically singular nouns in Western Armenian.¹⁴ The important question is whether the noun in the Western Armenian numeral+noun construction is a naturally atomic mass noun. Recall that Western Armenian allows both options in (44) for numerals greater than 1:

¹⁴ For some (Khanjian 2012), but not all (Sigler 1997: 156) speakers, both typical mass nouns and morphologically singular nouns pattern together to the exclusion of morphologically plural nouns in that the former, but not the latter, require the presence of the definite article as subjects of kind or generic predications:

- (i) *Western Armenian*
- | | | | |
|---------------------|----------|-----------|--------|
| a. * Vosgi | suy | e | |
| | gold | expensive | be.3SG |
| b. Vosgi-n | suy | e | |
| | gold-DEF | expensive | be.3SG |
| 'Gold is expensive' | | | |
- (ii) *Western Armenian*
- | | | | |
|--------------------------|--------------------------------|---------------------|--------|
| a. * Ahramoæz | votʃəntʃatsadz/pənatʃəntʃəvadz | e | |
| | dinosaur | annihilated/extinct | be.3SG |
| b. Ahramoæz-ə | votʃəntʃatsadz/pənatʃəntʃəvadz | e | |
| | dinosaur-DEF | annihilated/extinct | be.3SG |
| 'Dinosaurs are extinct.' | | | |
- (iii) *Western Armenian*
- | | | | |
|--------------------------|--------------------------------|---------------------|--------|
| a. Ahramoæz-ner | votʃəntʃatsadz/pənatʃəntʃəvadz | e-n | |
| | dinosaur-PL | annihilated/extinct | be-3PL |
| b. Ahramoæz-ner-ə | votʃəntʃatsadz/pənatʃəntʃəvadz | e-n | |
| | dinosaur-PL-DEF | annihilated/extinct | be-3PL |
| 'Dinosaurs are extinct' | | | |

Pires de Oliveira and Rothstein (2011) show that this contrast obtains in a good number of contexts in Brazilian Portuguese, where morphologically singular nouns mirror the distribution of typical mass nouns very closely. With regard to Bale and Barner's (2009) comparative construction test for mass vs. count nouns, it is difficult to see what the results mean. Bale and Barner argue that the comparative construction in (iv) can help tease apart the mass vs. count status of the noun involved:

- (iv) Seymour has more **water/apples/luggage** than Esme

With typical mass nouns like *water*, the assessment of the comparison in (iv) necessarily takes place along a scale other than numerosity (volume, weight, length, etc.). With typical count nouns in their plural form, such as *apples*, and with naturally atomic mass nouns (Bale and Barner call them 'object-mass', and other labels are used elsewhere), the comparison takes place only along the numerosity scale (i.e., (iv) is true if the number of apples or pieces of luggage that Seymour has is greater than Esme's, independently of their weight or volume), never along other scales. The problem is that Western Armenian *xəntsor* 'apple' can participate only in a non-numerosity comparison in (v):

- (v) *Western Armenian*
- | | | | | |
|--|--------|-------|--------------------------------|---------|
| Maro-n | indzme | aveli | xəntsor/xəntsorner/tʃur | uni |
| maro-DEF | me.ABL | more | apple/apple.PL/water | has.3SG |
| 'Maro has more apple/apples/water than me' | | | | |

The non-numerosity comparison is the only possible interpretation for the typical mass noun *tʃur* 'water', but also for the morphologically singular *xəntsor* 'apple' (only a numerosity comparison is possible for the plural noun, as expected). It is unclear what this tells us about the mass vs. count status of *xəntsor*.

(44) *Western Armenian*

Yergu **dəgha/dəgha-ner**
 two boy.SG/boy-PL
 ‘Two boys’

Donabédian (1993) and Sigler (1997) argue that there is a difference in interpretation between the singular form and the plural form in such constructions. With *yergu dəgha*, “the speaker is not interested in the individual [boys], but in the number and type of person”, whereas with *yergu dəghaner*, “the speaker is interested in the [boys] individually” (Sigler 1997: 41, 146-150). Consider the following examples (cf. Sigler’s 1997: 148-50 own examples):

(45) *Western Armenian*

John: Ajsor jad martiggə kal-en gor ajs poyots-i-n
 today many people INDIC walk-3PL.PRES PROG this street-DAT-DEF
 metʃ
 in
 ‘A lot of people are walking on this street today’
 Bill: Ajo dʒifd es ajsor yergu **aytʃig** ants-av
 yes right be.2SG today two girl pass.by-PAST.3SG
 ‘Yes, that’s true. Two girls passed by today’
 Bill: Ajo dʒifd es ajsor yergu **aytʃig-ner** ants-an
 yes right be.2SG today two girl-PL pass.by-PAST.3PL
 ‘Yes, that’s true. Two girls passed by today’

(46) *Western Armenian*

Teacher: Afagerd-ner, ov koʏtsa-v xəntsor-əs
 student-PL who steal.PAST-3SG apple-1SG.POSS
 ‘Students, who stole my apple?’
 Student: #Jes desa ov ərav yergu **aytʃig** xəntsor-ə koʏts-av
 I see.PAST who did two girl apple-DEF steal-PAST.3SG
 ‘I saw who did it. Two girls stole the apple’
 Student: Jes desa ov ərav yergu **aytʃig-ner** xəntsor-ə
 I see.PAST who did two girl-PL apple-DEF
 koʏts-an
 steal-PAST.3PL
 ‘I saw who did it. Two girls stole the apple’

When in the context number is relevant, as in (45), either expression is appropriate. When in the context it is identity that is relevant, not number, as in (46), the singular form of the noun is infelicitous, whereas the plural form is felicitous. The plural form of the noun in this construction is thus compatible with both types of context, whereas the singular form is compatible only with the counting context. This difference between the morphologically singular and plural forms is not associated *per se* with the plural suffix, as no such effect obtains in (47) or (48):

(47) *Western Armenian*

Yereg kifer **sarsur-ner** ga-i-n xohanoc-i-n meč
 Yesterday night cockroach-PL exist.PAST.3PL kitchen-GEN-DEF under
 'Last night there were cockroaches in the kitchen'

(48) *Western Armenian*

ՅՈՒՅՈՎ-ի-ն **lezvaked-ner** masnagce-c-an
 meeting-DAT-DEF linguist-PL participate-AOR-3PL
 'Linguists participated in the meeting'

For Sigler (cf. Donabédian), the difference exemplified in (45) and (46) follows from morphologically singular nouns being (typical) mass in the numeral+noun construction, and from the morphologically plural noun being count. *Dəgha* in (44), being (typical) mass, does not allow differentiation among different subparts of the boy-mass. Being count, *dəghaner* does allow such differentiation, which then entails identification.

Whatever its merits, we cannot maintain this analysis in the face of the contrast, commonly noted in the literature, between typical mass nouns like *water* and naturally atomic mass nouns like *luggage* in English, or *menino* in Brazilian Portuguese. *Dəgha* in (44), if mass, is naturally atomic mass, with clear differentiation between different subparts of the boy-mass, constituted by boy-atoms (cf. Bale and Barner 2009, Bale and Khanjian 2008, Rothstein 2010a, b, among others). But, more importantly, neither typical mass nor naturally atomic mass nouns can combine directly with numerals, in English or in other languages (cf. English **three water*, **three luggage*; Brazilian Portuguese **tres menino*, *tres meninos*, Cilene Rodrigues, p.c.). I haven't been able to find clear cases of naturally atomic mass nouns in Western Armenian, but typical mass nouns do not combine directly with numerals (cf. (50)) (Khanjian 2012):

(49) *Western Armenian*

*Jerek **kini/vosgi/alujr**
 three wine/gold/flour

(50) *Western Armenian*

Hisun gram **alujr**
 fifty gram flour
 'Fifty grams of flour'

We must then assume that the Western Armenian morphologically singular nouns in (44) appear there in a second, count denotation, and that the difference illustrated in (45)/(46) is due to something other than a potential mass/non-mass contrast. The first idea is indeed part of Scontras' account, as shown in the next section, and of the developments I introduce to it in later sections. This second, count denotation is actually likely to be systematically available for morphologically singular nouns, as when a definite article, which Western Armenian does have, is added to our earlier examples, only a semantically singular denotation arises:

(51) *Western Armenian*

Maro-n **tuz-ə** g-u-de
 Maro-DEF fig-DEF IMP-eat.3SG
 'Maro eats the fig'

- (52) *Western Armenian*
 Տեղան-ե-ն ի՛նջ-օ օղակ-ը-ն
 table-ABL-DEF bottle-DEF fall.AOR-3SG
 'From the table the bottle fell'

This interpretation is not due to the definite article, since the definite article gives rise to plural interpretations with plural marked nouns:

- (53) *Western Armenian*
 Բա՛նջ-եր-օ օղակ-ը-ն
 Elephant-PL-DEF escape-AOR-3PL
 'The elephants escaped'

- (54) *Western Armenian*
 Մարո-ն տու՛նջ-եր-օ օղակ-ը-ն
 Maro-DEF fig-PL-DEF IMP-eat.3SG
 'Maro eats the figs'

A possibility worth pursuing for the contrast between (45)/(46) is one in which the introduction of an identifiability component is done by a different item within the noun phrase, such as a (silent) determiner or a quantifier. This would not be too surprising, as we know from other languages that quantifiers can indeed be sensitive to such distinctions (Russian uses *koe-wh* as an indefinite determiner to require the speaker to be able to identify the referent; cf. Martí and Ionin 2017 and references cited there).^{15, 16}

For Bale, Gagnon and Khanjian (2011a) the differences in Table 1 follow in part from morphologically singular nouns in English being semantically singular while semantically number neutral in Turkish and Western Armenian. I have argued, however, that morphologically singular nouns with a number-neutral semantics do not appear in argument positions in Turkish or in the numeral+noun construction. In Western Armenian, morphologically singular nouns may be naturally atomic mass nouns, but under such an interpretation nouns cannot be counted, so that interpretation cannot be

¹⁵ According to Bale *et al.* (2011), Bale and Khanjian (2014), Western Armenian only has exclusive plurals:

- (i) *Western Armenian*
 Երեք-եր-ո՞ւն անձեր-ու՞ն?
 child-INDEF.PL have.2SG.PRES
 'Do you have two or more children?'

I will not be able to offer any confirmation of this hypothesis here, but I will offer an account in section 6 that is independent of whether languages of type 3 have inclusive plurals or not.

¹⁶ Western Armenian has a classifier, *had*, as shown in Bale and Khanjian (2008) and Sigler (2003) (cf. also Borer 2005, Khanjian 2012). This classifier can appear (and, for some speakers, is preferred) in (44):

- (i) *Western Armenian*
 Երկու (had) մեծիկ/մեծիկ-եր
 two CLASS boy.SG/boy-PL
 'Two boys'

For some, but not all, speakers, *had* is impossible with morphologically plural nouns. *Had* cannot occur with mass nouns. Turkish is also claimed to have an optional classifier; see Sağ (2016, 2017).

what we find in the numeral+noun construction. Bale, Gagnon and Khanjian's assumptions about the semantics of morphologically plural forms in Turkish and Western Armenian may not be correct either. Thus, the amount of variation in noun and numeral denotations that Bale, Gagnon and Khanjian need is not justified empirically, in addition to being undesirable theoretically.

4 Scontras (2014) and the semantics of number features

Scontras (2014) proposes a single semantics for all numerals, including *one*, and a single semantics for morphologically singular nouns across the three language types. For Scontras, morphologically singular nouns in the three types of languages are taken to be semantically singular (which, given the evidence discussed in the previous section, is the correct assumption, in particular for languages of types 2 and 3), but the semantics of the feature [SINGULAR] can vary from one language to another.

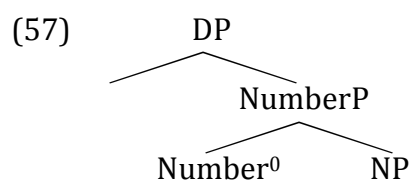
For the semantics for nouns, he assumes the following, where '*' is Link's (1983) *-operator. In a universe with just three boys in it, Louis, Daniel and George, as before:

$$(55) \begin{aligned} [[\text{boy}]] &= \{L, D, G\} \\ [[*\text{boy}]] &= \{L, D, G, L+D, L+G, D+G, L+D+G\} \end{aligned}$$

[[Boy]] is the set of atoms that are boys, and [[*boy]] is the set of all possible sums of boy atoms. A second ingredient in Scontras' account are the two number features [SG], which triggers singular form (even if null) and agreement, and [PL], which triggers plural form and agreement. Whereas [SG] comes with a singularity presupposition, [PL] is presupposition-less (from Sauerland 2003):

$$(56) \begin{aligned} [[\text{SG}]] &= \lambda P: \forall x \in P [\#x=1].P \\ [[\text{PL}]] &= \lambda P.P \end{aligned}$$

Given Heim's (1991) Maximize Presupposition, it follows that, if the presuppositions of [SG] are met, then [SG] is used; otherwise, [PL] is used. The syntax of noun phrases that have no numeral is as in (57)¹⁷:



Consider the four possible combinations of noun semantics and number features in a language of type 1:

¹⁷ Given the varied ways in which authors designate the head that hosts number features, I've decided to call it Number⁰. It is '#' in Scontras (2014), 'ϕ' in Sauerland (2003), and 'Num⁰' in Harbour (2014). As for NP in (57), it is 'nP' for Harbour (2014). The term 'noun phrase' as used in this paper is merely descriptive and applies to whatever the final projection in (57) and related structures is. Further categories between DP and the other projections in (57) are possible, of course, but irrelevant for our purposes.

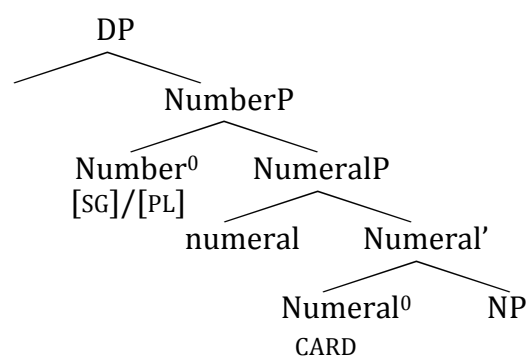
(58)

- a. $[[[SG\ boy]]] = [[boy]] = \{L, D, G\}$ $\rightarrow boy$
 b. $\#[[SG\ *boy]]$ $\rightarrow \cancel{boy}$
 c. $\#[[PL\ boy]] = [[boy]] = \{L, D, G\}$ $\rightarrow \cancel{boys}$
 d. $[[[PL\ *boy]]] = [[*boy]] = \{L, D, G, L+D, L+G, D+G, L+D+G\}$ $\rightarrow boys$

When combined with [SG], only [[boy]], (58)a, gives rise to a well-formed meaning. In (58)a, the presupposition of [SG] that every member of the denotation of its input be individuals constituted of exactly one atom, or atomic, is satisfied and the meaning of the whole is the same as the meaning of [[boy]], thus giving rise to the correct semantics. In (58)b, on the other hand, [[*boy]] contains both atoms and non-atoms, and so the presupposition of the feature is not met and the result is a presupposition failure. Even though (58)b would have yielded the form *boy*, it does not yield a well-formed meaning. (58)a does, which also yields the form *boy*. The feature [PL], being presupposition-less, gives a well-formed result whether it combines with [[boy]] or [[*boy]], as shown in (58)c and (58)d, but (58)c is disfavored by Maximize Presupposition, as (58)a delivers the same result but uses an item with a presupposition, the feature [SG]. Thus, (58)a is realized morphologically as *boy*, with the corresponding (atomic) semantics of [[boy]] in (55), and (58)d is realized morphologically as *boys*, with the corresponding (inclusive) semantics of [[*boy]].

Numerals denote numbers, of type $\langle n \rangle$ in this system (cf. (7), (8)), following Hackl (2001), Krifka (1995), Rothstein (2011) and many others. They occupy the specifier position of NumeralP ('NumP' for Scontras), a projection headed by Numeral⁰, occupied by the cardinality predicate CARD in our case, and with NP as its syntactic argument:¹⁸

(59)



Crucial here is the work of CARD, whose semantics is as follows, also as in Hackl (2001) and others¹⁹, for '#' an atom-counting function:

(60) $[[[CARD]]] = \lambda P \lambda n \lambda x. P(x) \ \& \ \#x = n$

¹⁸ Scontras argues that NumeralP is more generally MeasureP, and that units of measurement other than cardinality (e.g., for weight, volume, length...) are possible. He then provides a semantics for measure phrases (*two kilos of apples*). I put measure phrases aside here (cf. Acquaviva 2005, Rothstein 2017 for arguments that NumeralPs and MeasurePs are different). It is possible that my proposal in section 6 cannot maintain the generality regarding units of measurement that Scontras' account accomplishes, a matter I leave for future research.

¹⁹ (60) does not existentially quantify over individuals, which CARD is assumed to do in many accounts. Existential quantification can be carried out by a (silent) quantifier higher in the structure.

CARD takes a predicate P and a number n and returns the set of individuals in P each of which is constituted of exactly n atoms. Given these assumptions, the reason why in a language of the first type, like English, *two boys* is possible but *two boy* isn't is as follows. First, CARD may combine with either $[[\text{boy}]]$ or $[[*\text{boy}]]$:

(61)

- a. $[[\text{CARD boy}]] = \lambda n \lambda x. [[\text{boy}]](x) \ \& \ \#x = n$
- b. $[[\text{CARD *boy}]] = \lambda n \lambda x. [[*\text{boy}]](x) \ \& \ \#x = n$

Either (61)a or (61)b may then combine with the numeral, though the result is not well-formed for (61)a (there are no members in $[[\text{boy}]]$ constituted of exactly 2 atoms):

(62)

- a. $\#[[\text{two CARD boy}]]$
- b. $[[\text{two CARD *boy}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 2$

There are then two possibilities to consider in Number⁰: either (62)b combines with [SG], as in (63)a, or it combines with [PL], as in (63)b:

(63)

- a. $\#[[\text{SG two CARD *boy}]] \rightarrow \textit{two boy}$
- b. $[[\text{PL two CARD *boy}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 2 \rightarrow \textit{two boys}$

(63)a is a presupposition failure, and hence so is *two boy*, because there are no members in the denotation of its input (in (62)b) constituted of exactly 1 atom. Only (63)b is well-formed, which correctly gives rise to *two boys* and to its correct semantics. For *one*, Scontras appeals to an additional Economy Principle, in (64):

(64) Given two expressions that are denotationally equivalent and where one expression is more complex than the other, choose the simpler expression

(65) provides the two possibilities we have for NumeralP at this point:

(65)

- a. $[[\text{one CARD boy}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1$
- b. $[[\text{one CARD *boy}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 1$

We then have the following four possibilities for NumberP:

(66)

- a. $[[\text{SG one CARD boy}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1 \rightarrow \textit{one boy}$
- b. $\#[[\text{SG one CARD *boy}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 1 \rightarrow \textit{one boy}$
- c. $\#[[\text{PL one CARD boy}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1 \rightarrow \textit{one boys}$
- d. $\#[[\text{PL one CARD *boy}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 1 \rightarrow \textit{one boys}$

In (66)a, the presuppositions of [SG] are satisfied by the denotation of its input, a set of atoms. This means that it, and not (66)c, is chosen, and *one boy* results (with the correct semantics), not *one boys*. (66)b and (66)d are ruled out by the Economy Principle in (64), since they are denotationally equivalent to (66)a but are more complex (since

[[*boy]] is used, and [[*boy]] is more complex than [[boy]]). Because there is at least one successful derivation for *one boy* ((66)a, not (66)b), *one boy* is predicted to be grammatical in English, or, more generally, in languages of type 1, correctly.

For languages of type 2, such as Turkish, Scontras also assumes (55) (which, as we know, is correct for singular forms in Turkish, and may or may not be correct for plural forms) and the same syntax as above. There is a crucial difference, however, in that in Turkish, [SG] is stipulated to be sensitive to relative atomicity, as opposed to English [SG]. Being sensitive to relative atomicity, or P-atomicity, means that what counts as an atom for a predicate P is relative to what is in P—for any P, the relative atoms of P are those members of P which have no parts in P:

- (67) $\text{card}_{P\text{-atom}}(x)$ is defined only when $P(x)=1$.
When defined, $\text{card}_{P\text{-atom}}(x) = \{y \in P: y \leq x \ \& \ \neg \exists z \in P \ z < y\}$

The cardinality of the set that contains those relative atoms is what Turkish [SG] is sensitive to. The number features assumed for Turkish are in (68), with [SG_T] being the singular number feature for Turkish (I'll speak of [SG_E] from now on for English [SG]), and with [PL] still presupposition-less:

- (68) $[[\text{SG}_T]] = \lambda P: \forall x \in P [\text{card}_{P\text{-atom}}(x)=1].P$
 $[[\text{PL}]] = \lambda P.P$

For numeral-less phrases, this system gives rise to the following:

- (69)
- | | |
|--|-------------------------------|
| a. $[[\text{SG}_T \text{ çocuk}]] = [[\text{boy}]] = \{L, D, G\}$ | $\rightarrow \text{çocuk}$ |
| b. $\#[[\text{SG}_T * \text{ çocuk}]]$ | $\rightarrow \text{çocuk}$ |
| c. $\#[[\text{PL çocuk}]]$ | $\rightarrow \text{çocuklar}$ |
| d. $[[\text{PL çocuk}]] = [[* \text{ boy}]] = \{L, D, G, L+D, L+G, D+G, L+D+G\}$ | $\rightarrow \text{çocuklar}$ |

In (69)a, the presupposition of [SG_T] is satisfied, since [[çocuk]] denotes a set of individuals that have no parts that are also in [[çocuk]]. This is not true in the case of (69)b, which is thus a presupposition failure—it is not the case that all members of the sister of [SG_T] are P-atoms, since the set contains plural individuals and their parts. (69)a is correctly realized as *çocuk* and gives rise to the desired semantics. Both (69)c and (69)d satisfy the requirements of [PL], since this feature imposes no requirements. (69)c, however, expresses the same meaning as (69)a, and (69)a is presuppositional while (69)c is not, so (69)c is not selected. (69)d is morphologically realized as *çocuklar* 'boys' and gives rise to the desired semantics. For phrases with a numeral, we have:

- (70)
- | |
|--|
| a. $[[\text{CARD boy}]] = \lambda n \lambda x. [[\text{boy}]](x) \ \& \ \#x = n$ |
| b. $[[\text{CARD *boy}]] = \lambda n \lambda x. [[* \text{ boy}]](x) \ \& \ \#x = n$ |

- (71)
- | |
|--|
| a. $\#[[\text{two CARD boy}]]$ |
| b. $[[\text{two CARD *boy}]] = \lambda x. [[* \text{ boy}]](x) \ \& \ \#x = 2$ |

Maximize Presupposition chooses (72)a over (72)b, giving rise to *iki çocuk* ‘two boys’ with the correct semantics:

(72)

- a. $[[[SG_T \text{ two CARD *boy}]] = \lambda x. [[[*boy]](x) \ \& \ \#x = 2 \quad \rightarrow \textit{iki çocuk}$
 b. $[[[PL \text{ two CARD *boy}]] = \lambda x. [[[*boy]](x) \ \& \ \#x = 2 \quad \rightarrow \textit{iki-çocuklar}$

Maximize Presupposition chooses (73)a over (73)c; (73)b and (73)d are not selected because there is a less complex expression for each one, (73)a and (73)c, respectively, as per the Economy Principle in (64). The correct realization and meaning result:

(73)

- a. $[[[SG_T \text{ one CARD boy}]] = \lambda x. [[boy]](x) \ \& \ \#x = 1 \quad \rightarrow \textit{bir çocuk}$
 b. $\#[[SG_T \text{ one CARD *boy}]] = \lambda x. [[[*boy]](x) \ \& \ \#x = 1 \quad \rightarrow \textit{bir-çocuk}$
 c. $\#[[PL \text{ one CARD boy}]] = \lambda x. [[boy]](x) \ \& \ \#x = 1 \quad \rightarrow \textit{bir-çocuklar}$
 d. $\#[[PL \text{ one CARD *boy}]] = \lambda x. [[[*boy]](x) \ \& \ \#x = 1 \quad \rightarrow \textit{bir-çocuklar}$

The account of Turkish *bir* ‘one’ and English *one* combinations is the same, even if $[[[SG_T]] \neq [[SG_E]]$, since with respect to a set of atoms, absolute atomicity and relative atomicity yield the same result (cf. (66) and (73)). Given $[SG_T]$, twosomes count as atomic for Turkish *iki* ‘two’ (threesomes for *üç* ‘three’, etc.), so nouns are morphologically singular with all numerals ((72)). They do not count as atomic for $[SG_E]$.

The account for languages of type 3 is simply that the singular feature in this language is ambiguous between $[SG_T]$ and $[SG_E]$. Western Armenian *meg* ‘one’ surfaces with morphologically singular nouns because both (66) and (73) yield the same result. When $[SG_T]$ is used with *yergu* ‘two’, etc., a morphologically singular noun surfaces ((72)). When, instead, $[SG_E]$ is used, a morphologically plural noun surfaces ((63)). $[SG_T]$ and $[SG_E]$ do not compete with each other in Western Armenian, since they are both equally presuppositional. The correct semantics is produced.

5 Scontras' [SG_T] ≈ Harbour's [+minimal]

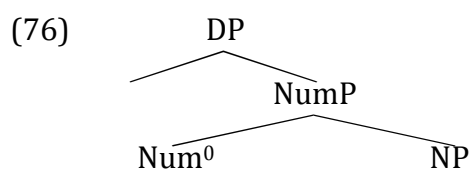
While Scontras manages to account for the cross-linguistic patterns in Table 1 with a single semantics for all numerals (including *one*) and without claiming that morphologically singular nouns in Turkish or Western Armenian are number neutral, the sensitivity of [SG_T] to relative atomicity serves no purpose other than to derive the Turkish and Western Armenian patterns. This is a stipulation that should be derived from independently needed principles, with the hope that doing so would constrain the possible range of meanings that the singular feature can have. Here, I address this problem by arguing that Harbour's (2011, 2014) [+minimal] feature, which he shows to be part of a general compositional theory of number values, and thus motivated independently, has the same effect as Scontras' [SG_T]. Seeing [SG_T] as Harbour's [+minimal], we can derive the language type 1 vs. language type 2 pattern in precisely the principled way we are after. That is, according to the proposal made below, numeral+noun constructions in languages of type 2 use the form of the noun that they do because the theory of grammar assigns those languages a [±minimal] number system. After introducing Harbour (2014), I argue, with the help of Martí (2017a, b), that deriving Scontras' stipulation requires us to abandon Saulerland's (2003) theory of plurality, on which Scontras' system is built, as we saw in section 4.

Harbour (2014; see also 2011) derives all possible number values (singular, plural, minimal, paucal, etc.) from a compositional theory of number features. Two of the three features he postulates are [±atomic] and [±minimal]:²⁰

$$(74) \quad \begin{aligned} [[+atomic]] &= \lambda P \lambda x. P(x) \ \& \ \text{atom}(x) \\ [[-atomic]] &= \lambda P \lambda x. P(x) \ \& \ \neg \text{atom}(x) \end{aligned}$$

$$(75) \quad \begin{aligned} [[+minimal]] &= \lambda P \lambda x. P(x) \ \& \ \neg \exists y P(y) \ \& \ y < x \\ [[-minimal]] &= \lambda P \lambda x. P(x) \ \& \ \exists y P(y) \ \& \ y < x \end{aligned}$$

He assumes a syntax like that in (76), and a semantics for count NPs, the input to the number features, as in (77):



$$(77) \quad [[NP]] = \{L, D, G, L+D, L+G, D+G, L+D+G\}$$

(77) contains both atoms and non-atoms. [±Atomic] is sensitive to atoms, like [SG_E], whereas [±minimal] is sensitive to minimal parts, just like [SG_T]. The number system of a given language may choose one or more features. If it just chooses [±atomic], a

²⁰ 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. (i) is Harbour's semantics for [±minimal]:

$$(i) \quad \begin{aligned} [[+minimal]] &= \lambda P \lambda x. P(x). \neg \exists y P(y) \ \& \ y < x \\ [[-minimal]] &= \lambda P \lambda x. P(x). \exists y P(y) \ \& \ y < x \end{aligned}$$

Nothing of what I say here depends on this. [±Atomic] is of type <e,t>, not <et, et>, in his proposal, but, again, the difference is not important here.

straightforward singular-plural system like that of English, Spanish or German results. Languages may choose [\pm minimal] instead, or both [\pm minimal] and [\pm atomic] (see below). These features may combine with a third feature, [\pm additive], not discussed here, with well-formed feature combinations giving rise to the attested number values in the number systems of the languages of the world. Importantly, the full cross-linguistic typology of number system is derived from this small set of principles.

In many cases, as shown in Harbour (2011), it is impossible to tell whether a system is [\pm atomic] or [\pm minimal]. That's because, in the basic case, $[[+\text{atomic}]](P) = [[+\text{minimal}]](P)$, and $[[-\text{atomic}]](P) = [[-\text{minimal}]](P)$. Justification for [\pm minimal] comes from cases where the two features come apart. One such case is presented by languages that distinguish inclusive from exclusive first person pronouns or agreement markers, such as Winnebago (Lipkind 1945), as shown in Table 2:

	minimal	augmented
1 st person exclusive	ha-	ha- -wi
1 st person inclusive	hin-	hin- -wi
2 nd person	ra-	ra- -wi
3 rd person	∅-	∅- -ire

Table 2 Winnebago agreement

Since the speaker-hearer dyad is the minimal unit of the first person inclusive, it counts as [$+$ minimal] ((75)), but not as [$+$ atomic] ((74)). All of the augmented forms are [$-$ minimal] instead of [$-$ atomic]: that's more than 1 for all persons except for the first person inclusive, for which it is more than 2 (i.e., more than the speaker-hearer dyad).

Another case in which the difference between [\pm atomic] and [\pm minimal] can be appreciated is in systems that have both (cf. Noyer 1992). These are singular-dual-plural systems, found in many languages. Suppose the feature value [$-$ atomic] applied first to a predicate, and then [$+$ minimal] applied:

(78) $[[+\text{minimal}]]([[-\text{atomic}]](P))$

[$-$ Atomic] yields the subset of P, call it Q, that contains all and only the non-atoms in P. Q is then the input for [$+$ minimal], which delivers the subset of Q that contains all and only those individuals in Q which have no subparts in Q. This is the set containing all the plural P-individuals each of which is constituted of exactly 2 atoms. Thus, (78) gives rise to dual number, morphologically and semantically. (79) shows the three possible number values in a [\pm atomic, \pm minimal] system:

(79) $[[+\text{minimal}]]([[+\text{atomic}]](P)) \rightarrow$ singular
 $[[-\text{minimal}]]([[+\text{atomic}]](P)) \rightarrow$ #
 $[[+\text{minimal}]]([[-\text{atomic}]](P)) \rightarrow$ dual
 $[[-\text{minimal}]]([[-\text{atomic}]](P)) \rightarrow$ plural

Harbour derives the cross-linguistic typology of number systems from these assumptions. Impossible number systems cannot be derived in his account. E.g., a number system with dual but no plural cannot be derived because [$-$ atomic] is a building block of both dual and plural, so dual cannot exist without plural. Plural can exist without dual because dual necessitates [\pm minimal], whereas plural doesn't.

Importantly, [+minimal] achieves the same result as Scontras' [SG_T]. To see this, consider (72)a again, in (80)b, where [SG_T] applies to (71)a, in (80)a, and compare it to the result of applying [+minimal] to (71)a, in (80)c:

(80)

- a. [[two CARD *boy]] = $\lambda x. [[*boy]](x) \ \& \ \#x = 2$
- b. [[SG_T two CARD *boy]] = $\lambda x. [[*boy]](x) \ \& \ \#x = 2$
- c. [[[+minimal] two CARD *boy]] = $\lambda x. [[*boy]](x) \ \& \ \#x = 2$

[SG_T] checks that the set P denoted by its argument contains only plural boy individuals with no subparts in P. P contains only plural boy individuals each of which is constituted of exactly 2 atoms, and nothing else, as in (80)a, which indeed satisfies [SG_T]. Thus, NumberP in (80)a, with Scontras' [SG_T], is a set of plural boy individuals each of which is constituted of exactly 2 atoms. [+Minimal] is not presuppositional, but it still has the effect that NumberP denotes a set of plural boy individuals each of which is constituted of exactly 2 atoms.

In other words, we can replace [SG_T] with [+minimal]. This is important because the cost of Scontras' analysis diminishes substantially once this is accepted: while we still have to state that Turkish uses [+minimal] where English uses [+atomic], the fact that [+minimal] is used simply follows from Harbour's system. The amount of variation we predict is now principally constrained.

This can only be achieved if languages of type 2 are [\pm minimal] systems—in Harbour's system, if [+minimal] can be the value of Number⁰, then so can [−minimal]. Important questions arise now. What happens with [−minimal] in Scontras' analysis, given that there is no difference between [+minimal] and [−minimal] in presuppositional terms? And what about [PL]? More generally, the question is how plurals, and numeral+noun combinations, are derived if languages of type 2 are [\pm minimal] systems.

As it turns out, there is a basic incompatibility between Sauerland's (2003) proposal (and hence Scontras') and Harbour (2014): Martí (2017a, b) shows that embedding a view of plurality like Sauerland's in Harbour's system makes the wrong predictions about the cross-linguistic typology of plurality. As pointed out earlier, plural noun forms in English give rise to either exclusive or inclusive readings. The plural forms in (81) are interpreted inclusively: e.g., according to (81)a, Lina harvested neither one nor more tomatoes. Denotationally, this means that [[tomatoes]] should include both singular and plural tomato individuals:

(81)

- a. Lina didn't harvest **tomatoes**
- b. No **students** came to the party
- c. I don't have **children**
- d. Do you have **children**?

In upward-entailing (non-question) contexts, on the other hand, these same forms are usually interpreted exclusively. If (82)a is true, for example, Lina needs to have harvested more than one tomato:

(82)

- a. Lina harvested **tomatoes**

- b. **Students** came to the party
- c. I have **children**

Two main types of accounts of the distribution of exclusive and inclusive plurals in languages like English have been pursued. In the first type, plural forms are ambiguous between exclusive and inclusive readings (Farkas and de Swart 2010, Grimm 2012, Martí 2017a, b). According to the second type, plural forms are unambiguously inclusive and exclusive readings arise only pragmatically (via implicature, as in Spector 2007, or via Maximize Presupposition, as in Sauerland 2003 and others and as discussed in section 4; note that these principles are sensitive to the monotonic properties of the environment the plural form finds itself in). I refer to the second type of account as the Sauerland-style view of plurality—for our purposes, exactly how this approach is implemented is not so important, as all of these systems are [+atomic]-only systems. In either type of account, the semantics of [PL] in languages with only exclusive plurals can be treated as unambiguously exclusive.

Importantly for us, Martí (2017a, b) argues that the Sauerland-style view of plurality is incompatible with Harbour's account. Her argument is as follows. First, note that Sauerland-style accounts of plurality amount, in Harbour's terms, to the postulation of number systems that deploy [+atomic] (or, if wanted, a presuppositional version of it) to the exclusion of [-atomic]. [+Atomic]-only languages are languages with singulars and with inclusive plurals in downward-entailing questions and questions, like English. Given Sauerland's pragmatics, based on Maximize Presupposition, exclusive plurals arise via implicature (recall section 4). However, if languages can deploy [+atomic] without also deploying [-atomic], then it follows that such languages cannot use [-atomic] elsewhere in their number system. But Harbour (2011) and others argue that [-atomic] is used to derive dual number, as we saw earlier. A Sauerland-style view of plurality, combined with Harbour's approach to number, predicts that languages with dual number should not have inclusive plurals. This is contrary to fact: Martí shows that languages with both duals and inclusive plurals exist. Either the Sauerland-style view of plurality, or Harbour's theory of number, has to be abandoned.

A solution considered by Martí consists in embedding an ambiguity account of plurality within Harbour's system, using Farkas and de Swart's (2010) Strongest Meaning Hypothesis to explain the distribution of exclusive and inclusive plurals. The availability of inclusive plurals is due in this proposal to the possibility of not projecting NumberP (that is, having no number features operating on NP). Languages like English associate noun phrases where NumberP is not projected with plural forms (more on this assumption in section 6). This then derives the number neutrality associated with inclusive plurals in the right contexts. The availability of exclusive plurals is due to [-atomic]. Their distribution is regulated by the Strongest Meaning Hypothesis.

This analysis of plural forms being the only one that is compatible with the derivation of Scontras' [SG_T] from Harbour's theory²¹, a language like English must be a [±atomic] language with the possibility of not projecting NumberP. But this means that [PL] in English cannot be Scontras' [PL]. Thus, an alternative account of the cross-linguistic pattern in Table 1 is necessary if we want to be able to properly constrain the contribution of singular features across languages. In the account in section 6, whether a language has inclusive plurals or not is unrelated to which pattern it chooses for the noun+numeral construction—since we have no evidence that these two sets of facts are

²¹ Martí considers other possibilities, but they come very close to postulating the [-atomic] feature.

related, the null hypothesis is that the account of the latter should not rely on the former. At the very least, such a hypothesis needs to be considered alongside Scontras'.

Before providing that account, I demonstrate that adding a [-atomic]/exclusive plurality feature to Scontras' system does not work. In order for this demonstration to have full generality, I provide it in two versions: one for a language with inclusive plurals in addition to exclusive ones, one for a language with only exclusive plurals. We have no reason to suppose that the pattern in Table 1 is dependent on the nature of plurality in the language in question—e.g., as far as I know, languages of type 1 could be languages without inclusive plurals. It thus is important to understand, for any given account of the semantics of the numeral+noun construction, how reliant it is on assumptions about plurality. I will subject my own proposal in section 6 to the same scrutiny.

Let us begin with the possibility that a language of type 1 has inclusive plurals, an example of which is English. In keeping with Martí's arguments, we add the feature [EX-PL] to Scontras' system, with the following contribution ([IN-PL] is Scontras' [PL]):

$$(83) \quad \begin{aligned} [[SG_E]] &= \lambda P: \forall x \in P [\#x=1].P \\ [[EX-PL]] &= \lambda P: \forall x \in P [\#x>1].P \\ [[IN-PL]] &= \lambda P.P \end{aligned}$$

(83) is compatible with Harbour's, and thus Martí's, proposal, or, at least, it can be made compatible with it, as [SG_E] is very close to [+atomic], and [EX-PL], to [-atomic]. Both [EX-PL] and [IN-PL] are spelled out by -s. No wrong prediction concerning languages with dual number and inclusive plurals are made, as we can hypothesize that [EX-PL], or something very close to it, is one of building blocks of the dual. We also need to add a third possible denotation for nouns, else [EX-PL] is useless:

$$(84) \quad \begin{aligned} [[boy]] &= \{L, D, G\} \\ [[*boy]] &= \{L, D, G, L+D, L+G, D+G, L+D+G\} \\ [[+boy]] &= \{L+D, L+G, D+G, L+D+G\} \end{aligned}$$

In this case, the English pattern is still predicted correctly. Consider first noun phrases without numerals in English:

$$(85) \quad \begin{array}{ll} \text{a. } [[SG_E \text{ boy}]] = \{L, D, G\} & \rightarrow \textit{boy} \\ \text{b. } \#[[SG_E +\text{boy}]] & \rightarrow \textit{boy} \\ \text{c. } \#[[SG_E *\text{boy}]] & \rightarrow \textit{boy} \\ \text{d. } \#[[EX-PL \text{ boy}]] & \rightarrow \textit{boys} \\ \text{e. } [[EX-PL +\text{boy}]] = \{L+D, L+G, D+G, L+D+G\} & \rightarrow \textit{boys} \\ \text{f. } \#[[EX-PL *\text{boy}]] & \rightarrow \textit{boys} \\ \text{g. } \#[[IN-PL \text{ boy}]] = \{L, D, G\} & \rightarrow \textit{boys} \\ \text{h. } \#[[IN-PL +\text{boy}]] = \{L+D, L+G, D+G, L+D+G\} & \rightarrow \textit{boys} \\ \text{i. } [[IN-PL *\text{boy}]] = \{L, D, G, L+D, L+G, D+G, L+D+G\} & \rightarrow \textit{boys} \end{array}$$

(85)g and (85)h are ruled out by Maximize Presupposition (because of (85)a and (85)e, respectively). (85)e gives rise to *boys* with an exclusive semantics, and (85)i, to *boys* with an inclusive semantics. For the case of numerals, we consider, as usual, the case of numerals greater than 1, in (86), and the case of *one*, in (87):

(86)

- a. $[[\text{CARD boy}]] = \lambda n \lambda x. [[\text{boy}]](x) \ \& \ \#x = n$
 b. $[[\text{CARD *boy}]] = \lambda n \lambda x. [[*\text{boy}]](x) \ \& \ \#x = n$
 c. $[[\text{CARD +boy}]] = \lambda n \lambda x. [[+\text{boy}]](x) \ \& \ \#x = n$
 d. $\#[[\text{two CARD boy}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 2$
 e. $[[\text{two CARD *boy}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 2$
 f. $[[\text{two CARD +boy}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2$
 g. $\#[[\text{SGE two CARD *boy}]] \rightarrow \text{two boy}$
 h. $\#[[\text{SGE two CARD +boy}]] \rightarrow \text{two boy}$
 i. $[[\text{EX-PL two CARD *boy}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 2 \rightarrow \text{two boys}$
 j. $[[\text{EX-PL two CARD +boy}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2 \rightarrow \text{two boys}$
 k. $\#[[\text{IN-PL two CARD *boy}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 2 \rightarrow \text{two boys}$
 l. $\#[[\text{IN-PL two CARD +boy}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2 \rightarrow \text{two boys}$

(86)g and (86)h are presupposition failures, but they are the only sources of *two boy*, so *two boy* is correctly predicted to be ungrammatical. (86)k and (86)l lose out on the basis of Maximize Presupposition to (86)i and (86)j, respectively. *Two boys* thus has two sources, (86)i and (86)j, but they give rise to the same, correct meaning for it, so they can harmlessly co-exist. Both Maximize Presupposition and the Economy Principle of section 4 get put to use in the case of *one*:

(87)

- a. $[[\text{one CARD boy}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1$
 b. $\#[[\text{one CARD +boy}]]$
 c. $[[\text{one CARD *boy}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 1$
 d. $[[\text{SGE one CARD boy}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1 \rightarrow \text{one boy}$
 e. $\#[[\text{SGE one CARD *boy}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 1 \rightarrow \text{one boy}$
 f. $\#[[\text{EX-PL one CARD boy}]] \rightarrow \text{one boys}$
 g. $\#[[\text{EX-PL one CARD *boy}]] \rightarrow \text{one boys}$
 h. $\#[[\text{IN-PL one CARD boy}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1 \rightarrow \text{one boys}$
 i. $\#[[\text{IN-PL one CARD *boy}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 1 \rightarrow \text{one boys}$

(87)d gives rise to *one boy* with the correct semantics. (87)e loses against it on the basis of Scontras' economy principle. (87)h is less presuppositional than (87)d, so Maximize Presupposition rules it out as a source for the ungrammatical *one boys*. (87)i loses out against (87)d on the basis of economy, so the only other source for *one boys* ((87)f and (87)g are presupposition failures) is also ruled out, and *one boys* is predicted to be ungrammatical.

The next possibility to consider is that of a language of type 1 without inclusive plurals. Such languages receive the correct treatment if a feature [EX-PL], and no [IN-PL], is part of the system:

- (88) $[[\text{SGE}]] = \lambda P: \forall x \in P [\#x=1].P$
 $[[\text{EX-PL}]] = \lambda P: \forall x \in P [\#x>1].P$

- (89) $[[\text{boy}]] = \{L, D, G\}$
 $[[+\text{boy}]] = \{L+D, L+G, D+G, L+D+G\}$

There is no role for Maximize Presupposition in this case, as both features in (88) are presuppositional, but this isn't a problem here:

(90)

- | | |
|--|----------------------------|
| a. $[[\text{SG}_E \text{ boy}]] = \{L, D, G\}$ | $\rightarrow \text{boy}$ |
| b. $\#[[\text{SG}_E +\text{boy}]]$ | $\rightarrow \text{boy}$ |
| c. $\#[[\text{EX-PL boy}]]$ | $\rightarrow \text{boys}}$ |
| d. $[[\text{EX-PL} +\text{boy}]] = \{L+D, L+G, D+G, L+D+G\}$ | $\rightarrow \text{boys}$ |

The correct semantics obtains for *boy* and *boys*. For the numeral *two*, we have, correctly:

(91)

- | | |
|---|-------------------------------|
| a. $[[\text{CARD boy}]] = \lambda n \lambda x. [[\text{boy}]](x) \ \& \ \#x = n$ | |
| b. $[[\text{CARD} +\text{boy}]] = \lambda n \lambda x. [[+\text{boy}]](x) \ \& \ \#x = n$ | |
| c. $\#[[\text{two CARD boy}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 2$ | |
| d. $[[\text{two CARD} +\text{boy}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2$ | |
| e. $\#[[\text{SG}_E \text{ two CARD} +\text{boy}]]$ | $\rightarrow \text{two boy}}$ |
| f. $[[\text{EX-PL two CARD} +\text{boy}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2$ | $\rightarrow \text{two boys}$ |

And finally, for *one*:

(92)

- | | |
|---|--------------------------------|
| a. $[[\text{one CARD boy}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1$ | |
| b. $\#[[\text{one CARD} +\text{boy}]]$ | |
| c. $[[\text{SG one CARD boy}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1$ | $\rightarrow \text{one boy}$ |
| d. $\#[[\text{EX-PL one CARD boy}]]$ | $\rightarrow \text{one boys}}$ |

Languages of type 2 are more problematic, however. Consider a language of type 2 without inclusive plurals first (the same results obtain if the features were $[\pm\text{minimal}]$):

- (93) $[[\text{SG}_T]] = \lambda P: \forall x \in P [\text{card}_{P-\text{atom}}(x) = 1].P$
 $[[\text{EX-PL}]] = \lambda P: \forall x \in P [\#x > 1].P$

- (94) $[[\text{çocuk}]] = [[\text{boy}]] = \{L, D, G\}$
 $[[+\text{çocuk}]] = [[+\text{boy}]] = \{L+D, L+G, D+G, L+D+G\}$

The problem is that it is no longer predicted that numerals greater than 2 in these languages do not combine with plural-marked nouns, as both features in (93) are (equally) presuppositional and thus one cannot be picked over the other on the basis of Maximize Presupposition. The derivation of bare nouns, whether morphologically singular or plural, is unproblematic and gives rise to the correct semantics:

(95)

- | | |
|--|--------------------------------|
| a. $[[\text{SG}_T \text{ çocuk}]] = \{L, D, G\}$ | $\rightarrow \text{çocuk}$ |
| b. $\#[[\text{SG}_T +\text{çocuk}]]$ | $\rightarrow \text{çocuk}}$ |
| c. $\#[[\text{EX-PL çocuk}]]$ | $\rightarrow \text{çocuklar}}$ |
| d. $[[\text{EX-PL} +\text{çocuk}]] = \{L+D, L+G, D+G, L+D+G\}$ | $\rightarrow \text{çocuklar}$ |

The problem arises for numerals greater than 1 because of the impossibility of choosing (96)e over (96)f:

(96)

- a. $[[\text{CARD } \text{çocuk}]] = \lambda n \lambda x. [[\text{boy}]](x) \ \& \ \#x = n$
- b. $[[\text{CARD } +\text{çocuk}]] = \lambda n \lambda x. [[+\text{boy}]](x) \ \& \ \#x = n$
- c. $\#[[\text{iki CARD } \text{çocuk}]]$
- d. $[[\text{iki CARD } +\text{çocuk}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2$
- e. $[[\text{SG}_T \text{ iki CARD } +\text{çocuk}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2 \quad \rightarrow \text{iki } \text{çocuk}$
- f. $[[\text{EX-PL iki CARD } +\text{çocuk}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2 \quad \rightarrow \text{iki } \text{çocuklar}$

Note that the problem arises only with numerals greater than 1—(97)d is ruled out as a presupposition failure, so (97)c is the only possible source for *bir N*, and *bir çocuk* results, with the correct semantics:²²

(97)

- a. $[[\text{bir CARD } \text{çocuk}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1$
- b. $\#[[\text{bir CARD } +\text{çocuk}]]$
- c. $[[\text{SG}_T \text{ bir CARD } \text{çocuk}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1 \quad \rightarrow \text{bir } \text{çocuk}$
- d. $\#[[\text{EX-PL bir CARD } \text{çocuk}]] \quad \rightarrow \text{bir } \text{çocuklar}$

Problems with numerals also arise for type 2 languages with inclusive plurals. (100) shows that the correct results obtain for bare nouns, (101) is where problems arise:

²² Assuming an additional denotation for nouns for type 2 languages, as in (i), doesn't help, as numerals greater than 2 are still predicted to combine either with singular or with plural nouns. The impossibility of choosing (ii)n/(ii)m over (ii)o/(ii)p is what causes the problem, as (ii)o and (ii)p are well formed:

- (i) $[[\text{çocuk}]] = [[\text{boy}]] = \{L, D, G\}$
- $[[+\text{çocuk}]] = [[+\text{boy}]] = \{L+D, L+G, D+G, L+D+G\}$
- $[[*\text{çocuk}]] = [[*\text{boy}]] = \{L, D, G, L+D, L+G, D+G, L+D+G\}$
- (ii)
 - a. $[[\text{SG}_T \text{ çocuk}]] = \{L, D, G\} \quad \rightarrow \text{çocuk}$
 - b. $\#[[\text{SG}_T *\text{çocuk}]] \quad \rightarrow \text{çocuk}$
 - c. $\#[[\text{SG}_T +\text{çocuk}]] \quad \rightarrow \text{çocuk}$
 - d. $\#[[\text{EX-PL } \text{çocuk}]] \quad \rightarrow \text{çocuklar}$
 - e. $\#[[\text{EX-PL } *\text{çocuk}]] \quad \rightarrow \text{çocuklar}$
 - f. $[[\text{EX-PL } +\text{çocuk}]] = \{L+D, L+G, D+G, L+D+G\} \quad \rightarrow \text{çocuklar}$
 - g. $[[\text{CARD } \text{çocuk}]] = \lambda n \lambda x. [[\text{boy}]](x) \ \& \ \#x = n$
 - h. $[[\text{CARD } *\text{çocuk}]] = \lambda n \lambda x. [[*\text{boy}]](x) \ \& \ \#x = n$
 - i. $[[\text{CARD } +\text{çocuk}]] = \lambda n \lambda x. [[+\text{boy}]](x) \ \& \ \#x = n$
 - j. $\#[[\text{iki CARD } \text{çocuk}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 2$
 - k. $[[\text{iki CARD } *\text{çocuk}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 2$
 - l. $[[\text{iki CARD } +\text{çocuk}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2$
 - m. $[[\text{SG}_T \text{ iki CARD } +\text{çocuk}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2 \quad \rightarrow \text{iki } \text{çocuk}$
 - n. $[[\text{SG}_T \text{ iki CARD } *\text{çocuk}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 2 \quad \rightarrow \text{iki } \text{çocuk}$
 - o. $[[\text{EX-PL iki CARD } *\text{çocuk}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 2 \quad \rightarrow \text{iki } \text{çocuklar}$
 - p. $[[\text{EX-PL iki CARD } +\text{çocuk}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2 \quad \rightarrow \text{iki } \text{çocuklar}$
 - q. $[[\text{bir CARD } \text{çocuk}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1$
 - r. $\#[[\text{bir CARD } *\text{çocuk}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 1$
 - s. $\#[[\text{bir CARD } +\text{çocuk}]]$
 - t. $[[\text{SG}_T \text{ bir CARD } \text{çocuk}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1 \quad \rightarrow \text{bir } \text{çocuk}$
 - u. $\#[[\text{EX-PL bir CARD } \text{çocuk}]] \quad \rightarrow \text{bir } \text{çocuklar}$

- (98) $[[SG_T]] = \lambda P: \forall x \in P [\text{card}_{p\text{-atom}}(x) = 1]. P$
 $[[EX\text{-PL}]] = \lambda P: \forall x \in P [\#x > 1]. P$
 $[[IN\text{-PL}]] = \lambda P. P$

- (99) $[[\text{çocuk}]] = [[\text{boy}]] = \{L, D, G\}$
 $[[+\text{çocuk}]] = [[+\text{boy}]] = \{L+D, L+G, D+G, L+D+G\}$
 $[[*\text{çocuk}]] = [[*\text{boy}]] = \{L, D, G, L+D, L+G, D+G, L+D+G\}$

(100)

- | | |
|---|-------------------------------|
| a. $[[SG_T \text{ çocuk}]] = \{L, D, G\}$ | $\rightarrow \text{çocuk}$ |
| b. $\#[[SG_T +\text{çocuk}]]$ | $\rightarrow \text{çocuk}$ |
| c. $\#[[SG_T *\text{çocuk}]]$ | $\rightarrow \text{çocuklar}$ |
| d. $\#[[EX\text{-PL} \text{ çocuk}]]$ | $\rightarrow \text{çocuklar}$ |
| e. $[[EX\text{-PL} +\text{çocuk}]] = \{L+D, L+G, D+G, L+D+G\}$ | $\rightarrow \text{çocuklar}$ |
| f. $\#[[EX\text{-PL} *\text{çocuk}]]$ | $\rightarrow \text{çocuklar}$ |
| g. $\#[[IN\text{-PL} \text{ çocuk}]] = \{L, D, G\}$ | $\rightarrow \text{çocuklar}$ |
| h. $\#[[IN\text{-PL} +\text{çocuk}]] = \{L+D, L+G, D+G, L+D+G\}$ | $\rightarrow \text{çocuklar}$ |
| i. $[[IN\text{-PL} *\text{çocuk}]] = \{L, D, G, L+D, L+G, D+G, L+D+G\}$ | $\rightarrow \text{çocuklar}$ |

(101)

- | | |
|---|-----------------------------------|
| a. $[[CARD \text{ çocuk}]] = \lambda n \lambda x. [[\text{boy}]](x) \ \& \ \#x = n$ | |
| b. $[[CARD +\text{çocuk}]] = \lambda n \lambda x. [[+\text{boy}]](x) \ \& \ \#x = n$ | |
| c. $[[CARD *\text{çocuk}]] = \lambda n \lambda x. [[*\text{boy}]](x) \ \& \ \#x = n$ | |
| d. $\#[[iki \text{ CARD} \text{ çocuk}]]$ | |
| e. $[[iki \text{ CARD} +\text{çocuk}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2$ | |
| f. $[[iki \text{ CARD} *\text{çocuk}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 2$ | |
| g. $[[SG_T \text{ iki} \text{ CARD} +\text{çocuk}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2$ | $\rightarrow \text{iki çocuk}$ |
| h. $[[SG_T \text{ iki} \text{ CARD} *\text{çocuk}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 2$ | $\rightarrow \text{iki çocuk}$ |
| i. $[[EX\text{-PL} \text{ iki} \text{ CARD} +\text{çocuk}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2$ | $\rightarrow \text{iki çocuklar}$ |
| j. $[[EX\text{-PL} \text{ iki} \text{ CARD} *\text{çocuk}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 2$ | $\rightarrow \text{iki çocuklar}$ |
| k. $\#[[IN\text{-PL} \text{ iki} \text{ CARD} +\text{çocuk}]] = \lambda x. [[+\text{boy}]](x) \ \& \ \#x = 2$ | $\rightarrow \text{iki çocuklar}$ |
| l. $\#[[IN\text{-PL} \text{ iki} \text{ CARD} *\text{çocuk}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 2$ | $\rightarrow \text{iki çocuklar}$ |
| m. $[[bir \text{ CARD} \text{ çocuk}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1$ | |
| n. $\#[[bir \text{ CARD} +\text{çocuk}]]$ | |
| o. $[[bir \text{ CARD} *\text{çocuk}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 1$ | |
| p. $[[SG_T \text{ bir} \text{ CARD} \text{ çocuk}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1$ | $\rightarrow \text{bir çocuk}$ |
| q. $[[SG_T \text{ bir} \text{ CARD} *\text{çocuk}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 1$ | $\rightarrow \text{bir çocuk}$ |
| r. $\#[[EX\text{-PL} \text{ bir} \text{ CARD} \text{ çocuk}]]$ | $\rightarrow \text{bir çocuklar}$ |
| s. $\#[[EX\text{-PL} \text{ bir} \text{ CARD} *\text{çocuk}]]$ | $\rightarrow \text{bir çocuklar}$ |
| t. $\#[[IN\text{-PL} \text{ bir} \text{ CARD} \text{ çocuk}]] = \lambda x. [[\text{boy}]](x) \ \& \ \#x = 1$ | $\rightarrow \text{bir çocuklar}$ |
| u. $\#[[IN\text{-PL} \text{ bir} \text{ CARD} *\text{çocuk}]] = \lambda x. [[*\text{boy}]](x) \ \& \ \#x = 1$ | $\rightarrow \text{bir çocuklar}$ |

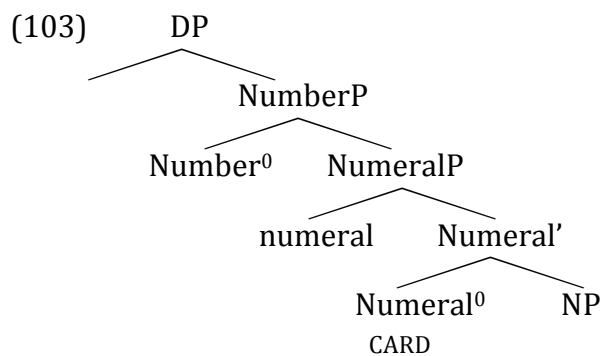
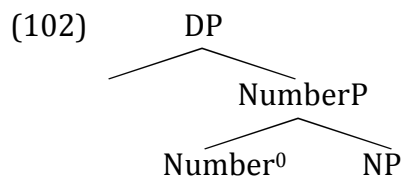
(101)i and (101)j are the problem: we can't rule them out on the basis of Maximize Presupposition via comparison with (101)g or (101)h, since the two features involved, $[SG_T]$ and $[EX\text{-PL}]$, are presuppositional. In fact, the account just sketched is what we would want for type 3 languages, since (100)-(101)/(95)-(97) give rise to the type 3

language pattern. However, if this is how type 3 languages are derived, we then have no account of type 2 languages.

In order to derive Scontras' (2014) account of types 2 and 3 languages from the independently-justified semantics for number features in Harbour (2014), Scontras' treatment of plurality has to be abandoned. That's because his treatment of plurality, as shown in Martí (2017a, b), is not compatible with Harbour (2014). An alternative account of the patterns is thus necessary.

6 A new account

The syntax of noun phrases with and without numerals is as before:



I assume Harbour's (2014) compositional theory of number features, in particular, Harbour's [\pm atomic] and [\pm minimal], repeated here:

(104) [[+atomic]] = $\lambda P \lambda x. P(x) \ \& \ \text{atom}(x)$
 [[-atomic]] = $\lambda P \lambda x. P(x) \ \& \ \neg \text{atom}(x)$

(105) [[+minimal]] = $\lambda P \lambda x. P(x) \ \& \ \neg \exists y P(y) \ \& \ y < x$
 [[-minimal]] = $\lambda P \lambda x. P(x) \ \& \ \exists y P(y) \ \& \ y < x$

As in Scontras and others, numerals denote numbers. CARD has the same semantics it had in his system too, repeated here:

(106) [[CARD]] = $\lambda P \lambda n \lambda x. P(x) \ \& \ \#x = n$

Like Harbour, I assume that the denotation of NP contains both atoms and non-atoms:

(107) [[[NP boy]]] = {L, D, G, L+D, L+G, D+G, L+D+G}

A language with inclusive plurals, as per Martí (2017a, b), allows NumberP in (102) not to be projected. I propose that type 1 languages, such as English, are [\pm atomic] systems, that type 2 languages, such as Turkish, [\pm minimal] systems, and that type 3 languages,

such as Western Armenian, have access to a [\pm atomic] system and to a [\pm minimal] system. I don't appeal to Maximize Presupposition or to the Economy Principle in (64).

In what follows, I first show how the pattern in Table 1 is derived from these assumptions. I then comment on the plausibility of Turkish number being a [\pm minimal] system, and, finally, on the idea that a language may have two number systems at its disposal but deploy only one of them at any given time, which is a crucial aspect of my analysis of type 3 languages.

A type 1 language with inclusive plurals, such as English, is derived as follows. [+Atomic] spells out as \emptyset , and [-atomic] as *-s*. Numeral-less noun phrases where NumberP is not projected spell out as *-s*, as per Martí (2017a, b):

(108)

- | | | |
|---------------------------------------|--|------------------------------|
| a. [[[+atomic] [NP boy]]] | = $\lambda x. [[[NP boy]]](x)$ and $\text{atom}(x)$ | → <i>boy</i> |
| b. [[[-atomic] [NP boy]]] | = $\lambda x. [[[NP boy]]](x)$ and $\neg \text{atom}(x)$ | → <i>boys</i> |
| c. [[[DP [NP boy]]]] | = $\lambda x. [[[NP boy]]](x)$ | → <i>boys</i> |
| d. #[[[+atomic] two CARD [NP boy]]] | | → <i>two boy</i> |
| e. [[[-atomic] two CARD [NP boy]]] | = $\lambda x. [[[NP boy]]](x)$ & $\text{card}(x) = 2$ | → <i>two boys</i> |
| f. [[[+atomic] one CARD [NP boy]]] | = $\lambda x. [[[NP boy]]](x)$ & $\text{card}(x) = 1$ | → <i>one boy</i> |
| g. #[[[-atomic] one CARD [NP boy]]] | | → <i>one boys</i> |

(108)a is the only source for *boy*, with the correct semantics. (108)b gives rise to the form *boys* and assigns it an exclusive semantics. (108)c results from a syntax where NumberP is not projected, so no number features apply to (107), giving rise to an inclusive semantics for *boys*. (108)d is ill-formed, and the only source of *two boy*, so *two boy* is correctly predicted to be ungrammatical in English. (108)e, with [-atomic] in Number⁰, is the only source for *two boys* and gives rise to the desired semantics. (108)f is the only well-formed source for *one boy*, and it, again, gives rise to the correct semantics. (108)h is ill-formed, and the only possible source for *one boys*, which is thus predicted to be ungrammatical. A type 1 language without inclusive plurals simply doesn't have (108)c available to it.

It is important to properly understand Martí's statement that the lack of NumberP is spelled out with plural forms in languages with inclusive plurals, such as English, for the account in (108) to work. There are, in particular, at least two ways of understanding it. One is that absence of NumberP is spelled out with plural forms in English. Another one is that the absence of NumberP in numeral-less noun phrases is spelled out with plural forms in English. Either way gives the correct result for bare nouns, but only the second way gives the correct result for noun phrases with numerals. If the claim applies specifically only to numeral-less noun phrases, then no further possibilities need be considered for noun phrases with numerals in (108). If, on the other hand, it is the mere absence of NumberP that prompts the choice of plural forms, the wrong predictions are made for *one boys*: this combination is ungrammatical, but it is predicted to be grammatical under this assumption—[[one CARD boy]], without NumberP but with NumeralP, would be assigned the spell out *one boys*, with the same meaning as *one boy*. Given that Martí is not concerned with the account of numerals, understanding her statement in this way does not affect her analysis of inclusive plurals.

Languages of type 2 are [\pm minimal] systems in this account. In Turkish, [+minimal] spells out as \emptyset and [-minimal] spells out as *-lar*. We thus have:

(109) [[[NP çocuk]]]

(110)

- a. $[[[+minimal] \text{ çocuk}]] = \lambda x. [[\text{ çocuk}]](x) \ \& \ \neg \exists y [[\text{ çocuk}]](y) \ \& \ y < x \ \rightarrow \text{ çocuk}$
- b. $[[[-minimal] \text{ çocuk}]] = \lambda x. [[\text{ çocuk}]](x) \ \& \ \exists y [[\text{ çocuk}]](y) \ \& \ y < x \ \rightarrow \text{ çocuklar}$
- c. $[[\text{ iki CARD çocuk}]] = \lambda x. [[\text{ çocuk}]](x) \ \& \ \text{card}(x) = 2$
- d. $[[[+minimal] \text{ iki CARD çocuk}]] = \lambda x. [[\text{ iki CARD çocuk}]](x) \ \& \ \neg \exists y [[\text{ iki CARD çocuk}]](y) \ \& \ y < x \ \rightarrow \text{ iki çocuk}$
- e. $\#[[[-minimal] \text{ iki CARD çocuk}]] \rightarrow \text{iki-çocuklar}$
- f. $[[\text{ bir CARD çocuk}]] = \lambda x. [[\text{ çocuk}]](x) \ \& \ \text{card}(x) = 1$
- g. $[[[+minimal] \text{ bir CARD çocuk}]] = \lambda x. [[\text{ bir CARD çocuk}]](x) \ \& \ \neg \exists y [[\text{ bir CARD çocuk}]](y) \ \& \ y < x \ \rightarrow \text{ bir çocuk}$
- h. $\#[[[-minimal] \text{ bir CARD çocuk}]] \rightarrow \text{bir-çocuklar}$
- i. $[[[[_{DP} \text{ çocuk}]]]] = \lambda x. [[[_{NP} \text{ çocuk}]]](x) \ \rightarrow \text{ çocuklar}$

(110)d and (110)g give the same result that [SG_T] gave in Scontras' system. (110)d denotes a set of boy individuals composed of exactly two atoms, these two-atom, plural boy individuals having no proper subparts in (110)c (which contains only plural boy individuals composed of exactly two atoms). (110)g denotes a set of boy individuals composed of exactly one atom, these atomic boy individuals having no proper subparts in (110)f (which contains only boy atoms). These are the only sources for the grammatical *iki çocuk* 'two boys' and *bir çocuk* 'one boy', respectively, which also result in the correct semantics. Crucially, no matter what numeral is present in the phrase, [-minimal], which spells out as *-lar*, never gives rise to a well-formed result ((110)e, (110)h)—that is because [-minimal] selects from its input P those individuals that have proper subparts in P, and there are no such subparts in [[*iki CARD çocuk*]], [[*bir CARD çocuk*]], etc. If Turkish does turn out to have inclusive plurals, then it also has (110)i available to it. Thus, the correct pattern is generated for type 2 languages such as Turkish from the assumptions made.

Finally, in this system languages of type 3 have at their disposal both a [\pm minimal] number system and a [\pm atomic] number system for Number⁰. In Western Armenian, [+minimal]/[+atomic] spells out as \emptyset , and [-minimal]/[-atomic] spells out as *-(n)er*. [\pm Minimal] and [\pm atomic], however, do not combine—this ensures that Western Armenian is correctly predicted not to have a dual (cf. discussion in section 5), but to have the language type 2 ((110)) and the language type 1 ((108)) patterns with numerals (if a type 3 language has inclusive plurals, then it also has (108)c/(110)). When [\pm atomic] is chosen for Number⁰, the type 1 pattern follows. Notice, in particular, that [+atomic] cannot be the feature involved in the generation of *yergu dægħa* 'two boys', since (108)d is ill-formed. However, a language like Western Armenian in this account may choose to use [\pm minimal] in Number⁰ instead, and (110)d, which uses [+minimal], results in the correct form and meaning for *yergu dægħa*. Likewise, [-minimal] cannot be the feature involved in the derivation of *yergu dægħaner* 'two boys', since (110)e uses this feature and is ill-formed. However, (108)e is also allowed in Western Armenian, and the correct form and meaning for *yergu dægħaner* results. Since both (108)g and (110)h are ill-formed, and since there is no other source for *meg dægħaner* 'one boys', *meg dægħaner* is predicted to be ungrammatical. *Meg dægħa* 'one boy' has two sources, (108)f and (110)g, both of which give rise to the correct semantics.

If this analysis is correct, then languages of type 2 are not [\pm atomic] systems but [\pm minimal] systems. The next question is whether there are other parts of the grammar of these languages where we can detect that [\pm minimal] is at work. One place to look,

given the discussion in section 4, is in their pronoun system—if exclusive first person is distinguished from inclusive first person, then [\pm minimal] is being used in the language. Unfortunately, Turkish does not distinguish exclusive vs. inclusive first person in its pronoun system (see Kornfilt 1997: 281), where a simple singular vs. plural distinction is made. The pronoun data on its own is thus compatible with Turkish being either a [\pm atomic] system or a [\pm minimal] system. Other languages that I hypothesize to be of type 2, such as Finnish (Karlsson 1982: 74) or Hungarian (Tompá 1968: 61) do not distinguish exclusive vs. inclusive first person either, and neither do Western Armenian or Miya (Schuh 1998: 187), languages of type 3. However, type 2 or type 3 languages with an inclusive vs. exclusive first person distinction do exist. For example, Itzaj Maya (Hofling 2000) is a candidate for a type 3 language. Itzaj Maya makes a distinction on several of its pronoun series between inclusive and exclusive first person, which in Harbour’s system is captured by making it a [\pm minimal] number system. In addition, it makes an obligatory singular-plural distinction on its nouns (Hofling 2000: 118). Importantly, when nouns combine with numerals²³, they may or may not take plural marking (Hofling 2000: 227). In my approach, this is because the noun system of Itzaj Maya has access to either [\pm minimal] or to [\pm atomic], but the singular-plural distinction on nouns, whether effected via [\pm minimal] or [\pm atomic], has the same surface morphological realization, like, I claim, Western Armenian²⁴.

In type 2 and type 3 languages with a distinction between inclusive and exclusive first person pronouns, then, the pronominal and nominal number systems both have access to the same feature, [\pm minimal]. One new place in the grammar of a language where we might be able to tell whether [\pm atomic] or [\pm minimal] is at work is thus numeral+noun combinations. From the perspective of Harbour (2011, 2014), this result entails that it is possible to tell whether a language has a [\pm minimal] number system outside of its pronoun system.

The final issue to address is the idea that a language would be able to use either [\pm atomic] or [\pm minimal], but not both at the same time. This is distinct from the claim that a language is a [\pm atomic, \pm minimal] system. With the latter, as we saw before, a singular-dual-plural system is generated:

- (111) [\pm minimal][\pm atomic](P) \rightarrow singular
 [-minimal][\pm atomic](P) \rightarrow #
 [\pm minimal][\pm atomic](P) \rightarrow dual
 [-minimal][\pm atomic](P) \rightarrow plural

In Harbour’s theory, if a language has a [\pm atomic, \pm minimal] number system, number values such as plain [\pm atomic], plain [\pm minimal], etc. are impossible. The claim for

²³ Spanish-based numerals are directly followed by the noun in Itzaj Maya, without mediation of classifiers, but native, non-Spanish-based numerals must be followed by a numeral classifier (Hofling 2000: 141). I put constructions that use numeral classifiers aside here, though the treatment of numerals as part of a complex NumeralP assumed here (cf. (59), (103)) is compatible with analyses of numeral classifiers such as those in Krifka (1995), Wilhelm (2008) and many others, where numeral classifiers introducing counting functions (cf. CARD).

²⁴ A prediction that my and Scontras’ account make and that remains to be confirmed is that there should be languages just like Western Armenian or Itzaj Maya but in which [-atomic] and [-minimal] (or [+atomic] and [+minimal]) are not spelled out via the same morpheme. On the surface, this would look like Western Armenian or Itzaj Maya except that the plural morpheme of nouns in the numeral+noun construction (which spells out [-atomic]) would be one of two plural morphemes (one for [-atomic], one for [-minimal]) that are used more generally in the language.

languages of type 3 is, on the contrary, that none of the complex values in (111) are possible, but each of [+atomic], [+minimal], [-atomic], and [-minimal], on their own, is. The question is whether this claim is sensible within Harbour's theory. There two aspects of it to consider: (a) whether a language's number system could, in principle, have access to [\pm atomic] and [\pm minimal] separately, and (b) if so, how these features would be deployed in such a language. In fact, Harbour's theory already assumes (a), for good empirical reasons: languages with different number distinctions in different domains (e.g., pronouns vs. nouns), exist. Consider the emphatic pronouns of Sursurunga (Corbett 2000: 26-30, Hutchisson 1986):

	singular	dual	lesser paucal	greater paucal	plural
1 st exclusive	iau	giur	gimtul	gimhat	gim
1 st inclusive		gitar	gittul	githat	git
2 nd	iáú	gaur	gamtul	gamhat	gam
3 rd	-i/on/ái	diar	gitul	dihat	di

Table 3 Sursurunga emphatic pronouns

Sursurunga has different forms of its emphatic pronouns depending on whether the number of referents is 1 (singular), 2 (dual), a very small number (lesser paucal), a slightly bigger number than that (greater paucal), or more than that (plural). Despite this level of sophistication on its emphatic pronouns, Sursurunga nouns are invariant and make no number distinctions at all (Don Hutchisson, p.c.). Independently of how Sursurunga is accounted for (for Harbour, it is a [\pm atomic, \pm minimal, \pm additive*]²⁵ system), a basic distinction has to be made between the pronominal number system and the nominal number system. The innovation needed for languages of type 3 is concerned, then, only with (b), in that, in at least some of the languages we know of, distinctions are made in one domain that are different from distinctions made in another, but for the language type 3 account above to work, two separate sets of distinctions apply in the same domain (nouns).

This state of affairs might be less problematic than it seems at first sight. Going back to Miya, mentioned in the introduction, Schuh (1989: 175, 1998: 198) shows that Miya animate and inanimate nouns in numeral+noun combinations behave differently. Consider the plurals in Table 4:

singular form	plural form	translation
kúnkul	kúnkulálàw	<i>cap</i>
kàm	kàmàmáw	<i>house</i>
dəm	dəmàmàw	<i>tree</i>
dlərkiy	dlərkaw	<i>chicken</i>
‘ám	təvàm	<i>woman</i>
áfúw	cùw	<i>goat</i>

Table 4 Miya pluralization

Other nouns, such as *dlərkiy* 'chicken' follow a separate pattern, and nouns such as 'ám 'woman' and *áfúw* 'goat' have irregular plurals. When combined with numerals greater than 1, animate nouns, a class which includes all humans, most domestic animals and fowl, and some large wild animals, cannot be morphologically singular. Thus, we have:

²⁵ In Harbour (2011, 2014), features are allowed to repeat; when that is the case, it is indicated with an asterisk. Thus, in Sursurunga, [\pm additive] repeats. See Harbour (2011, 2014) for more details.

- (112) *Miya*
- | | | |
|----------------------------|---------|----------------------------|
| a. təvəm/*'ám | tsər | (cf. 'ám wútə 'one woman') |
| woman.PL/woman.SG | two | |
| 'Two women' | | |
| b. dlərkaw/*dlərkiy | fəɖə | |
| chicken.PL/chicken.SG | four | |
| 'Four chickens' | | |
| c. cùwàwáw/*áfuw | dəbítím | |
| goat.PL/goat.SG | ten | |
| 'Ten goats' | | |

This is the language type 1 pattern. For inanimate nouns, however, both morphologically singular and plural nouns are possible:

- (113) *Miya*
- | | | |
|---------------------------|--------|--|
| a. zəkìyáyàw/zəkìy | vàatlə | |
| stone.PL/stone.SG | five | |
| 'Five stones' | | |
| b. kàmámáw/kàm | máahà | |
| house.PL/house.SG | six | |
| 'Six houses' | | |
| c. kusámámàw/kùsàm | vàatlə | |
| mouse.PL/mouse.SG | five | |
| 'Five mice' | | |

Thus, for inanimate nouns, *Miya* follows the Western Armenian pattern. In our terms, this entails that only [\pm atomic] is generated in Number⁰ for animate nouns, whereas for another subset of nouns, the inanimate ones, either [\pm atomic] or [\pm minimal] is generated. Thus, we have a language where, overall, the number system has both [\pm atomic] and [\pm minimal] at its disposal, but these features are deployed differently for different nouns. According to this analysis, *Miya* is a mix of the patterns in language types 1 and 2, but a different mix for inanimate vs. animate nouns.

7 Conclusion

In this paper I have argued for an analysis of the cross-linguistic pattern in Table 1 based on the system in Scontras (2014), but with the following developments: (a) a single, number-neutral semantics for NP for all languages, as in Harbour (2011, 2014), (b) a non-arbitrary appeal to [SG_T] in the form of Harbour's [+minimal], so that what was expressed as a stipulation before is now derived from the theory of number, and (c) a Harbour-compatible understanding of inclusive and exclusive plurality, facilitated by the adoption of Mart's (2017a, b) proposal. The proposal achieves this while maintaining the appeal of Scontras' system, including his uniform interpretation for numerals across languages, and the correct treatment of bare nouns in Turkish and Western Armenian, which was shown to be a problem for Bale, Gagnon and Khanjian (2011a). I hypothesized type 1 languages to be [\pm atomic] number systems, type 2 languages to be [\pm minimal] number systems, not [\pm atomic], and type 3 languages to have both [\pm atomic]

and [\pm minimal] number systems, though the three types of languages still surface as to what descriptively appear to be singular-plural systems:

	[\pm atomic]	[\pm minimal]	[\pm atomic] or [\pm minimal]
<i>One N</i>	morphologically singular N	morphologically singular N	morphologically singular N
<i>Two, etc. N</i>	morphologically plural N	morphologically singular N	morphologically singular or plural N
Example languages	English, Spanish, German	Hungarian, Turkish, Finnish	Western Armenian, Miya, Itzaj Maya

Table 5 The three language types, according to their number system

Thus, the only element of variation in this system is the type of number system each language type has—and the type of number system a language might have is regulated by the principles of Harbour’s theory of number. In the account presented here, numerals greater than 1 combine with morphologically plural nouns in English because the members of a set of non-atoms are not atoms, and such a set can thus be characterized by [$-$ atomic] (which spells out as $-s$ in English). Such numerals combine, on the other hand, with morphologically singular nouns in Turkish because individuals in a set of non-atoms also count as having no subparts in the set, and such a set can thus be characterized by [$+$ minimal] (which spells out as \emptyset in Turkish). The individuals in a set of atoms, on the other hand, are both atoms ([$+$ atomic]) and have no subparts in the set ([$+$ minimal]), so the difference between Turkish and English is obliterated in the single case of the numeral *one*, correctly, something which follows the logic of Harbour (2011, 2014). From the perspective of Harbour (2011, 2014), the paper demonstrates that the numeral+noun construction is another domain, in addition to inclusive first person pronouns, where the difference between [\pm atomic] and [\pm minimal] may be detected. From the perspective of Scontras (2014), the paper demonstrates that the structure of his explanation of the patterns in Table 1 does not require a Sauerland-style view of plurality. Consequences of these ideas for the number marking of nouns when combined with the numeral *zero* in different languages are discussed in Martí (2017c).

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