

Crosslinguistic and experimental evidence for non-number plurals^{*}

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In this paper, I find support for the idea that plural marking shows variation across languages but can still be captured in a universal syntax (Wiltschko 2008, 2011). The proposal that the plural morpheme heads the Number Phrase (Ritter 1991; Bernstein 1991; Valois 1991; *inter alia*) is not adequate to account for plural marking in all languages. Wiltschko (2008) proposed that plurals may merge either as heads or adjuncts to various projections along the spine of the Determiner Phrase (DP, NumP, nP and the root). I provide syntactic, semantic and experimental evidence that the plural morpheme in Yucatec Maya is adjoined to the DP. I highlight evidence from other language types for variation in the syntax of plural marking, and I discuss how this variation might be constrained in particular ways. The implication of these findings is that identity of function does not imply identical syntax or semantics.

Keywords: plural marking; Number Phrase; Determiner Phrase; Yucatec Maya; sentence production; morphosyntactic priming

1. Introduction¹

In some languages, the plural marker is argued to be the head of a functional Number Phrase (often abbreviated NumP or #P). NumP functions much like the inflectional layer of the clause (Bernstein 1991; Ritter 1991, 1995; Valois 1991; *inter alia*). This proposal has received crosslinguistic support from a variety of languages including Hebrew (Ritter 1991) and Romance (Bernstein 1991; Picallo 1991; Valois 1991). Recently, however, Wiltschko (2008) proposed that languages may vary in terms of where and how plural morphology merges. She proposed that across languages plural markers can merge either as heads or as adjuncts and that they can merge at various points along the spine of the DP (at the root, the categorizing nP, NumP, or DP). In this paper, I present evidence for a DP-adjoined plural marker in Yucatec Maya. I also present the results of an experimental investigation with speakers of Yucatec Maya in which variation in the

use of optional plural marking provides additional support for the DP-adjoined analysis. In addition, I discuss crosslinguistic evidence for plural markers that merge at the level of the categorizing nP, at the Quantificational Phrase, and at the Determiner Phrase in various languages. I also discuss how this typology of plural marking might be constrained in particular ways. The clear implication of these findings is that identical syntax does not follow from identical function, as Wiltschko (2008) points out.

2. The syntax of plural marking

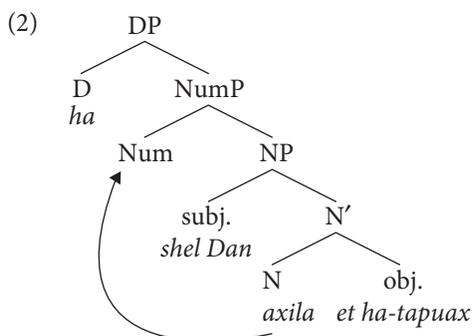
In this section, I discuss crosslinguistic variation in the morphosyntax of plural marking. First, I briefly review the literature that provides crosslinguistic support for a functional Number Phrase dominating the noun and selecting the Determiner Phrase. Then, I review the proposal of Wiltschko (2008), which argues that in some languages the plural does not merge as a head of the Number Phrase. Then, I adopt Wiltschko's diagnostics and highlight additional evidence in order to argue that the plural morpheme in Yucatec Maya is adjoined to the DP. To the best of my knowledge, this proposal is the first conclusive evidence for the DP language type presented within the diagnostics of Wiltschko's (2008) theory.

2.1 Number Phrase

Many crosslinguistic investigations of the structure of noun phrases have led to the conclusion that the head of the noun phrase is not the noun itself, but rather a functional projection that dominates the nP, called the Determiner Phrase (DP) (Abney 1987; see also Brame 1982; Kornfilt 1984; Reuland 1983; Szabolsci 1983). Additional functional projections have been posited to exist between the DP and the nP. For example, it has been argued that the Number Phrase dominates the noun (and it, in turn, is dominated by the DP) (Bernstein 1991; Carstens 1991; Delfitto & Schroten 1991; Picallo 1991; Ritter 1991, 1992; Valois 1991). The Number Phrase contains the number feature (\pm PLURAL) requiring head movement, and it has been used to explain word order variation across languages. For example, the Number Phrase is the landing site for noun movement in languages with prenominal adjectives, such as Romance (e.g. Bernstein 1991; Picallo 1991; Valois 1991). The Number Phrase is argued to be necessary to account for word order in Hebrew construct state genitive noun phrases (Ritter 1991). Assuming an underlying subject-noun-object order, the construct state genitive in (1) would have to involve movement of the noun to a projection between the DP and NP in order to derive the surface order noun-subject-object, as shown in the tree in (2).

- (1) *ha-axila shel Dan et ha-tapuax*
 the-eating of Dan of the-apple
 'Dan's eating of the apple'

(Ritter 1991:39)



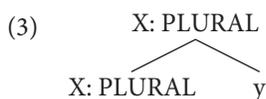
The existence of the Number Phrase as a landing site for noun movement and as the locus of plural morphology has indeed received wide crosslinguistic support. Wiltschko (2008), however, pointed out that in Halkomelem, the Number Phrase as the functional head which houses the plural morpheme is not tenable. She proposes a syntactic typology of plural marking for non-inflectional plural languages in which plural marking shows different properties. In the next sections, I outline the syntax of plural marking proposed by Wiltschko (2008).

2.2 Non-inflectional plural marking

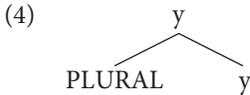
Wiltschko (2008) proposed a syntactic typology of plural marking according to which languages can vary by two parameters: (1) how the plural merges and (2) where the plural merges. In Sections 2.2.1 and 2.2.2, I review Wiltschko's proposal for how and where the plural merges, and I then apply her diagnostics to data from Yucatec Maya in Section 3.

2.2.1 How the plural merges

The first parameter along which a language may vary is how the plural marker merges: as a head or an adjunct (Wiltschko 2008). A plural morpheme that merges as the head of a phrase has the ability to change the label of the constituent with which it merges. In the tree in (3) (adapted from Wiltschko 2008), the plural of category *x* merges with a constituent of category *y*, and the resulting constituent takes the label of *x*.



A plural morpheme that merges as an adjunct, however, lacks this category-changing potential that a head shows. In the tree in (4) (adapted from Wiltschko 2008), a plural adjunct merges with a constituent of category y . The resulting constituent carries the label of y , not of the plural morpheme.



I assume, following Wiltschko (2008), as well as Hornstein and Nunes (2008) and Sato (2010), that adjuncts are syntactic objects that merge without the ability to change the label of the item with which they merge. Hornstein and Nunes (2008) suggest that specifiers and complements require both concatenation and labeling, while adjuncts require only concatenation. Wiltschko (2008, Footnote 13) presents a suggestion along the same lines.

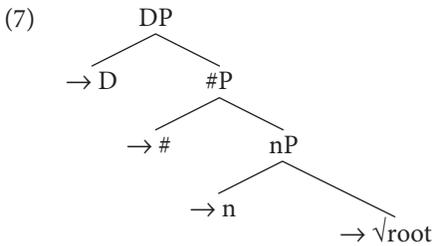
Wiltschko (2008) provides two diagnostics for a plural that merges as an adjunct, optionality and lack of agreement. In English, plural marking is obligatory, as is number agreement. In Upriver Halkomelem, however, Wiltschko shows that plural marking is not obligatory. The examples in (5a) and (5b) show that a noun phrase with the numeral three does not require plural marking. Similarly, number agreement is not obligatory. The examples in (6a) through (6d) show that the plural determiner may or may not be used in combination with a plural-marked noun.²

- (5) a. *te lhíxw swíweles*
 DET three boy
- b. *te lhíxw swóweles*
 DET three boy.PL
 ‘the three boys’ (Wiltschko 2008:642)
- (6) a. *t’ílém ye s-í:wí:qe*
 sing DET.PL man.PL
 ‘The men are singing’
- b. *t’ílém te s-í:wí:qe*
 sing DET man.PL
 ‘The men are singing’
- c. *t’ílém ye swíyeqe*
 sing DET.PL man
 ‘The men are singing’
- d. *t’ílém te swíyeqe*
 sing DET man
 ‘The man is singing’ (Wiltschko 2008:643)³

Wiltschko takes these facts, that plural marking and number agreement are not obligatory, as evidence that the plural marker in Upriver Halkomelem is an adjunct.⁴

2.2.2 Where the plural merges

The second parameter by which the syntax of plural marking can vary is where the plural merges (Wiltschko 2008). Since the advent of the DP hypothesis (Abney 1987; also Brame 1982; Szabolcsi 1983, 1987), a number of functional projections have been proposed between the DP and the noun, or root of the nominal phrase. Wiltschko considers the DP projection, the NumP projection (which she calls #P), the categorizing nP projection and the root as potential sites for a plural to merge along the spine of the DP (see the tree diagram in (7) below).



Wiltschko (2008) argues that the plural marker in Upriver Halkomelem adjoins to the root. The main evidence that the plural in Upriver Halkomelem merges at the root is that it can occur inside of compounds and derivational morphology. The example in (8) shows an adjective that can be nominalized with the prefix *-s*, as in (9). When the noun in (9) is pluralized, via reduplication, the reduplicated morpheme does not contain the nominalizer, as shown in (10). In other words, the process of pluralization via reduplication ignores the presence of derivational morphology.

(8) *p'eq'*
white
'white'

(9) *s-p'eq'*
NML-white
'white spot on skin'

(10) *s-p'eq'-p'eq'* (**sp'eq'sp'eq'*)
NML-white-PL
'white spots on the skin'

(Wiltschko 2008: 645, data from Galloway 1993: 379)

In addition, Wiltschko shows that in Upriver Halkomelem, the plural can occur inside of a compound. And, the interpretation of the plural morpheme in the compound refers to the first noun, stripes, not the compound as a whole, chipmunk, as shown in (11) below.

- (11) *s-xexp'-t:tsel*
 NML-stripe.PL-back
 'chipmunk (with more than two stripes)'
 (Wiltschko 2008:644, data from Galloway 1980:63)

Another piece of evidence that the Upriver Halkomelem plural merges at the (acategorical) root is that it can combine with a verb (as in (12)) resulting in a plural semantics with an interpretation that the event is repeated. Likewise, the plural can combine with adjectives resulting in an intensification of the property, as shown in (13).

- (12) *qw'oleqw-et*
 whip.PL-TRANS
 'whip something/someone several times' (Wiltschko 2008:679)
- (13) *tsméth'-meth'*
 blue.PL
 'very/lots of blue' (Wiltschko 2008:680)

Table 1 summarizes the diagnostics for the syntactic variation of the plural morpheme in English and Upriver Halkomelem.

Table 1. Properties of plural marking in English, Halkomelem (from Wiltschko 2008)

Diagnostic	English	Halkomelem
obligatory plural marking	Yes	no
obligatory agreement	Yes	no
plural inside compounds	No	yes
plural inside derivational morphology	No	yes
Acategorical	No	yes

Following these diagnostics, I will turn to an analysis of how and where the plural morpheme *-o'ob* in Yucatec Maya merges.

3. The DP-adjoined plural in Yucatec Maya

In this section, I present syntactic and semantic evidence for the plural morpheme *-o'ob* in Yucatec Maya as adjoined to the DP.⁵ Then, in Section 4, I present

experimental data in support of the DP-adjoined plural hypothesis for Yucatec Maya.

First, I will provide a background on the basics of person and number marking in Yucatec Maya, which has been informed by a number of scholars of Yucatec grammar (largely Bricker 1981 & Bohmeyer 2002). Yucatec is a head-marking language that marks person and number with cross-reference morphemes that affix to the verbal core. Like other Mayan languages, Yucatec is split-ergative. It has two sets of cross-reference markers, called Set A and Set B by Mayanists. Set A (the ergative set) precedes the lexical verb, but follows the initial aspect-mood marker. The plural Set A marker is a discontinuous morpheme. The third person plural Set A marker is homophonous with the nominal plural and, its use is optional. Set A markers are used to mark possessors and subjects of intransitive verbs in the imperfective aspects.

Table 2. Set A cross-reference markers

Person	Singular	Plural
First	in	k...-òon
Second	a(w)	a(w)...-èèx
Third	u(y)	u(y)...(-òòb)

The Set B markers are all verbal suffixes. The Set B markers are used to mark subjects of intransitive verbs in the perfective aspects.

Table 3. Set B cross-reference markers

Person	Singular	Plural
First	-en	-òòn
Second	-ech	-èèx
Third	-Ø/-ij	-òòb

In transitive clauses, Set A marks the agent or possessor subject, while Set B indicates the undergoer/object. There is some ambiguity inherent in third person plural cross-reference marking in the language, since the plural Set B markers are homophonous with the second element of the discontinuous morpheme of the Set A marker. And, the third person plural *-òòb* is homophonous with the nominal plural marker.⁶ Thus, the sentences in (14) and (15) below have three potential interpretations.

- (14) *T-u bis-aj-òòb*
 PFV-A3 carry-CMP-A3.PL/B3.PL
 ‘S/he took them.’/‘They took it.’/‘They took them.’ (Lucy 1992: 53)

- (15) *u péek-oòb*
 A3 dog-A3.PL/B3.PL/PL
 ‘his dogs’/‘their dog’/‘their dogs’ (Lucy 1992: 47)

In the remainder of the paper, I refer to the nominal plural *-oòb* simply as the plural. I refer to the plural cross-reference markers as either the Set A or Set B third person plural cross-reference marker.

3.1 The plural merges as an adjunct in Yucatec

In this section, I present evidence that the nominal plural morpheme *-oòb* in Yucatec Maya merges as a syntactic adjunct, as does the plural in Upriver Halkomelem.

3.1.1 *Optionality*

The first piece of support for the proposal that the plural morpheme *-oòb* in Yucatec Maya is not a functional head is that its use is optional. In Yucatec Maya, the presence of the plural morpheme is not necessary for a nominal phrase to be interpreted as referring to a plurality. The phrase in (16) without plural marking can be interpreted as referring to one or more than one girl. The example in (17) with plural marking must refer to more than one girl. This optionality supports the analysis that the plural marker in Yucatec Maya merges as an adjunct.

- (16) *le x-ch'úupal-o'*
 DEF FEM-girl-D2
 ‘the girl’/‘the girls’
- (17) *le x-ch'úupal-oòb-o'*
 DEF FEM-girl-PL-D2
 ‘the girls’

3.1.2 *Lack of agreement*

The second piece of evidence that the plural morpheme *-oòb* in Yucatec Maya merges as an adjunct and not as a functional head is that it does not trigger obligatory number agreement or concord.

In the example in (18), the adjective need not be marked with the plural morpheme when the noun is plural-marked (though it may be, when it is post-nominal). This example shows that there is no number agreement required between nouns and adjectives in the noun phrase.

- (18) *le x-ch'úupal-oòb ki'ichpam(-oòb)*
 DEF FEM-girl-PL pretty(-PL)
 ‘the pretty girls’

In the sentence in (19), the plural morpheme *-o'ob* can optionally be used on the postverbal noun. The covariation of plural form with the third person plural Set A marker *-o'ob* is also optional. This example shows that subject-verb agreement for number is not obligatory in Yucatec Maya, and it supports the conclusion that the plural marker merges as an adjunct in the language.

- (19) *Táan u k'aay(-o'ob) le x-ch'úupal(-o'ob)-o'*
 PROG A3 sing(-PL) DEF FEM-girl(-PL)-D2
 'The girls are singing'

In the next section, I examine the distributional facts in favor of the analysis of the nominal plural morpheme in Yucatec Maya as adjoined to the DP.

3.2 The plural merges at the DP in Yucatec

In this section, I outline the syntactic and semantic facts about the plural morpheme *-o'ob* in Yucatec Maya that support the analysis of the plural merging at the DP and not in a lower position along the spine of the DP. First, I present evidence that the plural morpheme in Yucatec does not merge at the root, in Section 3.2.1, or the Number Phrase, in Section 3.2.2. Then, I present evidence for its position in the DP in Section 3.2.3.

3.2.1 *The plural does not merge at the root*

The plural marker in Yucatec Maya does not merge at the root or the categorizing head. The plural morpheme *-o'ob* can combine with verbs and adjectives, but when it does, it does not result in the pluractional reading (shown in (20)) or an intensification of the property (shown in (21)), as it does in Halkomelem. It is arguably the homophonous third person plural cross-reference marker *-o'ob* that attaches to verbs and adjectives co-referencing a third person plural argument.

- (20) *Táan u yaalkab-o'ob*
 PROG A3 run-PL
 'They are running'/NOT: 'Running repeatedly'
- (21) *ki'-o'ob*
 delicious-PL
 'They are delicious.'/NOT: 'very delicious'

These facts indicate that the plural marker in Yucatec does not merge at or below the level of the categorizing head. It does not show the variation in meaning that would be expected if it adjoins at or below the syntactic head that determines the category, as is the case for Upriver Halkomelem.

In addition, the nominal plural marker *-o'ob* cannot occur inside of compounds (as shown in (22)), nor can it occur inside of derivational morphology

(as shown in (23) with the instrumental suffix and in (24) with the inalienable possession suffix).

(22) *le pol-ch'oom-o'ob-o'* **le pol-o'ob-ch'oom-o'*
 DEF head-village-PL-D2 DEF head-PL-village-D2
 'governors'⁷

(23) *x-muk-ub-o'ob* **x-muk-o'ob-ub*
 AG-bury-INSTR-PL AG-bury-PL-INSTR
 'shovels' (Bricker et al. 1998: 365)

(24) *in b'aak-el-o'ob* **in b'aak-o'ob-el*
 A1 bone-IP-PL A1 bone-PL-IP
 'my bones' (Bricker et al. 1998: 359)

Thus, we can conclude that in Yucatec, unlike Upriver Halkomelem, the plural morpheme merges higher than the root and the categorizing head. Table 4 repeats the diagnostics for adjuncthood and position outlined previously in Table 1 incorporating the observations thus far for Yucatec Maya.

Table 4. Properties of plural marking in English, Halkomelem and Yucatec Maya

Diagnostic	English	Halkomelem	Yucatec Maya
obligatory plural marking	yes	No	no
obligatory agreement	yes	No	no
plural inside compounds	no	Yes	no
plural inside derivational morphology	no	Yes	no
Acategoryal	no	Yes	no

Since we have seen evidence that the plural morpheme in Yucatec Maya merges as a syntactic adjunct, but it does not meet the diagnostics for merging at the root, as it does in Halkomelem, we will turn to evidence for the plural in Yucatec merging higher than the Number Phrase.

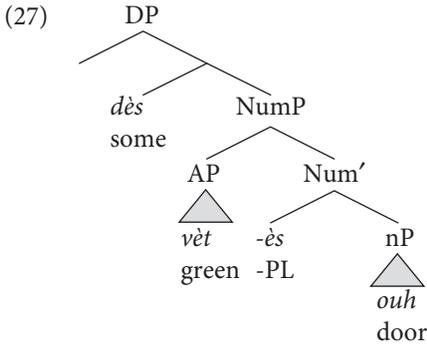
3.2.2 *The plural does not merge at the Number Phrase*

There is evidence that the plural morpheme in Yucatec merges higher than the Number Phrase. In Walloon, a language for which there is evidence that the plural marker heads the Number Phrase, a plural marker can occur on a prenominal adjective, unlike the case for Yucatec. The examples in (26) and (27) from Bernstein (1991) show the plural marker occurring on prenominal adjectives. The tree in (27) diagrams the phrase in (25) and the position of the adjective in relation to the plural marker in the head of NumP.

(25) *dès vètés-ouh*
 some green.PL-door
 'some green doors'

(26) *dès nèurs-ouy*
 some black.PL-eye
 'some black eyes'

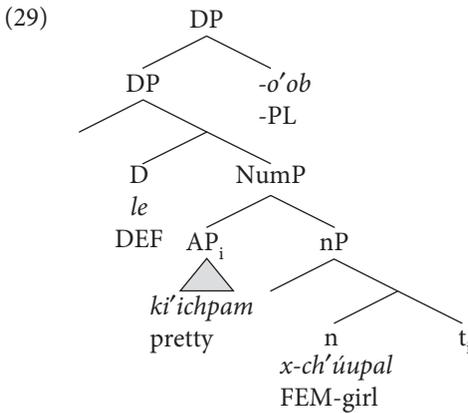
(Bernstein 1991, data from Remacle 1952 & Morin 1986)



In Yucatec Maya, adjectives can optionally take the plural marker *-òòb* but only when the adjective is in postnominal position. The variant in (28b) is unacceptable with plural marking on the prenominal adjective (whether or not the noun has plural morphology). The variant in (28a) without plural on the prenominal adjective and the variant in (28c) with plural marking on a postnominal adjective are acceptable.

- (28) a. *le ki'ichpam x-ch'úupal(-òòb)*
 DEF pretty FEM-girl(-PL)
 b. **le ki'ichpam-òòb x-ch'úupal(-òòb)*
 DEF pretty-PL FEM-girl(-PL)
 c. *le x-ch'úupal(-òòb) ki'ichpam(-òòb)*
 DEF FEM-girl(-PL) pretty-PL
 'The pretty girls'

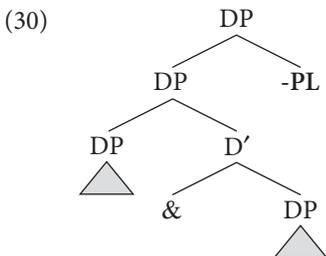
Assuming that prenominal adjectives merge at NumP (perhaps via movement, as in Kayne 1994), then the fact that plural marking in Yucatec Maya is ungrammatical on prenominal adjectives (but not postnominal adjectives) can be explained. The example in (28a) is diagrammed in the tree in (29) below. It shows that the prenominal adjective, adjoined as a specifier to NumP, cannot take plural marking, since the plural is adjoined to the DP and not lower.⁸ If the plural morpheme headed the Number Phrase, we would expect it to combine with a prenominal adjective in Yucatec, but it cannot.



In order to derive the morpheme order facts of Yucatec, with the DP-adjoined plural occurring in phrase-final position, we have to assume that the plural morpheme is right-adjoined to the DP. The facts just presented on the lack of plural marking on prenominal adjectives do not unambiguously support the proposal that the plural is adjoined (rightward) to the DP, versus the NumP or another layer of the DP, so I turn to other evidence that it merges higher than NumP.

3.2.3 *The plural merges at the DP*

A stronger piece of evidence in support of the DP-adjoined hypothesis for Yucatec Maya comes from the phenomenon of plural marking with conjoined nouns. The syntax of coordination arguably involves a structure that is headed by a coordinate phrase (Munn 1993; Progovac 1997) and dominated by a phrase of the same category as the conjuncts (Jackendoff 1977; Chomsky 1981; Gazdar et al. 1985; Sag et al. 1985). In other words, in a coordinate structure, the two DPs are dominated by a maximal DP. Given that the plural marker *-o'ob* in Yucatec adjoins to DPs, we predict that it should be possible for the plural morpheme to adjoin to the highest DP, which dominates the DPs of both conjuncts. This means that in Yucatec the plural marker can be adjoined to either of the DPs of the two conjoined nouns or to the highest DP, which dominates the conjunct as a whole, as shown in (30).



Because the plural morpheme can be adjoined to the highest DP, as in (30), it can occur in phrase-final position of a DP with two conjoined nouns and result in the interpretation that both nouns of the conjunct are singular. It can also result in the meaning that the first noun is singular and the second plural or that the first noun is plural and the second singular, or that both nouns are plural. The example in (31) demonstrates this phenomenon in Yucatec.

- (31) [*le x-ch'úupal yéetel le xi'ipal*] -o'ob
 DEF FEM-girl and DEF boy -PL
 'the girl and the boy'/'the girls and the boy'/'the girl and the boys'/'the girls and the boys'

The meaning in which both nouns of the conjunct are singular or that the first is plural and the second singular is only possible if the plural marker adjoins to the highest DP and not one of the lower DPs. This is unambiguous evidence that the plural marker in Yucatec is adjoined to the DP. It would not show the behavior it does with conjoined nouns if it were merged at the Number Phrase or lower.

In the next section, I present additional semantic evidence for the plural morpheme in Yucatec Maya as merging at the DP. In Section 4, I present an experimental timed translation task with bilingual speakers of Yucatec Maya and Spanish involving conjoined DPs, the results of which show quantifiable experimental evidence for the DP-adjoined hypothesis for Yucatec Maya through variation in the use of plural marking with conjoined nouns.

3.4 Semantics of DP

In addition to the syntactic facts presented in Section 3.3, there is semantic evidence that the plural morpheme -o'ob in Yucatec Maya merges at the DP. In Yucatec, the use of the plural marker results in a specific interpretation. The example in (32) shows that in a context in which the shoes are non-specific, no plural marker is used. In contrast, when referring to a specific pair of shoes among a set of other shoes, the plural marker is used (as in (33) below).

- (32) *Tumben le xanab-o'?*
 New DEF shoe-D2
 'Are those shoes new?' CONTEXT: A student comes to school wearing shoes that appear to be new. Another student asks this student "Are those shoes new?"
- (33) *Tumben le xanab-o'ob-o'?*
 New DEF shoe-PL-D2
 'Are those shoes new?' CONTEXT: A person goes into a shoe store and sees a pair of shoes that look old on a rack with many other shoes that look new. This person asks the salesperson "Are those shoes new?"

According to Enç (1991), specificity involves a subset relation, or “standing in some recoverable relation to a familiar object” and is a weaker identity link than definiteness, or identity of reference.⁹ If the plural morpheme in Yucatec Maya is adjoined to the DP, then we would predict the specificity effect observed in (33) above. Assuming that the DP is the locus of definiteness and specificity (Lyons 1999) (or referentiality (Longobardi 1994) a related notion), the fact that the use of the plural morpheme results in a specific interpretation provides additional semantic evidence for the idea that the plural marker in Yucatec resides in the DP.¹⁰

In the next section, I present quantitative experimental evidence for the DP-adjoined plural hypothesis for Yucatec Maya.

4. Experimental evidence for the DP-adjoined plural in Yucatec Maya

This experiment, which provides evidence for the DP-adjoined plural in Yucatec Maya, is a timed translation task in which bilingual Yucatec-Spanish speaking participants translated sentences from Spanish to Yucatec under time pressure. The Spanish stimulus sentences had conjoined nouns that varied in number marking (singular and plural). Due to the nature of translation, there is an inherent potential influence of the stimulus language, Spanish, on the Yucatec responses. Because number marking is obligatory in Spanish, it may influence the use of optional plural marking in Yucatec. In addition, because plural marking is indeed optional in Yucatec, another possible influence on the response is underspecification. If a participant hears a plural noun in Spanish, there is no requirement to use the plural in the translation into Yucatec. I examine these influences on the experimental responses and show that they alone cannot account for all of the data. It is necessary to take into consideration the DP-adjoined plural hypothesis in order to account for all of the data in the experimental responses.

4.1 Crosslinguistic sentence production

Since this experiment is a translation task in which participants translated stimulus sentences from Spanish to Yucatec Maya under time pressure, a discussion of crosslinguistic priming is in order. First, it is worthwhile to mention that there is strikingly little sentence production research on non-Indo European languages and far less on head-marking languages such as Yucatec Maya (see Jaeger & Norcliffe 2009). This experiment represents an important investigation into the processes underlying sentence production in a language that is typologically quite different from the vast majority of languages examined in controlled quantitative psycholinguistic research.

Priming is a well-known and well-studied phenomenon in sentence production (see Nicol 1996 & Branigan 2007 for an overview). Syntactic (and morpho-syntactic) priming refers to the facilitatory effect on the processing of a given sentence due to having recently processed a sentence with the same or similar structure (Nicol 1996) or the tendency to repeat syntactic structures across contextually unrelated utterances (Branigan 2007). This effect has been shown to hold at the word and sentence levels and even across languages in bilingual populations. For example, after hearing a passive sentence in Spanish, Spanish-English bilinguals were more likely to produce passive sentences than actives or intransitives (Hartsuiker et al. 2004; Meijer & Fox-Tree 2003). However, priming may not be a deep syntactic effect. Loebell and Bock (2003) found a priming effect from German to English (and vice versa) for the dative shift (which shares the same surface word order, just as English and Spanish passives do). But, they failed to find a significant effect of syntactic priming for passive sentences across languages in English-German bilinguals. The passive sentences in German were verb-initial, differing structurally from the English passives, which were subject-initial.

In this experiment, we might expect morphosyntactic priming in that the plural morpheme (or feature) in the Spanish stimulus will prime the use of the optional plural morpheme in the Yucatec responses. Since, however, there is an important structural difference between Spanish plurals (heading the Number Phrase) and Yucatec Maya plurals (adjoined to the DP), it is possible that the priming effect may fail to obtain under conditions in which the syntactic representations of the Spanish plural and the Yucatec plural are not completely congruent.

4.2 Method

This experiment is a timed translation task in which participants heard Spanish stimulus sentences with conjoined nouns and an intransitive verb. The participants translated these sentences into Yucatec under time pressure. There were 18 items in 4 conditions, shown in Table 5. Of the 18 items, 5 had both of the conjoined nouns referring to humans (e.g. 'the girl and the woman' or 'the doctor and the nurse'). The remaining 13 items had both of the nouns of the conjunct referring to animals (e.g. 'the frog and the rabbit' or 'the cat and the dog'). There were 36 fillers. One third of the fillers consisted of transitive sentences in which the number of the subject varied. Another third consisted of transitive sentences with conjoined object nouns varying in number, and the final third were sentences with predicate adjectives. The items and fillers were pseudo-randomized and arranged in a Latin Squares design into four experimental lists. The Spanish stimuli were recorded from the synthetic voice of Alberto, a male Latin American Spanish synthetic voice from the AT&T Labs Natural Voices test-to-speech project[®].

Table 5. Experiment conditions

Condition	Noun 1 (N1)	Noun 2 (N2)	Verb
Singular-Singular (SS)	<i>La muchacha y</i> The girl-SG and	<i>la mujer</i> the woman-SG	<i>están cocinando</i> are-PL cooking
Singular-Plural (SP)	<i>La muchacha y</i> The girl-SG and	<i>las mujeres</i> the women-PL	<i>están cocinando</i> are-PL cooking
Plural-Singular (PS)	<i>Las muchachas y</i> The girls-PL and	<i>la mujer</i> the woman-SG	<i>están cocinando</i> are-PL cooking
Plural-Plural (PP)	<i>Las muchachas y</i> The girls-PL and	<i>las mujeres</i> the women-PL	<i>están cocinando</i> are-PL cooking

4.3 Procedure

Participants were seated at a table in front of a laptop. Participants wore a Siemens headset with a unidirectional microphone. The experiment was delivered with the Experiment Builder experimental design software developed at the University of Rochester. The participants were given oral instructions from the experimenter. They were also given written instructions on screen before the experiment began. Participants went through four practice trials before the experimental trials began.

In the experiment, the Spanish stimulus sentence was initially delivered then repeated two times. The participant was instructed that he or she could listen to the Spanish stimulus sentence all three times or press the spacebar anytime after hearing the sentence the first time to advance to the recording of the Yucatec translation. On the screen, there was a cartoon picture of an ear when the participant was to be listening to the Spanish stimulus and a cartoon picture of a mouth when the participant was to be saying the Yucatec translation. Participants were given 15 seconds to say the translation in Yucatec. A time bar appeared at the bottom of the screen to indicate how much time remained. If the participant had already completed his or her responses and there was still time remaining, the participant was allowed to press the spacebar to advance to the next trial, if he or she so desired. The experiment took no longer than 30 minutes to complete.

4.4 Participants

Twenty-eight bilingual Yucatec Maya-Spanish speakers between the ages of 18 and 42 participated in the experiment. Participants were compensated 25 Mexican pesos (just over 2 U.S. dollars) for the participation. The experiment was carried out in a sound-proof recording room or an unoccupied classroom at La Universidad del Oriente in Valladolid, Yucatan, Mexico. Most of the participants were undergraduate students at the university.

4.5 Results

The Yucatec responses were coded by the author and by two native speakers of Yucatec Maya for plural marking on the first noun, the second noun, and the verb. Responses were excluded from the analysis if they were unintelligible, or if the coder was unsure of whether there was a plural or not, if the response was in Spanish, or if there was no response given. Responses were excluded if they were translated with a transitive verb and plural object (e.g. *make the food-PL* rather than *cook*). Responses with nouns that were borrowed from Spanish were included if they had Yucatec morphology (e.g. the Yucatec definite determiner and/or distal deictic marker or plural marker) because there was no significant effect of Spanish borrowings on the likelihood of the use of the Yucatec plural marker *-o'ob* in the experimental responses.

Chi-squared tests revealed significant dependence between the use of plural marking in the Yucatec responses and the Spanish stimulus conditions. There were significantly more plurals marked on the second noun in the SP and PP conditions, compared to the SS and PS conditions ($X^2(3) = 161, p < 0.001$). In addition, there were significantly more plurals marked on the first noun in the PS and PP conditions compared to the SS and SP conditions ($X^2(3) = 101, p < 0.001$) (see Figure 1).

These results are consistent with the expectation that morphosyntactic priming from the Spanish stimulus to the Yucatec response would be an influence on the experimental responses. Figure 2 shows black boxes around the responses which are consistent with complete morphosyntactic priming, that

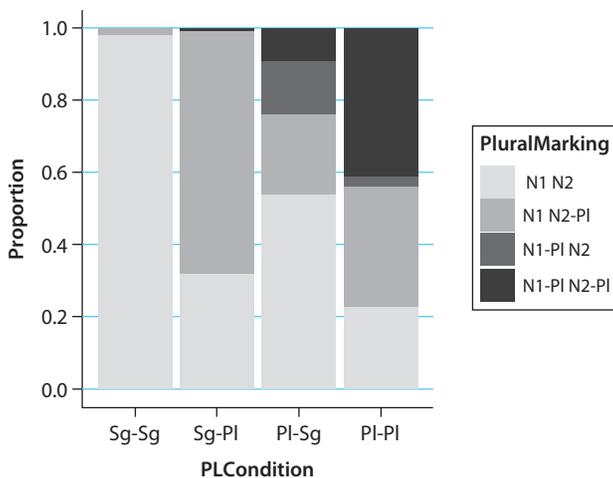


Figure 1. Plural marking on first and second noun by condition

is, if the participant marked plurals in his or her responses on exactly and only those nouns that had plural marking in the Spanish stimulus. For example, in the PS condition, morphosyntactic priming can explain responses in which the first noun was marked with the plural morpheme and the second was not. Interestingly, the proportion of responses consistent with morphosyntactic priming was very small in the PS condition (and also somewhat small in the PP condition) compared to the SS and SP conditions.

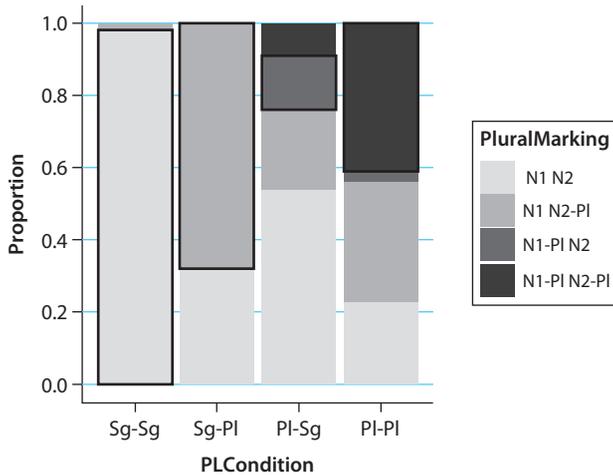


Figure 2. Responses consistent with morphosyntactic priming by condition

Another potential predictor of the experimental responses is underspecification. Since plural marking in Yucatec Maya is not obligatory, the participant could have simply not used the plural morpheme in the Yucatec translation, even if he or she heard a plural in the Spanish stimulus. For example, in the PS condition, a perfectly felicitous response in Yucatec is one in which neither the first noun nor the second noun is marked with the plural morpheme. In addition, underspecification can account for responses in the PP condition in which only one of the two nouns was marked with the plural morpheme in the Yucatec response. The responses that can be accounted for by an underspecification account are shown in black boxes in Figure 3.

There are, however, still some responses that cannot be accounted for by morphosyntactic priming or underspecification. These responses include: (1) in the SS condition when a plural was used after the second noun, (2) in the PS condition when a plural was used after both the first and second nouns, and (3) in the PS condition when a plural was used only after the second noun. These responses can be unambiguously accounted for by the DP-adjoined plural hypothesis for

Yucatec Maya. Figure 4 shows black boxes around the responses that cannot be accounted for by morphosyntactic priming or underspecification but can indeed be accounted for by the DP-adjoined hypothesis.

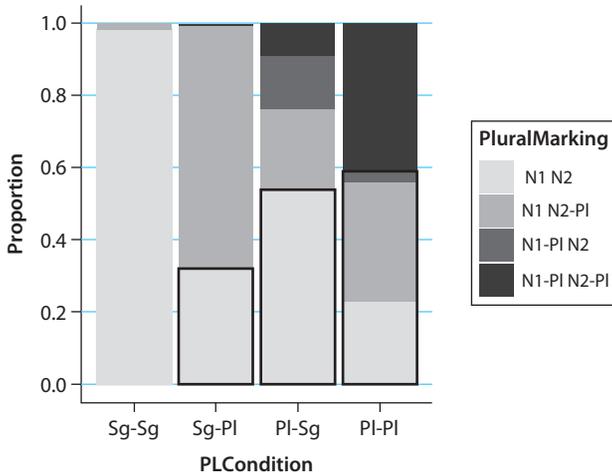


Figure 3. Responses consistent with underspecification by condition

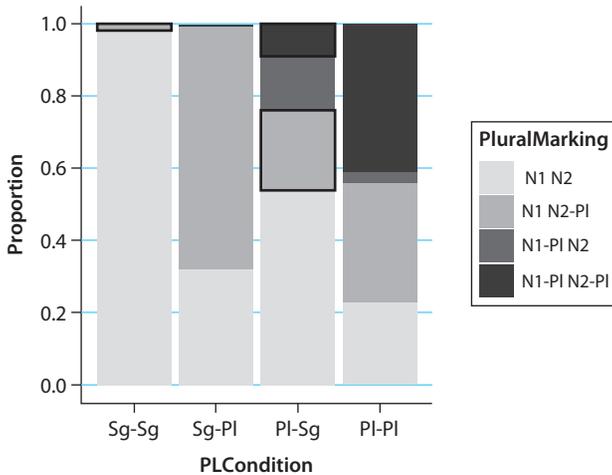


Figure 4. Responses unambiguously accounted for by DP-adjoined hypothesis

In addition, collapsing all of the experimental conditions, there were significantly more plurals marked after the second noun than the first. This result is unexpected given that the number of singular and plural first and second nouns

was equal in the Spanish stimuli. Figure 5 shows that in the Yucatec responses the first noun was marked with plural morphology in only about 15% of the responses, while the second noun had plural morphology in about 38% of the responses (a significant difference ($X^2(1) = 23, p < 0.001$)).

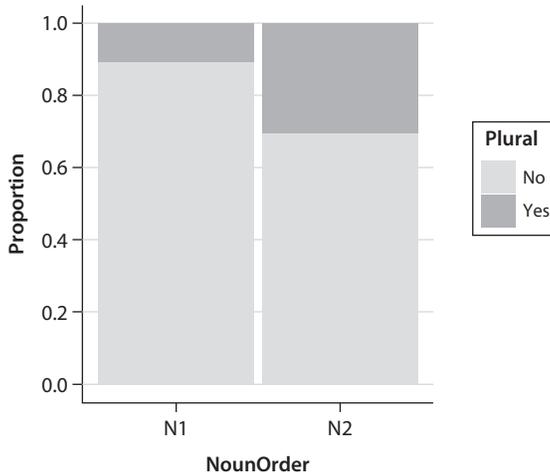


Figure 5. Proportion of plural marking on the first and second noun in all responses

This asymmetry is unexpected if morphosyntactic persistence was the only influence on the data. It is also unexpected in the case of underspecification (not using the plural because it is optional in Yucatec). The asymmetry is, however, consistent with the proposal that the plural marker in Yucatec is right-adjoined to the DP. Given the syntax of the plural marker in Yucatec, a preference for placing the plural in phrase-final position (or adjoined to the highest DP) arose in the processing preferences in this experiment.

4.6 Discussion

This experiment was a translation task in which participants translated sentences with conjoined nouns from Spanish into Yucatec under time pressure. As expected, morphosyntactic priming was a significant factor in the responses. In conditions in which the Spanish stimulus noun was plural, there was significantly more plural marking in the Yucatec responses. Another potential influence on the responses came out. Underspecification was consistent with a number of the responses. Since plural marking is not obligatory in Yucatec, participants often did not use plural marking when there was a plural morpheme on the Spanish stimulus noun. After examining the responses that were consistent with morphosyntactic priming and with underspecification, there were a number of responses that could only

Gillon (in prep) proposes a similar split analysis of plural marking in Innu-aimun. Innu-aimun has one plural with identical semantics to that of the plural in English. She argues that this plural marker merges at the Number Phrase. She also shows that Innu-aimun has another plural, which has different semantics, similar to lexical plurals. In Innu-aimun, plural mass nouns have two distinct interpretations depending on which plural marker they take. The Number plural implies individuation (the ‘bottles of water’ interpretation of (35)) while the other, which merges at nP, does not (the ‘lots of water’ interpretation of (35)).

- (35) *nipiaa*
 water.PL
 ‘bottles of water’/‘lots of water’ (Gillon in prep:8)

As is predicted by Gillon’s analysis, count nouns can similarly get mass interpretations by combining with nP plurals (the ‘tea’ interpretation in (36)).

- (36) *nipish-a*
 leaf-INAN.PL
 ‘tea’/‘cups of tea’ (Gillon in prep:15)

There seems to be convincing interpretational, and some distributional, evidence for plural marking that merges at the categorizing head, nP. In the next section, I present some arguments for a plural that merges at the Quantificational Phrase.

5.2 QP plurals

A Quantificational Phrase is argued to be another functional layer of the DP spine (Giusti 1997) (DP > QP > NumP > nP > root). If this is the case, we might predict a plural marker that can merge at the QP. Park (2008) presents arguments for such a plural marker in Korean. Park (2008) argues that the plural marker *-tul/deul* in Korean merges at the QP. The main argument for this proposal is semantic. In Korean, the plural marker implies distributivity. The sentences in (37) and (38) show that the plural marker *-tul/deul* in Korean is optional with collective predicates with a distributive sub-entailment. When the plural is used, as in (38), the reading is that all of the professors participate.

- (37) *Swuhakkwa kyoswu-ka kyosil-ey moyessta*
 math department professor-NOM classroom-LOC gather-PST
 ‘The professors of a math department gathered in the classroom’
- (38) *Swuhakkwa kyoswu-tul-I kyosil-ey moyessta*
 math department professor-PL-NOM classroom-LOC gather-PST
 ‘(All) the professors of a math department gathered in the classroom’
 (Park 2008, data from Kwak 2003)

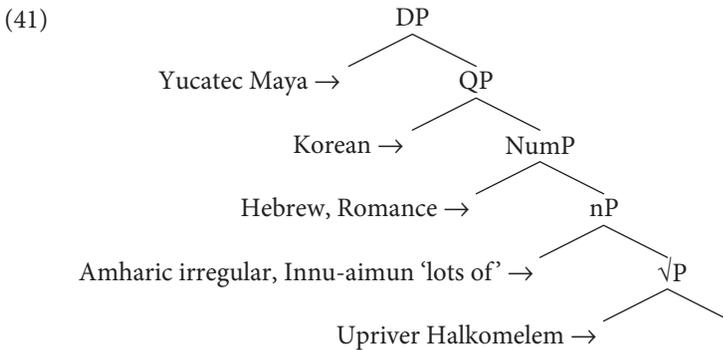
With truly collective predicates with no distributive sub-entailment, however, the plural marker *-tul/deul* is infelicitous (as in (40) compared to (39) without plural morphology).¹¹

- (39) *Swuhak-kwa-nun kyoswu-ka ney myeng-ita*
 math department-TOP professor-NOM four CL-CPL.DC
 ‘The professors of a math department are a group of four’
- (40) ??*Swuhak-kwa-nun kyoswu-tul-I ney myeng-ita*
 math department-TOP professor-PL-NOM four CL-CPL.DC
 ‘The professors of a math department are a group of four’

Park connects these facts to the plural marker in Korean adjoining to the QP rather than the Number Phrase. In the next section, I summarize the data examined so far in a typology of the syntax of plural marking. I also discuss how the variation in plural syntax might be constrained in particular ways.

5.3 Constraining the typology

The languages that we have discussed as examples of variation in the syntax of plural marking can be organized into a typology of where the plural merges. This typology is shown in the tree in (41).



I provided evidence for the DP-adjoined plural in Yucatec Maya. Park (2008) argues for the plural marker *-tul/deul* in Korean merging at the QP. Many scholars have argued for the plural heading the Number phrase (most notably Ritter 1991; Bernstein 1991; Picallo 1991; Valois 1991). Gillon (in prep) and Kramer (2009) along with Acquaviva (2008) and Alexiadou (2010) have argued for nP plurals in a variety of languages. And, Wiltschko (2008) argues that the plural marker in Upriver Halkomelem is adjoined to an acategorical root.

If Wiltschko’s (2008) typology is taken to its logical end, based on the extended DP spine in (41) above, we would predict 10 types of languages: head or adjunct to DP, QP, NumP, nP and the root. It is possible, however, to imagine

that this typology is more tightly constrained. For example, we might expect that if a plural merges as a head, having the label-changing potential, it would always label the projection as Number. If this is true, the typology would be cut down to 6 types: (1) head of NumP, (2) adjoined to NumP, (3) adjoined to DP, (4) adjoined to QP, (5) adjoined to nP, (6) adjoined to the root.

6. Conclusion

In this paper, I have discussed the idea that there is wide variation across languages in the syntactic and semantic properties of plural marking. Still, the phenomenon can be captured by a universal syntax that allows variation in where and how plurals are merged (Wiltschko 2008). Wiltschko (2008) proposed that plural marking can merge as a head or an adjunct and to various projections along the spine of the DP (DP, NumP, nP, root). Wiltschko argued that plural marking in Upriver Halkomelem merges as an adjunct to the root. I presented evidence that the plural morpheme in Yucatec Maya merges as an adjunct to the DP. In addition to the distributional and interpretational evidence from elicited data, I presented experimental evidence for the DP-adjoined plural hypothesis for Yucatec Maya. In the experimental responses, there was significant variation in the use of plural marking in timed translations from Spanish to Yucatec Maya, and some of the responses could only be unambiguously accounted for by the DP-adjoined syntax of the plural morpheme in Yucatec Maya. I also highlighted data from a variety of other languages that provide evidence for plural morphology that merges at other points along the DP spine, namely QP and nP. I have provided a wealth of different evidence Yucatec Maya along with evidence from other scholars of other languages for variation in the syntax of plural marking. The clear implication of these findings, as Wiltschko (2008) pointed out, is that identity of function does not imply identical syntax or semantics.

Notes

* This paper is based on research conducted for my dissertation at the University of Arizona (Butler 2011). I owe many thanks to Heidi Harley, Simin Karimi, Andy Barss and Janet Nicol whose comments and suggestions greatly shaped this paper. I also thank my Yucatec Maya speaking consultants, particularly Samuel Canul Yah, José Cano Sosaya and Gerónimo Can Tec. I owe many thanks to the Yucatec speaking experiment participants and the faculty and staff at La Universidad de Oriente in Valladolid, Yucatan Mexico, particularly Michal Brody, Marta Poot and Angel Virglio Salazar. This research was partially funded by grants to

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1. The abbreviations I use in this paper are: A – Set A cross-reference marker, AG – agentive, B – Set B cross-reference marker, CL – classifier, CMP – completive, D1 – proximate deictic particle, D2 – distal deictic particle, DEF – definite, FEM – feminine, IMPF – imperfective, INAN – inanimate, INC – incompletive, IND – indicative, IP – inalienable possession, IRREG – irregular, LOC – locative, MSC – masculine, NEG – negation, NML – nominalizer, NOM – nominative, PL – plural, PFV – perfective, PST – past tense, REG – regular, TOP – topic, TRANS – transitive.
2. Gerdts (2012) argues that in Island Halkomelem the plural marker cannot be adjoined to the root because it shows agreement effects. For example, Gerdts shows that in Island Halkomelem, bare Class A nouns cannot combine with plural adjectives, while bare Class B nouns can. In addition, diminutives cannot combine with plural adjectives unless they are also plural marked. However, as Wiltschko (2008) points out, co-variation of plural form does not presuppose a syntactic *Agree* relation. Non-inflectional plural marking can appear without a syntactic *Agree* relation. Since the relevant plural feature is interpretable and valued, there is no requirement for it to take part in an *Agree* relation (because *Agree* is only necessary to delete an uninterpretable feature or value an unvalued feature).
3. Wiltschko (Footnote 9) notes that the example in (6d) is normally interpreted as singular in the absence of any plural marking, but it is also compatible with a plural interpretation and the presence of a numeral of cardinality greater than one.
4. The property of plural morphology that it can merge either as a head or an adjunct is not unique to plural marking. In fact, this variation is reminiscent of the syntactic behavior of negation (cf. Hankamer 2011; Zanuttini 1996, 1997). I thank Heidi Harley for this point. Wiltschko (2008, Footnote 41) also notes that negation behaves similarly, merging either as a head or as an adjunct. She also mentions that diminutives (see Steriopo 2008) and evidentials (see Blain & Déchaine 2007) show the same head/adjunct parameterization.
5. This is not the first proposal for a plural merging at the DP. Li (1999) argues that the collective morpheme *-men* in Chinese resides in D. Also, Ghomeshi (2003) analyzes the plural morpheme in Persian as merging at DP, but see Gebhardt (2008) for arguments against the DP analysis of the plural in Persian. In this paper, I present novel types of syntactic, semantic and experimental evidence for the DP-adjoined plural in Yucatec Maya.

6. This three-way homophony is curious and may not be accidental (as an anonymous reviewer points out). The nominal plural *-o'ob* may have been borrowed from the third person plural cross-reference marking paradigm. Other Mayan languages have a distinct nominal plural. For example, Chol (a Mayan language spoken in Chiapas, Mexico) use a distinct nominal plural *-la* in addition to the *-o'ob* plural (Coon, pc.). Yucatec also has a plural-like morpheme *-tak* that affixes to adjectives. If the nominal plural was indeed borrowed from the cross-reference marking paradigm, this fact may also be related to the syntax of the nominal plural in the DP in Yucatec. These are questions that I regrettably leave for future research.
7. The definite determiner “le” is not obligatory in this phrase. It is grammatical without the definite determiner, but it has a kind or generic interpretation.
8. It is possible that Yucatec Maya lacks a Number Phrase altogether (as Wiltschko discusses for Upriver Halkomelem and as Kwon & Zribi-Hertz 2004 argue for the plural in Korean). I do not have clear evidence at this point to say definitively that the language lacks a Number Phrase. I will have to leave the issue for future research.
9. The notion of specificity is somewhat vague. It is possible, based on the Yucatec examples, that the relevant notion could be familiarity (in the sense of Heim 1982), as argued by Fiengo (1987). Also, as an anonymous reviewer points out, the relevant notion of specificity, in particular the definition implicating a subset relation is also similar to the partitive. See also Cinque (1990), Chung (1994) and Pesetsky (1987) on the role of specificity in the grammar. More research on the role of specificity in the grammar of Yucatec is needed.
10. But see Coppock and Wechsler (2012) and Gillon and Armoskaite (2011) for arguments that D is not required for definiteness.
11. I thank JaeHoon Choi for verifying these judgments in Korean for me.

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