Where Number Lies:

Plural marking, numerals, and the collective-distributive distinction

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Dedication

To Abboudeh, for the love of unanswered questions,

And to Hodhod, for the love of crafting tools

To both, for the longing to find answers
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They say university years are the best time of your life. My experience so far is that this generalization is only true if you don’t go to grad school. The years I spent in grad school have been the most exciting, enriching, and intellectually stimulating years of my life. And I owe this to the professors, colleagues, and friends I had and those I encountered along the way. I will take the opportunity of finishing my thesis to publicly express my gratitude to and for these wonderful people who contributed to my training and shared the experience with me on three continents.

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Chapter 1: Questions and background: plural marking, numerals, and collective-distributive interpretations

1.1. Introduction: Main claims

This dissertation addresses the question of what a plural DP is with special attention to numeral-containing DPs. I argue that cardinal numerals have more than one possible merger site in the DP and that the availability of a collective interpretation of numeral-containing DPs is dependent on the structure, and specifically, on the merger site of the numeral. A lower merger site (1) results in a collective interpretation of the DP and a higher merger site (2) results in an exclusively distributive interpretation. More generally, I propose that a specific functional projection, #, is necessary for the availability of collective reading of a DP.

In addition, I argue that there are two types of plural marking on nouns in Arabic: one that is semantically operative and functions as a count morpheme in a count projection,
and another that is semantically vacuous and marks agreement with numerals when they merge in the lower position (in #).

I assume that all parts of speech are functions, arguments to functions, or both, composing with one another. I propose that quantifiers are functional elements with a specific merger site in the DP, but numerals are not. Instead, numerals are lexical elements of a special kind, which some functional elements in the DP can take as an argument.

In section 1.2, I describe my theoretical assumptions, followed, in section 1.3, by a brief overview of noun phrases in Lebanese Arabic, where much of the empirical evidence in the rest of the dissertation starts. In section 1.4, I present the big questions addressed by this thesis, reviewing briefly some of the recent debate on the questions within the generative framework. In section 1.5, I briefly describe two empirical puzzles that lead the theoretical discussion, and which eventually lead to the conclusions described above. In section 1.6, I situate the thesis and the empirical puzzles it deals with in the context of a rich tradition of work – both traditional and modern – on Arabic grammar. Finally, in section 1.7, I give the roadmap for the rest of the thesis.

Due to the interdisciplinary nature of the study of plurals, the term ‘plural’ can refer to several things, including plural marking (e.g. -s on nouns in English), plural interpretation (e.g. involvement of multiple participants), or a certain notion of syntactic plurality that may not be overtly visible (e.g. the propensity to trigger plural marking in other parts of a sentence in the form of agreement). For this reason, I avoid using the word ‘plural’ on its own to refer to any of the above. Instead, I will use the following nomenclature and notation:

**Plural marking** (or plural marker) is a morphological marking on nouns, verbs, adjectives, and pronouns (3), which may be a suffix (3a), a suppletion form (3d), or covert (3e). My assumptions and claims about the meaning of plural marking on nouns is discussed in section 1.2 and in chapter 2. I claim, in chapter 3, that plural marking on verbs, adjectives, and pronouns is semantically vacuous (section 3.4).

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1 Unless otherwise specified, all Arabic examples in this thesis are given in Lebanese Arabic.
3.  

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<td>a. apple</td>
<td>apples</td>
<td>Noun, English</td>
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<td>b. jolie</td>
<td>jolies</td>
<td>Adjective, French</td>
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<td></td>
<td>beautiful</td>
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<td>c. il prend</td>
<td>ils</td>
<td>prénom</td>
<td>Pronoun and verb, French</td>
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<td></td>
<td>he takes</td>
<td>they</td>
<td>take-pl</td>
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<td>d. goose</td>
<td>geese</td>
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<td>e. sheep</td>
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I use the term **non-plural marking** to indicate absence of plural marking in a context where plural marking is possible. I remain neutral on whether this non-plural marking is explicitly non-plural, or if it is simply the lack of plural marking\(^2\).

A sentence has a **collective interpretation** when its denotation is a proposition that describes an eventuality with multiple participants (also called “group-level interpretation”; Dowty 1987).

A sentence has a **distributive interpretation** when its denotation is a proposition that describes multiple eventualities with single participants (also called “individual-level interpretation”; Dowty 1987).

I will call a DP or a part of a DP **syntactically plural** when its presence forces plural marking on any expression that agrees with it, including adjectives, verbs, and pronouns. I will call it **syntactically non-plural** if it does not.

I will use the term **plural individual** in the sense of Link (1983). In other words, I use “plural individual” to refer to an individual that is the sum of two or more other individuals. A non-plural individual is anything that is not a plural individual.

Finally, I use ‘←’ following a sentence and before a context to indicate that the proposition expressed by the sentence of interest is true in the context following the ‘←’. I use ‘↛’ to indicate that the proposition expressed by the sentence of interest can be false in the context described after the ‘↛’. For example, (4a) is read as (4b).

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\(^2\) I separate non-plural marking from covert plural marking as in sheep, and discuss this further in chapter 3.
4. a. Simon got his shirt wet
   ← Simon spilled a liquid on his shirt
   ↔ Simon spilled a liquid on his shoes

b. The proposition *Simon got his shirt wet* is true in a context in which Simon spilled a liquid on his shirt. The proposition *Simon got his shirt wet* is not necessarily true in a context in which Simon spilled a liquid on his shoes.

1.2. Theoretical assumptions: A very syntactic semantics

I follow a theoretical tradition that assumes a close mapping between structure and interpretation. I also assume a system in which content words, like *cat* and *eat* have no syntactic properties in and of themselves, but functional projections, like N and V, and functional items, like the elements spelled out as *if* and *the* do.

I assume a DP structure with multiple functional projections (Abney 1987, Ritter 1991, and many others), and specifically, I assume an incremental structure in which every functional layer encodes a semantic function and operates on the part of the tree with which it composes. The presence versus absence of any given functional layer changes the interpretation and the syntactic properties of the whole structure and there are no semantically vacuous functional projections. I assume the execution of this idea in Borer (2005).

Throughout this thesis, I use the semantic framework of Heim and Kratzer (1998), based on Frege’s conjecture that semantic composition is essentially function application. I assume a formal language consisting of two basic types: *e* for individuals and *t* for truth values, and complex types derived on the basis of the basic ones, and I use the interpretation function [[ ]] such that the meaning of *a* is [[a]]. Assuming all nodes in a given syntactic structure denote individuals (type *e*), truth values (type *t*), or functions made up of combinations of *e* and *t* (e.g. <*e*,*t*>, <<*e*,*t*>, *t*, etc.), the truth conditions of propositions are computed by repeated function application (taken from Heim & Kratzer...
1998:43-44):

(i) If $a$ is a terminal node, $a$ is specified in the lexicon.

(ii) If $a$ is a non-branching node, and $b$ is its daughter, then $[[a]] = [[b]]$.

(iii) If $a$ is a branching node and $b$ and $c$ are its daughters, and $[[b]]$ is a function whose domain contains $[[c]]$ then $[[a]] = [[b]]([[c]])$.

Moreover, following (Link 1983) I assume that the domain of entities $D_e$ contains both singular individuals and plural individuals, taking plural individuals to be sums, and taking $D_e$ to be closed under sum. So if $a$ is in $D_e$ and $b$ is in $D_e$, the plural individual $a+b$ is also in $D_e$ (cf. also Landman 1989 for a similar view)

I will now briefly review Borer’s (2005) treatment of count and mass DPs to illustrate some of my assumptions. The count-mass distinction, Borer proposes, is mediated through the presence versus absence of a specific functional structure, Div, associated with division. So regardless of the ontological properties of the noun itself, in the presence of Div (5), the DP will have a count denotation and will behave syntactically as a count DP, allowing count quantifiers, such as *many*, to occur. In the absence of Div (6), a DP with the same head noun will have a mass denotation and will behave syntactically as a mass DP, allowing only mass quantifiers, such as *much*, to occur.

5. **Count Structure:**

   \[
   (D_{\text{max}}^{\#})^D_{\text{max}}^{\#} \quad \text{Div}_{\text{max}}^D \quad \text{N}_{\text{max}} \\
   \]

6. **Mass Structure:**

   \[
   (D_{\text{max}}^{\#})^D_{\text{max}}^{\#} \quad \text{N}_{\text{max}}^D \quad \text{Div}_{\text{max}} \\
   \]
In this system, it is assumed that any element that merges in Div is a classifier. One advantage of such a system is that it straightforwardly captures the frequently observed flexibility of the mass-count classification without resorting to type shifting. Examples from Borer (2005) are given in (7)-(10).

7. a. I'd like beer, please.
   b. I'd like a beer, please.

8. a. I had wine.
   b. I had three wines.

9. a. There is rabbit in my soup.
   b. There is a rabbit in the garden.

10. a. That's quite a bit of carpet for the money.
    b. That's a nice carpet.

Languages like Mandarin Chinese, which contain morphological (non phrasal) classifiers, provide a direct illustration of the structure in (5). In such languages, countness is denoted by the presence of an overt morphological classifier (11). The lack of an overt morphological classifier is specifically associated with mass interpretation (12).
11. a. henduo li mi
   a-lot CL rice
   ‘many grains of rice’

   b. san li mi
   three CL rice
   ‘three grains of rice’

12. a. henduo mi
   a-lot rice
   ‘much rice’

   b. *san mi
   three rice
   ‘three rices/three grains of rice’

Assuming morphological classifiers like li in (11) in Mandarin Chinese are instances of Div, the structure of (11 a-b) would be as in (13). In the absence of Div, as in (14), a classifier is impossible and thus mass interpretation emerges. As a consequence, henduo is interpreted as ‘much’ rather than ‘many’ (12a), and numerals are barred (12b).³

³ It is important to point out that ‘mass’ is not taken to be equivalent to ‘grinded’. So while DPs with a mass structure as in (14) are always mass, and never admit count quantifiers, this does not preclude them from referring to individuated objects. Rather, such a structure simply fails to provide the individuation. In fact, in most contexts, ‘much rice’ entails ‘many grains of rice’, and the example in (12a) can be used to refer to what is, in the world, many individuated objects. It simply does not specify their individuation.

To give a clearer example, Chinese quantifiers like henduo can occur with profession nouns such as student, and be interpreted as ‘many students’, as it would not make much sense to say much student (Audrey Li, p.c.) – although it can, in principle mean it, it is pragmatically ruled out. An example from English, with a typically mass noun, illustrates the same phenomenon (i) (cf. Ouwayda (in prep) for experimental evidence on the
Not all languages have Chinese-type classifiers. In languages with a productive number system, like English, Borer proposes that the dividing functional structure is marked by the presence of plural (or singular) marking. As illustrated in the examples (7)-(10) above, like morphological classifiers, plural marking and * occur on nouns that are countability of mass DPs).

i. Q. Do we have enough bottles for all the students?
   A. Yes, I have a lot of water (meaning I have enough bottles of water)
otherwise unspecified as mass or count and mark the entire DP as grammatically count. In a language like English, then, the relevant structures would be as in (15).

15. a. \( (D^{\text{max}} \quad \#_{\text{max}}) \)  
   \( D \)  
   \( \# \)  
   \( \text{many} \)  
   \( \text{Div}^{\text{max}} \)  
   \( \text{Div} \)  
   \( N^{\text{max}} \)  
   \( \text{pie-s} \)  
   \( \text{pie} \)  

   b. \( (D^{\text{max}} \quad \#_{\text{max}}) \)  
   \( D \)  
   \( \# \)  
   \( \text{much} \)  
   \( \text{Div}^{\text{max}} \)  
   \( \text{Div} \)  
   \( N^{\text{max}} \)  
   \( \text{pie} \)  

One argument for treating plural marking as a classifier rather than a \# head is that the denotation of bare plurals, while count, is not quantified. Like mass DPs, Borer argues, bare plurals do not induce telicity (16c-d). Singulrals, on the other hand, like quantified DPs, do induce telicity (16a-b), suggesting that the singular includes quantification and therefore invokes \#. A singular DP, therefore, is syntactically more complex than a bare plural DP. Borer proposes the structure in (17) for singulars in English, where a gives value to both Q and Div, indicating both countness and quantity (cf. also Carlson 1977, who argues that singular indefinites and bare plurals do not behave alike and are therefore different in their components).

16. a. I ate three pies in an hour  
   b. I ate a pie in an hour  
   c. *I ate pies in an hour  
   d. *I ate pie in an hour
17. a. 

\[ (D^{\text{max}}) \]

\[ \text{D) } \]

\[ \#^{\text{max}} \]

\[ \# \]

\[ \text{Div}^{\text{max}} \]

\[ a \]

\[ \text{Div} \]

\[ N^{\text{max}} \]

\[ a \]

\[ \text{pie} \]

Given that Div encodes countness in the DP structure, I assume that the head of the Div structure has a denotation that takes a predicate of undivided ‘stuff’, and returns a predicate of a countable (atomic) individual, either kind or unit, and I assume that any shape or dimension specifications, which are sometimes part of the meaning of classifiers, may be supplied by the element merging in Div. I will assume two types of classifiers: kind classifiers, for examples like (18a), and division classifiers for examples like (18b).

18. a. I have tried three oils/boxes, and this is the lightest

   (meaning oil types, or box types)

b. I have bought three waters/boxes

   (meaning water bottles, or actual boxes)

I propose the denotation in (20) for kind classifiers. In this denotation, I assume \( + \) is a formal function of type \( <<e,t>, e> \) that takes as its argument (the characteristic function of) a set of individuals \( S \) and returns the individual that consists of the sum of all individuals that are members of \( S \), as illustrated in (19).

19. a. \( S = \{a, b, c, d\} \)

b. \( + (S) = a + b + c + d \)
20. a. \([\text{[CL}_{\text{kind}}]] = \lambda P \lambda y. \exists S [\forall x[P(x) \rightarrow x \in S]] \text{ and } \exists S_{2} S_{2} \subseteq S \text{ and } \forall z[z \in S_{2} \rightarrow z \text{ has some salient property}] \text{ and } y = + (S_{2})] \]

b. Paraphrase: Given a predicate P, return a predicate that is true of the sum of all members of some salient subset of the set of individuals P is true of.

As for the unit classifier, one possible denotation is given in (21), where the properties of a standard ‘unit’ are provided pragmatically. With this classifier, DivP would denote a standard unit of the type of individuals that the predicate denoted by the NP is true of. Note, importantly, that I do not intend to build singularity into the definition of the classifier. Rather, the classifier only provides the division, and the predicate must still be quantified.

21. a. \([\text{[CL}_{\text{unit}}]] = \lambda P_{\text{e,t}} \lambda x. P(x) \text{ and } x \text{ is a pragmatically or lexically salient unit or division of stuff (piece, container, etc.)} \]

b. Paraphrase: Given a predicate P, return a predicate that is true of a unit of the stuff that P is true of.

Plural marking, which I assume to be an instantiation of Div, is an ambiguous classifier that can have either the denotation in (20) or that in (21), as it allows both the kind interpretation (22a) and the unit interpretation (22b). Mandarin Chinese classifiers typically have more specific semantics, and can be restricted to either (20) or (21). The classifier li from example (11), for instance, would have a denotation like that in (21).

22. a. I’ve tried \textbf{three wines} and I didn’t like any of them.

b. I’m not thirsty. I already drank \textbf{two waters}.
I assume that the lexical items that receive the labels ‘noun’, ‘verb’, etc. upon entering the syntax are predicates of type $<e,t>$. Functional items, i.e., the heads of functional nodes like Div, are functors that apply to these predicates, returning expressions with different meanings (and of different types). I assume determiners, for instance, are functors that merge in the head of the functional projection D. They are of type $<<e,t>,e>$ (i.e. they take a predicate of type $<e,t>$ and return an individual of type e) or they are of type $<<e,t>,<<e,t>,t>>$ (i.e. they take a predicate of type $<e,t>$ and return a generalized quantifier of type $<<e,t>,t>>$). When the DP is a subject, for example, it combines with a verb phrase of type $<e,t>$ and yields a truth value.

To illustrate the relevant semantic compositions, take a sentence whose subject is a count DP, like (23). Assume the components of (23) have the denotations in (24). The semantic composition is illustrated in (25)-(26).

23. henduo li mi huai-le
many CL rice spoil-pfv
‘many grains of rice spoiled’

24. a. $[[\text{mi}_\text{RICE}]] = \lambda x. \text{x is rice}$

b. $[[\text{li}_\text{CLASSIFIER}]] = \lambda P_{<e,t>}. \lambda x. P(x) \text{ and } x \text{ is a small and rounded unit}$
   Paraphrase: Given a predicate $P$, return a predicate that is true of small rounded units of the stuff that $P$ is true of

c. $[[\text{henduo}_{\text{many}}]] = \lambda P_{e,t}. \lambda Q_{e,t}. \exists S \forall x \in S P(x) \text{ and } Q(x) \text{ and } |S| > c_{\text{salient standard}}$
   Paraphrase: Given a predicate $P$, return a function that takes a predicate $Q$ and returns truth if there is a set larger than a contextually salient standard whose members are such that $P$ and $Q$ are true of them.
25. a. \[[\text{henduo}_{\text{many li mi}}]\] = \lambda Q. \exists S \forall x \in S \text{ x is rice and x is a small and rounded unit and } Q(x) \text{ and } |S| > c_{\text{salient standard}}

b. Paraphrase: Given a predicate Q, return truth if there is a set larger than a contextually salient standard whose members are small round units of rice and Q is true of them

26. a. \[[\text{henduo}_{\text{many li mi huai-le}}]\] = \[[\text{henduo}_{\text{many li mi}}]\] \cdot \[[\text{huai-le}]\] = 1 iff 
\exists S \forall x \in S \text{ x is rice and x is a small and rounded unit and x spoiled and } |S| > c

b. Paraphrase: many grains of rice spoiled is true iff there is a set larger than a contextually salient standard whose members are small round units of rice and they spoiled

Similarly, I illustrate the composition for the same sentence but without the classifier. That is the sentence in (27). Assume the denotation in (28) for \text{henduo} in its occurrence as ‘much’ in a mass context, the semantic composition of the DP is given in (29a), and that of the full sentence is given in (29b).

27. \text{henduo mi huai-le}
   much rice spoil-pfv
   ‘much rice spoiled’
28. a. \[[\text{henduo}_{\text{much}}]\] = \lambda P. \lambda Q. \exists x. P(x) and Q(x) and magnitude(x) > c_{\text{salient standard}}

b. **Paraphrase:** Given a predicate P, return a function that takes a predicate Q and returns truth if there is an individual that P is true of and Q is true of, whose magnitude is larger than some salient standard

c. \[[\text{henduo mi}]\] = \lambda Q. \exists x. x is rice and Q(x) and magnitude(x) > c_{\text{salient standard}}

d. **Paraphrase:** *henduo mi huai-le* is true iff there is an individual whose magnitude is larger than a certain salient standard, and that individual is rice and that individual spoiled

29. a. \[[\text{henduo mi}]\] = \lambda Q. \exists x. x is rice and Q(x) and magnitude(x) > c_{\text{salient standard}}

c. \[[\text{henduo mi huai-le}]\] = 1 iff 
\[\exists x. x \text{ is rice and } x \text{ spoiled and magnitude}(x) > c_{\text{salient standard}}\]

d. **Paraphrase:** *henduo mi huai-le* is true iff there is an individual whose magnitude is larger than a certain salient standard, and that individual is rice and that individual spoiled

1.3. **Overview of the Lebanese Arabic noun phrase**

Arabic nouns are marked for definiteness, number, and gender. In Standard Arabic, nouns are also marked for case. Definiteness is marked with the definite marker *l*.\(^4\) Nunation (or *tanwiin*) is the addition of an /n/ sound that is typically in complimentary distribution with the definite determiner, except in masculine plural and dual nouns (Zabbal 2002; Fassi-Fehri 1993).

\(^4\) When a noun, adjective, or numeral to which the definite determiner *l* is prefixed, starts with a dental sound, the definite determiner is assimilated and becomes a doubling of the first sound in the word (i).

i. *l* + teffeeH \(\rightarrow\) t-teffeeH
the apple the-apple
1.3.1. Gender

Arabic nouns are marked for gender, either masculine or feminine (Corbett 1991, Cowell 1964). Feminine gender is typically overtly marked with a *taa marboutah*, pronounced *-ah* in Standard Arabic, or *-eh* in certain contexts in Lebanese Arabic and other dialects (I will henceforth refer to any instance of *taa marboutah* as *-ah* in the text, but I will transliterate the correct pronunciation in the examples). Masculine gender is typically marked by the absence of *-ah*.

When a noun’s denotee has a biological gender, the noun’s gender marking corresponds to the biological gender (30)-(31). Not all feminine nouns have a masculine counterpart by removing the *-ah* (31 d-e). Nouns whose denotees have no biological gender are marked for one of the two genders without consideration of their lexical properties (32)-(33).

While appearing productive in nouns whose denotees have a biological gender, *-ah* is not productive in non-biologically gendered nouns: So feminine nouns that do not denote females typically do not have a masculine counterpart, and non-biologically masculine nouns typically do not have a feminine counterpart (30d)-(33d). Even if a lexical item exists such that it appears to be the feminine/masculine counterpart of another non-biologically gendered noun, the meanings are very different (albeit maintaining some distant relation due to the common root) (32e)-(33e).

<table>
<thead>
<tr>
<th></th>
<th>a. Sabi;</th>
<th>b. bsein;</th>
<th>c. kalb;</th>
<th>d. asad;</th>
<th>e. jamal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>youth</td>
<td>cat</td>
<td>dog</td>
<td>lion</td>
<td>camel</td>
</tr>
<tr>
<td></td>
<td>‘boy’</td>
<td>‘male cat’</td>
<td>‘male dog’</td>
<td>‘male lion’</td>
<td>‘male camel’</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(*asad-eh)</td>
<td>(*jamal-eh)</td>
</tr>
</tbody>
</table>

---

5 This will be important in chapter 2, where a version of *-ah* turns out to be productive in nouns whose denotees are not biologically gendered. In that case, the evidence shows, *-ah* is more than a gender marker: it is a morphological classifier (see also Zabbal 2002, Fassi Fehri 1993).
31. a. Sabiy-eh; b. bsein-eh; c. kalb-eh; d. labweh; e. neeʔah
   youth-F cat-F dog-F lionesse camelF
   ‘young woman’ ‘female cat’ ‘female dog’ ‘lionesse’ ‘female camel’
   (Sabi (30a)) (bsein (30b)) (kalb (30c)) (*labw) (*neeʔ)

32. a. kersi; b. beeb; c. maʕmal d. derej e. maktab
   chair door; factory drawer desk
   (*kersieh) (*beebeh) (*maʕmaleh) (*der-eh) (maktabeh = library ≠ feminine desk)

33. a. Taawlah; b. siyyaarah; c. elbeh; d. šantah e. lawHah;
   tableF carF boxF backpackF paintingF
   (*Taawl) (*siyyaar) (*elb) (*šant) (lawH = board ≠ masculine painting)

1.3.2. Number

Arabic nouns can be plural, dual, or singular. Plural marking is overtly visible, dual is marked by the presence of the dual marker -ein, and singular is marked by the absence of both.

Arabic plural marking has three morpho-phonological realizations: broken plural, which is autosegmental; sound masculine plural, which is affixal, and sound feminine plural, which is also affixal. All three realizations of plural marking are highly productive and occur on nouns regardless of their conceptual properties. The choice between broken or sound plural depends largely on the morpho-phonological properties of the noun (Ghalayiini 1912).

Broken plural (glossed BR) may occur in masculine nouns (34) and feminine nouns (35). There are no lexical-semantic restrictions on its occurrence, it is productive, and it may occur in novel words introduced into the language (36). For certain vocabulary items, like rejjeel ‘man’ in (34a) it is the only pluralization strategy.
34. a. rijjeel → rjeel  
   man → man-pl\textsubscript{BR}  
   ‘man’ → ‘men’

b. fann → funuu\textsubscript{n}  
   art → art-pl\textsubscript{BR}  
   ‘art’ → ‘arts’

c. ktaab → kutub  
   book → book-pl\textsubscript{BR}  
   ‘book’ → ‘books’

35. a. šantah → šanat  
   bag → bag-pl\textsubscript{BR}  
   ‘bag’ → ‘bags’

b. madiine\textsubscript{h} → mudun  
   city → city-pl\textsubscript{BR}  
   ‘city’ → ‘cities’

c. šarTuu\textsubscript{T}a → šraaTiiT  
   rag → rag-pl\textsubscript{BR}  
   ‘rag’ → ‘rags’

36. a. banTalon → bnaaTliin  
   pants → pants-pl\textsubscript{BR}  
   ‘pair of pants’ → ‘pairs of pants’

b. blouzeh → blowaz  
   blouse → blouse-pl\textsubscript{BR}  
   ‘blouse’ → ‘blouses’

c. ?amiis → ?emsaan  
   shirt → shirt-pl\textsubscript{BR}  
   ‘shirt’ → ‘shirts’

(French pantalon)  
(French blouse)  
(French chemise)

Sound masculine plural (glossed SM) occurs only in nouns with masculine human denotees (37). The noun’s stem remains ‘sound’, unchanged, and the plural morphemes – \textit{\textit{iin}} attaches to it.\footnote{In Standard Arabic, the sound masculine plural may be marked for case, surfacing as -\textit{\textit{uun}} (nominative) or –\textit{\textit{iin}} (accusative/genitive). Lebanese Arabic has no case morphology on nouns, such that the sound masculine plural morpheme is always -\textit{\textit{iin}}.}
37. a. mʕallem → mʕallm-iin  
  teacher  
  ‘teacher’  
  mʕallem  
  b. šeHHaad → šeHHaad-iin  
  beggar  
  ‘beggar’  
  šeHHaad  
  c. mfatteš → mfattš-iin  
  inspector  
  ‘inspector’  
  mfatteš  
  d. muʃtarek → muʃterk-iin  
  participant  
  ‘participant’  
  muʃtarek

Sound feminine plural (glossed SF) has no lexical-semantic restrictions and occurs both on nouns with biologically feminine denotees (38), and on grammatically feminine nouns whose denotation is genderless (39). Like sound masculine plural, sound feminine plural leaves the stem intact, affixing to it -aat (pronounced -eet in certain contexts in Lebanese Arabic).

38. a. kalb-eh → kalb-eet  
  dog-F  
  ‘dog’  
  kalb-eh  
  b. mʔallm-eh → mʔallm-eet  
  teacher-F  
  ‘teacher’  
  mʔallm-eh  
  c. sabiy-eh → sabiy-eet  
  youth-F  
  ‘young lady’  
  sabiy-eh  
  d. mʕallm-iin → mʕallm-ee  
  beggar  
  ‘beggars’  
  mʕallm-iin

39. a. mxaddeh → mxadd-eet  
  pillow  
  ‘pillows’  
  mxaddeh  
  b. Tawlah → Tawl-eet  
  table  
  ‘tables’  
  Tawlah  
  c. lamb → lamb-aat  
  bulb  
  ‘lightbulbs’  
  lamb

Sound feminine plural marking also occurs on some masculine nouns, namely, derived nominals (40) and borrowed foreign nouns regardless of their grammatical gender (41) (Ghalayiini, 1912). In these examples, the non plural marked form is masculine, which is shown by the absence of feminine agreement on the adjectives following them.
40. a. ittiSaal Tawiil \(\rightarrow\) ittiSaal-eet;
call\(_M\) long-\(\emptyset\) call-pl\(_{SF}\)
b. xilaaf jaddi \(\rightarrow\) xilaaf-aat
conflict\(_M\) serious-\(\emptyset\) conflict-pl\(_{SF}\)

41. a. computer mniH \(\rightarrow\) computer-aat
computer\(_M\) good-\(\emptyset\) computer-pl\(_{SF}\)
b. talifoon jdiid \(\rightarrow\) talifoon-eet
telephone\(_M\) new-\(\emptyset\) telephone-pl\(_{SF}\)

1.3.3. Numerals

In both Standard and Lebanese Arabic, *weeHed* `one’ and *tneeN* `two’ do not occur as cardinal numerals: they only occur post-nominally, following singular and dual nouns, respectively, agreeing with the noun like adjectives (cf. agreement in section 1.3.5 as in (42a-b) and the dual (42c-d). Numerals larger than two can occur before the noun, functioning as cardinal numerals. Numerals 3 through 10 must be followed by plural-marked nouns (43). Numerals larger than 10 (henceforth transdecimal numerals\(^7\)) must be followed by non-plural marked verbs (44).

42. a. rejjeel (*weeHed*)
   man-\(\emptyset\) (one)
   b. m?allm-eh (*waHd-eh*)
   teacher-\(\emptyset\)-\(\emptyset\) (one-\(\emptyset\))
   c. rejjeel-ein (*tneeN*)
   man-\(\DL\) (two)
   d. m?allm-t-ein (*tn-\(\TL\)-ein*)
   teacher-\(\emptyset\)-\(\DL\) (two-\(\DL\))

\(^7\) Thanks to David Pesetsky for suggesting the name “transdecimal”.

---
43. a. tlat  rjeel/*rejjeel    b. arba?  m?allm-eet/*m?allm-eh  
    three  man-pl_{BR}/*man-Ø  four  teacher-pl_{SF}/*teacher-Ø-Ø

c. xams  ashya/*shii
    five  thing-pl_{BR}/*thing-Ø

44. a. tlatiin  rejjeel/*rejjeel    b. arbiin  m?allm-eh/*m?allm-eet  
    thirty  man-Ø/*man-pl_{BR}  fourty  teacher-Ø/*teacher-pl_{SF}

c. xamsiin  shii/*ashya
    fifty  thing-Ø/*thing-pl_{BR}

This is also the case in Standard Arabic. In addition, in Standard Arabic, nouns following numerals 3-10 are always genitive and plural (45a), and nouns following transdecimal numerals are typically accusative marked and singular (45b). The only exceptions are multiples of miʔa ‘hundred’, which are followed by non-plural marked genitive nouns (45c).

45. a. xams-at-u  rijaal-in
    five-f-nom  man-pl_{BR}-gen
    ‘Five men’

b. xamsuuna  rajul-an
    fifty  man-Ø-acc
    ‘Fifty men’

c. miʔatu  rajul-in
    hundred  man-Ø-gen
    ‘A hundred men’
Side note on numerals 3-10

Semitic languages have a left-headed genitive nominal construction called the construct state nominal\(^8\) (idaafa in Arabic, smixoot in Hebrew). The first element in a construct state appears in a special phonological form (bound form), in which feminine marking is pronounced as /at/ instead of /a/ (or the feminine marking is not pronounced, as in Lebanese Arabic) and where any marking of definiteness or indefiniteness, including nunation (cf. beginning of section 1.3), is dropped. Since the numerals 3-10 are followed by genitive-marked nouns, their composition with nouns is considered an example of construct states in Arabic. Supporting this is the fact that the numerals 3-10 take on the bound form when appropriate, by pronouncing the feminine form with a final /t/ prior to a noun (46a).

46. **Standard Arabic** | **Lebanese Arabic**
---|---
a. thalaath-at\(^u\)-awlaad-in | a’. tlatt\(^u\)-wleed
three-bound-nom child-pl\(_{ARB}\)-gen | three\(_{bound}\) child-pl\(_{ARB}\)
‘Three children’

Other types of constructs include noun-noun, which typically expresses possession (47a-b), and adjective-noun (47c-d).

---

47. a. sayyarat-u l-walad-i  
   car_{bound-nom} the-child-gen  
   ‘The child’s car’

b. siyyare-t l-walad  
   car_{bound} the-child  
   ‘The child’s car’

c. qaliil-u l-ʔadab-i  
   little-nom the-politeness-gen  
   ‘rude’ (of little politeness)

d. ʔaliil l-ʔadab  
   little the-politeness  
   ‘rude’

1.3.4. Agreement and marking with and within the noun phrase

Arabic is rich in agreement: adjectives, verbs, and pronouns are marked for number and gender. In Lebanese Arabic, adjectives modifying a singular noun agree with their modifiee in gender (48a-b), and adjectives modifying a plural or dual noun are marked with a gender-neutral plural marking that has the same morpho-phonological form as broken or sound masculine plural (48c).  

---

9 Standard Arabic distinguishes between +human and –human modifiers. Adjectives agree in all features, including number and gender with a +human modifiees (i). This is also true for adjectives modifying singular and dual [-human] modifies (iia-b). Adjectives modifying plural [-human] nouns exhibit a genderless –human plural agreement that is morpho-phonologically identical to the singular feminine marking -ah. The same is true for verbal agreement. (I include this to highlight the fact that, in this case, Lebanese Arabic and Standard Arabic are different.)

i. a. ʕaalem muhem  
   scientist important
b. ʕaalem-aan muhem-aan  
   scientist-DL important-DL

c. ʕaalem-uun muhem-uun  
   scientist-plsm important-plsm

ii. a. kalb muhem  
   dog important
b. kalb-aan muhem-aan  
   dog-DL important-DL

c. kilaab muhim-ah  
   dog-pl_{br} important-F
Verbs in Lebanese Arabic, like adjectives, agree in gender when the subject is singular and are plural marked when the subject is dual or plural, irrespective of gender. This is illustrated in (49).

49. a. (l-)ʕaalem weSel
   (the-)scientist arrived

   b. (l-)ʕaalm-eh weSL-et
   (the-)scientist-F arrived-F

   c. (l-)ʕaalem-een/ʕaalem-t-een/ʕaalm-iin/ʕaalm-eet
   (the-)scientist-DL/scientist-F-DL/scientist-plsM/scientist-plsF
   arrived-PL

14. The questions and debates

   The discussion in this thesis revolves around the structure and interpretation of the DP, with special attention to numerals’ place in the DP, the semantics of numerals, the syntax and semantics of plural marking, the count and mass distinction, and the collective-distributive distinction. Each of these topics has been the subject of serious exploration and debate over the last few years both from a syntactic point of view as well as from a semantic point of view. I reviewed some of the debate on the count-mass distinction in the section presenting the theoretical assumptions. The current section briefly goes over some of the views on what numerals are, the semantics of plural marking, and the collective-distributive interpretation distinction.
1.4.1. What numerals are

There are two ways to answer the question of what numerals are. The first is to answer the question of what they are in and of themselves: what numerals denote, how they are formed, and what cognitive means are used for their formation. The second is to answer how they interact with language, how they affect other parts of speech, and how their interaction with other parts of speech and their effect on interpretation compare to those of linguistic objects that appear to behave similarly to numerals, like quantifiers.

1.4.1.1. What numerals are in and of themselves

One possible view on what numerals are puts them entirely outside of the linguistic system, such that they are entirely opaque to language, and that any use of numerals in language borrows them from an entirely distinct cognitive system. But of course, as soon as words are used to name numerals, the linguistic system is involved, and hence an entirely separationist view is not possible. Moreover, as Ionin and Matushansky (2006) point out, there is evidence from case marking for the idea that numerals either directly interact with, or are formed within, the linguistic system. Case marking is a purely linguistic phenomenon. And in many languages numerals not only get case marked, but they also assign case to other expressions. In fact, the different parts of a complex numeral assign case to one another, as illustrated for Russian in (50), where dvadcat’ ‘twenty’ takes the nominative case marking of the noun phrase, assigns genitive case to millionov ‘million’ and the numeral assigns genitive case to knig ‘book’.

50. dvadcat’ millionov knig Russian (Ionin and Matushansky 2006)
   twenty-nom million-gen.pl book-gen.pl
   ‘twenty million books’

Ionin and Matushansky (2004, 2006) adopt a view that puts numerals as purely linguistic objects, formed entirely within the linguistic system, and through general linguistic means. They propose that numerals are modifiers (of type <<e,t>,<e,t>>), and that complex numerals are formed through modification (51) and DP coordination (52), for
multiplication and addition, respectively. Others have treated numerals as predicates of plural individuals of a certain size (Partee, 1986), determiners/quantifiers (Montague 1973, Bennett 1974, van der Does 1993), all of which are consistent with the purely linguistic view of numerals.

51. \([D \ [\text{three hundred thousand} [N \text{ apples}]])\]

52. \([\text{ConjP} \ [D \ [\text{three hundred} [N \text{ apples}]]) \ [\text{Conj'} \ and \ [D \ [\text{five} [\text{apples}]])]\]

Similarly in a view placing numerals close to, if not in, the language faculty, Kayne (2005a) argues that the choice of a numerical base in a given language is dependent on that language’s ability to add a nominal suffix to that numeral. Stavrou and Terzi (2008) build on this work, showing noun-like behavior of some numerals in Greek.

Likewise forming numerals in the linguistic system, Harbour (2011) proposes that numerals, and integers specifically, are generated using a “successor” function which is constructed using recursion alongside two linguistic primitives: atomicity ([± atomic]) and minimality ([± minimal]).

A third view of numerals treats them as directly related to, and interfacing with, language, but not necessarily entirely formed through general linguistic means or linguistic primitives. Scha (1981) assumes a system in which numerals enter the syntax as objects from the set \(\mathbb{N}\), combine with covert semantic functions, resulting in what ends up being numerical quantifiers and numerical modifiers. Such a system is consistent with this third view on what numerals are (see also Barwise and Cooper 1981). Zabbal (2005), like Scha, treats numerals as their own semantic type, n, and defines functions \(x\) and \(+\), that operate on numerals, and that are identical to the mathematical operators multiplication and addition. Depending on whether the functions \(x\) and \(+\) are assumed to be linguistic or borrowed from another linguistic system, Zabbal’s view can be couched in either the second or the third view on where numerals are formed: if \(x\) and \(+\) are linguistic functions, then numerals in Zabbal’s view are entirely formed in the linguistic system. If they are borrowed from a separate cognitive system responsible for mathematical reasoning, then
numerals in Zabbal’s view are formed outside of syntax, and merge into syntax after being fully formed.

In this thesis, I join Zabbal (2005) and Scha (1981) in arguing for a view that treats numerals as objects that enter syntax as type n objects, and interacting with other parts of speech through mediating functions that mediate semantically and syntactically between them and other parts of speech, limiting where they can occur and what semantic contributions they may make, and giving them the appearance of being quantifiers, modifiers, or other parts of speech.

1.4.1.2. Where numerals go in a DP

In the view that numerals are quantifiers (Montague 1973, Bennett 1974, van der Does 1993), they would be expected to occur quite high in the DP. In the view that numerals are modifiers (Ionin and Matushansky 2006), they can occur anywhere along the DP projection, resulting in different orders of compositions, and hence different interpretations, depending on where they merge. On this view, numerals are expected to behave differently from quantifiers, but similarly to other modifiers like adjectives. In Link’s (1998) view of numerals as modifiers that merge in a Num head, numerals are expected to have a predictable position in the DP, but to always be modificational. Finally, in the view that numerals enter the syntax as their own type, through mediating functions (Zabbal 2005, Scha 1981), and in the view that numerals are predicates of type <e,t> where type shifting results in modifier-like or quantifier-like behavior of numerals (Partee 1986), the interpretation ends up being entirely dependent on the choice of mediating function or type-shifting function.

While many distinctions between different types of quantifiers have been made, most notably between weak quantifiers like a and some, compatible with there-insertion (53a), and strong quantifiers like most and all, incompatible with there-insertion (53b) (Milsark 1974), numerals have often been put together with weak quantifiers. Particularly, weak quantifiers are typically ambiguous between a ‘cardinality’ interpretation (54a) and a proportional interpretation (54b) (Partee 1988, Diesing 1992, Adger 1994, inter alia). Diesing (1992) proposes that weak quantifiers involve existential closure whereas strong
quantifiers have their own quantificational force. Adger (1994) explains the difference by having the DP move to an AgrP, and allowing it to be interpreted either in its moved position or in its reconstructed position. Bowers (1988), on the other hand, proposes that strong quantifiers merge in D whereas weak quantifiers merge lower. Numerals also can take both of the interpretations in (54). The question I consider is whether numerals and weak quantifiers that take a ‘cardinality’ interpretation like many and few, all merge in the same position.

53.  a. There are some/many/three trees in the garden
        b. *There are most/all/the trees in the garden

54.  Many men are in the garden
        a. There are many men in the garden
        b. Many of the men are in the garden

In the view I propose, this would constitute a separate distinction: numerals can either merge low, in #, and take on modifier-like properties distinct from the properties of weak quantifiers like many, or they can merge higher, in Q, through a mediating function that gives them properties like many. I assume, following Adger (1994) that the cardinality vs. proportional interpretations are determined by where the DP is interpreted after its movement to a higher position in the IP (SpecAgr). On this view, the ‘cardinality’ vs. proportional interpretations is independent of the collective vs. distributive interpretation that merging in # or in Q determines.

1.4.2. Plural marking and classifiers

The most intuitive answer of what plural marking means is that it is a function that results in a ‘more than one’, or multiple individuals interpretation (cf. e.g. Lasersohn
For example, that it takes a predicate of singular individuals and returns a predicate of plural individuals. This is the strong view of plurality. But the strong view of plurality has been challenged: Giving a number of counter examples to the strong view of plurality, Borer (2005), Schein (2005), Sauerland (2003), Sauerland et al (2005), Farkas and de Swart (2010), Matushansky and Ionin (2011) among others, propose views in which what a plural marked nouns denotes need not result in a ‘more than one’ interpretation of the DP.

Providing examples in which plural marked nouns are used when singular interpretation is acceptable, like the fact that (55a) and (55b) are not truth-conditionally equivalent, Sauerland (2003) and Sauerland et al (2005), argue for a weak view of plurality, whereby a plural marked noun is a predicate that is true of “one or more” individuals, rather than of “more than one” individuals.

55.  a. You’re welcome to bring your children
   b. You’re welcome to bring your two or more children

In a view that maintains the intuitive notion that plural marking is associated with sums, Farkas and de Swart (2010) propose that plural marked nouns are actually polysemous between a strong plurality and a week plurality: specifically, they propose that a plural marked noun’s denotation either requires a sum (strong), or allows both atoms and sums (weak). They propose that the choice between the two is determined pragmatically.

10 There is, of course, the question of what being semantically plural is, Schein (1993) proposes that it means being multiple individuals, Link (1983) proposes that one individual can be plural by being the mereological sum of multiple individuals. As I state in section 1.2, in my work, I assume a formal system where the domain of individuals contains both atomic individuals and plural individuals (or sums). I propose that only a plural individual can get interpreted collectively, whereas a set of multiple non-plural individuals cannot. I discuss this more in my discussion of collective and distributive interpretations section 1.5.2 and chapters 3 and 4.
In a more radical view, showing, among other things, that plural marking is consistent with zero number, Schein (2005) argues against the ‘more than one’ view of plural marking, and proposes that what plural marking does is set up necessary but not sufficient conditions for counting.

56. The nonselfidentical custards are zero in number

Borer (2005) makes a more concrete syntactic and semantic claim, also treating plural marking as a function that sets up the necessary conditions for counting. She argues that plural marking is directly an instantiation of a count projection, thus equating it with classifiers. She bases her argumentation on the cross-linguistic complimentary distribution between plural marking and classifiers as illustrated in (57) for Armenian, the fact that singular DPs induce telicity while plural marked DPs do not (16), as well as on examples like those in (55), (56), and (58).

57. a. yergu hovanoc
two umbrella

b. yergu had hovanoc
two CL umbrella

c. yergu hovanoc-ner
two umbrella-pl

d. *yergu had hovanoc-ner
two CL umbrella-pl

58. a. 1.5 apples

b. *1.5 apple

In this thesis, I adopt a view that plural marking on nouns indeed is a classifier, and denotes a function that provides the necessary (and sufficient) conditions for counting. This is discussed in further detail in chapter 1. More discussion is provided in chapter 2.
1.4.3. Collective and distributive interpretations

There are two main questions concerning the collective-distributive distinction that are of interest in this thesis, and which have also been in debate in the field. The first question is what part of a sentence determines whether the proposition it denotes is collective or distributive: The DP or the predicate. The second question is whether collective interpretation is always available, while distributive interpretation is derived through semantic operations, or if it is the other way around.

In an answer to both questions, Bennett (1974) proposes that a DP allows a collective reading when it denotes a 'group' (a plural individual), and a distributive reading when it denotes 'individuals' (non-plural individuals). So in (168a), for example, *six boys* denotes a 'group'.

59.   a. Six boys are a soccer team
   b. Three boys brought their passport
   c. five boys ate a cake
   d. Seven boys gathered

Dowty (1987) on the other hand, citing unpublished work by Kamp and Frey, distinguishes lexically between different types of predicates: *brought their passport* in (59b) is a distributive predicate, *ate a cake* in (59c) is a mixed predicate, and *are a soccer team* and *gathered* in (168a) and (168d) are collective predicates (168c). Dowty (1987) distinguishes farther between “collective predicates with distributive sub-entailments”, like *gather* in (168a), which entails some properties of the parts of the plural individual it is true of (also called “semidistributive”, c.f. Schein (2013) inter alia), and “pure cardinality collective predicates”, like *be a soccer team* which, if it is true of a plural individual, it is not true of any part of it.

Scha (1981) distinguishes further between a number of readings on the collective-distributive spectrum, including cumulative (60b), and including the interpretation illustrated in (61), where for the sentence to be true, sides would have to be picked out and matched (later named co-distributive by Sauerland (1994a, 1994b)).
60. 600 firms have 5000 computers
   a. ← 600 firms each have 5000 computers
   b. ← The computers owned by 600 firms altogether are 5000

61. The sides of the squares are parallel to each other

   One of the main arguments for distinguishing between collective and distributive interpretations on the predicate itself is the fact that one can conjoin a distributive VP and a collective VP with the same subject DP (Dowty 1987, Lasersohn 1995). An example from Dowty (1987) in (62) illustrates the conjunction of a distributive predicate, a mixed one, and a collective one.

62. The students closed their notebooks, left the room, and then gathered in the hall after class (Dowty 1987)

   On many of these views, collective interpretation is directly available in the presence of multiple participants, requiring an operator to distribute (e.g. Sauerland 1998). Gillon (1987) and Schwarszchild (1996), on the other hand, claim that collective and distributive interpretations are both special cases of the interpretations, claiming that predicates are true of a set if it is true of a cover of that set (c.f. discussion of covers in chapter 4). I argue in chapter 3, based on novel data from Lebanese Arabic, for a similar view to that of Bennet (1974), that collective (and a co-distributive) interpretations can only appear if the DP denotes a plural individual or a quantifier over plural individuals, and that distributive interpretation is necessary when the DP denotes a quantifier over a set of non-plural individuals.
1.5. The empirical puzzles

Two puzzles from Lebanese Arabic serve as the empirical starting points for this thesis. The Classifier-Plural puzzle consists of an apparent counterexample to a universal generalization by T'sou (1976), who states that plural marking and morphological classifiers are always in complementary distribution. This complementarity is also predicted by Borer's (2005) system, described in section 1.2, which treats plural marking as a classifier. Indeed, as Borer points out, even in languages that have both plural marking and morphological classifiers, like Armenian, the two never co-occur. This is illustrated in (57), repeated below in (63).

63. a. yergu hovanoc
    two umbrella

   b. yergu had hovanoc
    two CL umbrella

   c. yergu hovanoc-ner
    two umbrella-pl

   d. *yergu had hovanoc-ner
    two CL umbrella-pl

However, there are cases in Arabic in which the two appear to co-occur. Chapter 2 investigates these cases. Showing that in some contexts, the feminine marker -ah in Arabic performs the function of a classifier, I present data showing that -ah, in its function as a classifier, co-occurs with what appears to be plural marking on the noun. Showing that such co-occurrences happen only in the presence of numerals and definite determiners, I argue that, rather than challenging the system described in section 1.2, the Arabic classifier facts serve as evidence for a structural distinction between numerals and quantifiers such as many and few.
The second puzzle concerns transdecimal numerals in Lebanese Arabic. As the facts in section 1.3 show, transdecimal numerals are followed by non-plural marked nouns. But as I point out in chapter 3, the effect of transdecimal numerals is not limited to nouns only: Adjectives within transdecimal-numeral-containing DPs, as well as verbs and pronouns agreeing with such DPs, all have the option to be either plural marked (65a) or non-plural marked (65b).

65. a. tleetiin walad Twaal weSl-uu abel bayy-on
   thirty child-∅ tall-pl arrived-pl before father-their
   ‘Thirty tall children arrived before their father(s)’

   b. tleetiin walad Tawiil weSel abel bayy-uh
   thirty child-∅ tall-∅ arrived-∅ before father-his
   ‘Thirty tall children arrived before their fathers’

Given that this optional agreement contrasts with how agreement works everywhere else in Arabic (cf. section 1.3.4), chapter 3 tackles the transdecimal facts, exploring semantic effects that correlate with these unusual agreement facts. Building on this, chapter 3 proposes that the lower merger site for numerals, #, is a pluralizing functional
projection and that in order to get a collective interpretation of a numeral-containing DP, the numeral must merge in #. Chapter 4 details the semantics of # and of the DP with and without #. Finally, chapter 5 provides a synthesis of all the proposals and assumptions made in this thesis, alongside their predictions.

1.6. Where this work fits in the Arabic and Semitic grammatical tradition

This thesis builds on a rich tradition of work in Arabic grammar, and the topics and empirical puzzles it deals with find themselves couched in a significant amount of insightful work by both traditional and modern Arabic and Semitic linguists and philologists. In the last thirteen hundred years, traditional Arabic grammarians have addressed many of the major syntactic questions theoretical linguists ask today, providing descriptions of Classical Arabic in analytical ways that not only look at what is going on, but provide enlightening discussions of why it may be the case. In this section, I discuss where the empirical issues in Lebanese Arabic that this dissertation deals with fit in this tradition.

1.6.1. The puzzle of transdecimal numerals

1.6.1.1. Transdecimals and agreement in traditional grammar

One of the main empirical puzzles this thesis looks at is the puzzle of transdecimal numerals, where the noun following a transdecimal numeral is non plural marked, and the predicates agreeing with the noun or DP are only optionally plural marked. These facts, while rarely commented on due to their limited context of use in Classical Arabic, are mentioned in some of the early philological work on Arabic. First, the basic facts on transdecimal numerals (cf. section 1.3.3), have received consideration and explanations by traditional Arabic grammarians. Ghalayini (1912:86) as well as Siibawayh's (796) Al-Kitab propose that the non-plural marking and the accusative-like case on nouns

\[11\] I include the exact Arabic quote from Siibawayh (796) because the pages in the freely available edition are not numbered:
following transdecimal numerals in Classical Arabic (66a) signals the fact that the noun is a \textit{tamyiiz}, and that it involves more structural complexity than a simple DP, such as a pseudopartitive or prepositional phrase.\footnote{12} Thus, in essence, claiming that (66a) is really a contraction of (66b).

66. \begin{itemize}
\item a. ra\'aytu \textit{fi}shriina walad-an (*awlaad-in) \implies saw.1s twenty \textit{child-\textit{\textendash}ACC} (*\textit{child-pl-gen})
'\textit{I saw twenty children}'
\item b. ra\'aytu \textit{fi}shriina min al-walad-i \implies saw.1s twenty \textit{of the-child-\textit{GEN}}
'\textit{I saw twenty children}'
\end{itemize}

\footnote{12}Treating the accusative-like marking as a contraction of a more complex structure is not implausible at all. The same accusative-like marking occurs elsewhere in Standard Arabic, functioning somewhat like a type-shifter, turning nouns and adjectives into adverbs (or \textit{Haal}, in Arabic) as in (i)-(ii), and into pseudopartitives (\textit{tamyiiz}), as in (iii). The situation with numerals would be similar to (iii). This proposal is discussed in further detail in chapter 3.

\begin{itemize}
\item i. thahaba \textit{wa}ladi walad-an \textit{wa} ?aadas rajul-an; \implies left.3ms child-my \textit{child-acc} and returned \textit{man-acc} welcomed-me greeting-acc
'My child left as a child and returned as a man' \implies \textit{He welcomed me greetingly}'
\item ii. istaqbalani mura\textit{HH}ib-an
\item iii. akhathtu saa\textit{atan} raaHatan
\end{itemize}

\footnote{12}
Moreover, the fact that this non-plural marking is not limited to nouns, but that adjectives, too, following transdecimal numerals can be non plural marked is mentioned in Ghalayini (1912:93), who says:

“If you put an adjective after the noun following eleven and its sisters, and twenty and its sisters, you can make it singular following the form of the noun, such as ʕindii thallathata ʕashara/thalaathuuna rajulan kariiman ‘I have thirteen/thirty man-ø generous-ø’, and you can make it plural, following the interpretation of the noun, like ʕindii thallathata ʔashara/thalaathuuna rajulan kiraaman ‘I have thirteen/thirty man-ø generous-pl’ because rajulan ‘man’ here means ‘men’. Do you not see that the meaning is ‘thirteen, or thirty of men’ [...]. And if you pluralize the adjective [...] make its case match the number, and not the noun, as in: ʕindii arbaʕata ʕashara/arbaʕuuna rajulan SaaliHuun ‘I have fourteen/fourty-nom man-ø-acc good-pl-nom’”

As for agreement on predicates outside the DP, Siibawayh (796), has a chapter on kam ‘how many’, in which he lists multiple examples of non-plural marked predicates composing with a DP containing kam (67). In that chapter, he describes kam as being a numeral and states that its properties and felicity conditions are identical to those of ʕushruun ‘twenty’, and other transdecimal numerals. Siibawayh says:

“kam ‘how many’ is grammatical wherever ʕushruun ‘twenty’ is grammatical, and if something is jarring with ʕushruun ‘twenty’ it is also jarring with kam ‘how many’, because ʕishriin ‘twenty’ is nunated, and kam ‘how many’ is also nunated. And xamsataʕashar ‘fifteen’ is also nunated, just like what nunation has been pronounced in, and if it were not for that, then they would not have said xamsataʕashara dirhaman but nunation is covert on it [xamsataʕashar ‘fifteen’] as it is on invariable nouns, and its [xamsataʕashar ‘fifteen’]s
syntactic position is the position of things that are nunated.” (Siibawayh, 796)\(^{13}\)

67. a. kam min-k-um shaahid-un ᵇala fulaan
   how-many of-you-pl witness-∅-nom on so-and-so
   ‘How many of you are witnesses against/for so and so?’

   b. kam rajul-an ataa-ka
   how-many man-∅-acc came-∅-you
   ‘How many men came to you?’

   c. kam ghulaam-an la-ka thaahib-un
   how-many boy-∅-acc to-you going-∅-nom
   ‘How many of your boys are going?’

Other well known sources like Al-Ajroumiyya (Al-Fadel’s explanation, nd), Ibn Malik (1274), etc. do not mention the agreement on the predicate, and for good reasons: number agreement on a verb agreeing with a DP occurs only in SVO word orders. The puzzle observed for transdecimal numerals is restricted to indefinite subjects, which are extremely restricted in Classical Arabic and much more permitted in modern varieties of Arabic. Specifically, SVO word order is acceptable when the subject is definite, and in a small number of indefinite cases, supposedly only for contrastive or poetic reasons (Al-Fadel 1985; Ghalayini 1912, reprinted 2011). Explicitly, Al-Fadel says:

\(^{13}\) Again, I include the Arabic quote from Siibawayh (796) for lack of page reference:
"Of the properties of the mubtada\(\prime\) (sentence-initial subject): the main thing is that it be definite, and one cannot start with an indefinite, unless it is \textit{mufiid} ‘informative’.” (Al-Fadel, 1985)

Ghalayini says the same thing, providing a list of possible indefinite subject that count as \textit{mufiid} ‘informative’, which include subject DPs that contain a numeral.\(^{14}\) Despite these exceptions, indefinite subjects are dispreferred in Classical Arabic, which explains the lack of extensive discussions of the transdecimal puzzle in the traditional literature.

These morphosyntactic facts that have previously received some attention in Classical Arabic are explored in more detail for Lebanese Arabic, alongside the novel semantic observations associated with them. The investigation of these data, as well as a conversation with traditional and modern work on numerals and their interaction with the noun phrase, are central to the discussions in chapters 3 and 4. The proposals developed in these chapters serves both to understand better what is going on in the Arabic noun phrase, as well as to shed further light on the nature of the interaction between the numerals and the rest of the sentence in language in general.

\subsection{1.6.1.2. The puzzle of transdecimal numerals is \textbf{not} a VSO puzzle}

It is very important to note that the work in this thesis focuses on SVO word order, and does not attempt to answer questions concerning agreement in VSO word order in Arabic. Much work has been done on verbal number agreement in VSO word order in

\footnote{\textsuperscript{14}} Specifically, Ghalayini lists the following contexts as ones permitting the SVO word order in Classical Arabic: (1) when it is it’s a construct, (2) when it isit’s modified by an adjective, (3) when the predicate is a location and precedes the subject, (4) when it isit’s preceded by negation, exclamation, or \textit{lawla} ‘if not for’, (5) when the head noun is derived and describes an action, (6) that it be a conditional particle, question particle, or exclamative particle, (7) in a wish such as ‘peace be upon you’, (8) that it be the modifier of an absent subject, (9) that the sentence be conjoined, (10) in a list, (11) when it is conjoined to a definite DP, (12) when it is conjoined with an indefinite containing a modifier, (13) when it names the kind not a token, (14) when it is an answer to a question.
Standard Arabic as well as modern varieties of Arabic (Aoun et al 1994, Munn 1999, Mohammad 2000, Aoun et al 2010, Benmamoun 2000, Benmamoun et al 2010, Halila 1992, Hoyt 2002, inter alia). But crucially, the facts in VSO word order are very different from those in SVO word order, both syntactically as well as semantically: First, for Standard Arabic, non-plural marking is the only marking possible on verbs in VSO word order regardless of the properties of the DP (68). In contrast, SVO word order requires plural marking on verbs following plural DPs, and non-plural marking is only optional when the DP contains a transdecimal numeral (65a-b). Second, in VSO word order in Standard Arabic, there is no semantic effect associated with the non-plural marking on verbs, and the non-plural marking occurs regardless of the properties of the subject DP. In contrast, the optional non-plural marking in SVO word order is exclusively restricted to subjects containing transdecimal numerals, and the plural/non-plural marking is associated with a sharp semantic contrast. As the question of why verbs must be non-plural marked in VSO word order in Standard Arabic has received a significant amount of attention from all aspects in the literature, I do not try to answer it.\textsuperscript{16}

\begin{verbatim}
68. Iltaqaa/*iltaq-uu l-`awlaad-u fii sh-shaari?-i Standard Arabic
met-Ø-M/*-PL the-children-NOM in the-street-GEN
‘The children met in the street’
\end{verbatim}

As for modern varieties of Arabic, Halila (1992) observes an optional non-agreement in VSO word order in Tunisian Arabic, and Hoyt (2002) observes associated scope effects in Rural Palestinian Arabic. These facts, too, are different from those in (65a-b): First, the relevant DP need not contain a numeral, second, the noun is the (apparent) subject is itself

\textsuperscript{15} But see Schein (2013) for semantic effects related to first conjunct agreement, when the subject consists of two coordinated DPs.

\textsuperscript{16} One plausible explanation for the non-plural marking on the verb in VSO word order is that this is a case of non-agreement, and that number agreement takes place in a spec-head configuration at T, and that under VSO word order, the subject fails to raise to SpecT (Benmamoun 2000).
plural marked, and third, these cases involve full non-agreement, not only number non-agreement. Rather, the non-agreement observed by Halila (1992) and Hoyt (2002) pattern very much like expletive agreement with a covert subject (see Ouwayda (2014) for further discussion).

1.6.2. The semantic function of feminine marking -ah

Another subject that this dissertation looks at, and that finds itself fitted in a cross-temporal debate in Semitic grammar, is the behavior of the feminine marker -ah in Arabic as more than merely a feminine marker. Recall from section 1.3.1 that Arabic marks feminine gender and that this marking, when not corresponding to biological gender, is not systematic. While grammatical gender is most often not systematic for nouns that denote things with no biological gender, the feminine marker -ah is sometimes used in certain contexts, with a semantic function unrelated to femininity. These semantic functions of the Semitic feminine marking have received significant attention in traditional and modern work on Semitic grammar. Hasselbach (2014) notes in an article on Semitic gender that feminine marking is used for a number of similar functions across Semitic languages. She lists, among these functions, that the feminine marker can be used to derive nouns denoting abstract concepts from adjectives and nouns in Hebrew, Acadian, Classical Arabic, and Geşez. The semantic functions ascribed to feminine marking also include creating diminutives in Acadian, deriving collectives in Hebrew, Geşez, and –rarely– in Classical Arabic, and finally, it can be added to nouns that name kinds (so called collective nouns), resulting in singular nouns (so called singulatives) in Classical Arabic, Hebrew, and Acadian.

It is this last function, the so called “singulative” function of the feminine marker that is of particular interest to this thesis. Wright (1967), Cowell (1964) and others, also discuss the feminine marker’s “singulative” function. Cowell provides a long list of examples from Syrian Arabic, showing the kind of lexical items this function can be occur with. I argue in chapter 2 that what grammarians, including Cowell and Wright refer to as a “singulative” marker in Arabic is none other than a classifier, just like the classifiers in
Mandarin Chinese discussed in section 1.2: it takes a predicate and returns a predicate of count individuals. The discussion of *-ah’s behavior as something other than a purely formal gender marker jump starts a discussion about its interaction with plural marking, a discussion that goes beyond Arabic, putting in question a typological universal, and providing clues about the very nature of count and mass DPs, plural marking, and agreement.

1.6.3. Work on collective interpretations in Arabic

The distinction between collective and distributive interpretations in Arabic has also received its share of interest, albeit from a different viewpoint, and in a different domain, than those of this thesis. Brustad (2000) makes observations on pragmatic effects relating to collective and distributive interpretations in Arabic, building on Khan’s (1984) “hierarchies of individuation” (where “individuation” is understood to be a concept closely linked to distributivity, where parts of a group are individually recognizable). She notes that after human plural nouns in Arabic, two types of plural marking are possible on the verb: What is traditionally referred to as *jam? l-ʕaaqel* ‘rational-subject plural marking (69a), and what is traditionally referred to as *jam? ghayr l-ʕaaqel* ‘non-rational-subject plural marking (69b).

What classical grammars refer to as “non-rational plural agreement” looks like (rational) non-plural feminine marking in Arabic (69c), but it is not it: unlike non-plural marking, the non-rational plural agreement in (69b) occurs with both feminine and masculine subjects (in fact, the subject in (69b) is masculine), and non-plural masculine agreement is unavailable, as illustrated in (69d). This suggests that the -*et* in (69b) is simply a plural marking form that is dedicated to non-volitional subjects or subjects that are conceptualized as herds with no autonomous members (what Brustad would call non-individuated). I gloss this unusual plural as -*plnv* for ‘non-volitional plurality’.
69.  

a. l-Dyuuf akal-uu
    the-guest-pl ate-PL

b. l-Dyuuf akl-et
    the-guest-pl ate.Ø-plNV

c. l-bent akl-et
    the-girl ate-F

d. *D-Dyuuf akal
    the-guests ate-Ø

Brustad shows a collectivizing pragmatic effect associated with the use of the non-volitional plural marking: If John has five guests, and his assistant Bill has met each guest, talked to him/her, and has seen that all the guests have eaten, Bill must say (69a). Saying (69b), while not false, is odd, and would be taken as a sign of disrespect towards the guests (treating them like a herd or as non-volitional beings). If, on the other hand, John has hundreds of guests, and Bill does not know many of them, Bill can felicitously say (69b), and it may even sound too meticulous to say (69a) (see Lotfi 2006 for similar effects in Persian).

I note, importantly, that this distinction is not the same as the collective/distributive distinction discussed in section 1.5.2 and in chapters 3 and 4: Taking a predicate like be a soccer team, which is one that must be interpreted collectively, both types of agreement are acceptable with it (70). The same goes with left their wife, which must be interpreted distributively (71).
70. a. D-Dyuuf Telǝf fariiʔ gool
    the-people turned_out-FNVP team soccer

    b. D-Dyuuf Telǝ-uu fariiʔ gool
    the-people turned_out-pl team soccer

    ‘The guests turned out to be a soccer team’

71. a. r-rjeel tark-et nesween-ah
    the-men left-FNVP wives-theirPLNV

    ‘Men left their wives’ (social trend)

    b. r-rjeel tarak-u nesween-un
    the-men left-PL wives-theirPL

    ‘The men left their wives’

This contrasts with the unavailability of non-plural-agreement on collective predicates like be a soccer team following cardinals 11+, as illustrated in (72).

72. a. *?eshriin walad telǝf fariiʔ gool
    twenty child turned_out-∅ team soccer

    b. a. ?eshriin walad telǝ-uu fariiʔ gool
    twenty child turned_out-pl team soccer

    ‘Twenty boys turned out to be a soccer team’

It is therefore important to note that the distinction in Brustad’s data is not between plural and non-plural marking, but rather between two types of plural marking. Relatedly, the distinction is not a semantic distinction between collective interpretation and distributive interpretation, but rather a related pragmatic distinction between DPs
denoting plural individuals whose parts are easily perceived as discrete and distinguishable, and DPs denoting plural individuals whose parts are lumped together such that each is considered irrelevant when not part of the group.

The discussion on the continuum of individuation, then, serves as an object for comparison between things that are truly semantic collective/distributive distinctions, and things that are pragmatic effects associated with different morphological markers. The observations in (69) and the data of interest in chapter 3 are situated in different domains, and a theory accounting for one cannot, and should not, account for the other.

1.7. **The roadmap**

The next chapter starts by presenting the classifier-plural puzzle, investigating closely the cases in which the Lebanese Arabic classifier, *AH*, co-occurs with what appears to be plural marking on the noun. The results of this discussion serve as a first motivation for positing a functional projection #, in which numerals but not quantifiers, may merge.

In chapter 3, I present in detail the puzzle of transdecimal numerals, using it as a starting point to motivate the idea that not all numeral-containing DPs are such that they allow a collective interpretation. Rather, collective interpretation of a given DP requires that the DP contain a specific functional projection, one associated with the formation of a predicate of plural individuals. In this chapter, I argue against a number of alternatives concerning the origins of the collective-distributive interpretation.

In chapter 4, I provide the details of the semantic proposal, show how it resolves the puzzle of transdecimal numerals and argue that numerals enter syntax as objects of type n, rather than being inherently modifiers, quantifiers, or predicates.

Tying all the claims and assumptions together, in chapter 5 I show how the proposed account predicts other possible DP structures and their interpretations, and I close with a discussion of group nouns, and their interaction with numerals in DPs.
Chapter 2. Two plural markings: division and agreement

In this chapter, I uncover and examine a curious interaction between plural marking and -AH, a morphological classifier, in Arabic. I argue that there are two different plural markings in Arabic: One that merges in Div, is semantically contentful, and serves as a count morpheme, and another that occurs in a functional projection in which cardinal numerals occur (#), and which is merely an agreement marker with cardinal numerals, contributing no semantics of its own (none that is distinguishable from the semantics of the cardinal numeral).

I start from the observation that a morphological classifier, -AH, coexists in Arabic alongside a productive plural marking. This coexistence constitutes a counter example to Chierchia’s (1998) Nominal Mapping Parameter, which predicts that morphological classifiers and plural marking do not occur in the same language. Other languages have been documented as counter examples for this prediction, including Western Armenian (Borer, 2005), Dutch (DeBelder, 2008), inter alia. Example (73) from Bale & Khanjian (2009) illustrates the existence of both a classifier (73a) and a plural marker (73b) in Western Armenian.

73. a. yergu had shenk Western Armenian
two CL building
‘two buildings’

b. Shenk-er desa-r Western Armenian
building-pl saw-2.sg
‘You saw some buildings.’

The Exoskeletal system (Borer 2005), which I briefly describe in section 1.2, treats plural marking as a count morpheme. In this system, plural marking occurs in the (unique)

17 I gloss the classifier as -AH for lack of English equivalent.
functional projection in the DP that is dedicated to classifiers and count morphology. This directly predicts that plural marking and morphological classifiers compete over the same functional projection and therefore must be in complementary distribution in any given nominal structure. It is important to emphasize the fact that unlike the Nominal Mapping Parameter's prediction, this prediction is derivation specific, and not language specific.

74. \( (D_{\text{max}}^{\#}) \)

\( \text{D}) \quad #_{\text{max}} \)

\( \# \quad \text{Div}_{\text{max}} \)

\( \text{Div} \quad N_{\text{max}} \)

\( \text{PluralMarking} \quad \text{OR} \quad N \)

\( \text{Classifier} \)

This prediction of complementarity is corroborated by a universal generalization to that effect. To quote T'sou 1976 (and see also Haspelmath, 2001; Doetjes, 1996, 1997):

**T'sou's Generalization**

[T]he study of nominal classifiers systems suggests an important hypothesis that the use of nominal classifiers and the use of plural morphemes [is] in complementary distribution in natural language. More correctly, it suggests that either a) a natural language has either nominal classifiers or plural morphemes, or b) if a natural language has both kinds of morphemes, then their use is in complementary distribution. (p. 1216)

This proposed universal has been shown to be robust: Very few cases have been cited as potential counter-examples, and those that have been, have been found to involve things
that are not count morphemes of the relevant sense (cf. De Belder (2008), who argues that what appears to be a count morpheme is in fact a size specifying morpheme, and Park (2008) who shows that the so called plural marking -tul in Korean is in fact a distributive operator). Indeed, generally, when a language has both plural marking and a morphological classifier, they do not co-occur within the same noun phrase. This is illustrated in (75) for Western Armenian (Borer 2005).

75. *yergu had shenk-er Western Armenian
two CL building-pl

Arabic has a morphological classifier, -AH. Interestingly, this morphological classifier appears to co-exist with a plural marker. This constitutes a challenge to T'sou's generalization as well as to Borer's system. As I show, however, this plural marker can only occur in the presence of a cardinal numeral or a definite determiner.

The rest of this chapter is organized as follows: In the next section, I introduce the Arabic morphological classifier -AH, showing that it has all the properties of a classifier. I then present the data showing that the morphological classifier -AH and plural marking co-occur in Arabic, which constitutes a challenge for T'sou's universal generalization (section 2.2). In section 2.3 I show that the plural marking that co-occurs with -AH does not behave like other plural marking in the language. Finally, in section 2.4, I present my proposal, arguing that the plural marking that co-occurs with -AH is a semantically vacuous agreement with cardinal numerals in a projection that quantifiers cannot license.

2.1. -AH: An Arabic morphological classifier

The morpheme -ah, otherwise only a feminine morpheme (cf. section 1.3.1), when added to nouns of a certain class (food types, animals, liquids, grains, materials, etc. – I will henceforth use the name “batch nouns” to refer to the bare form of these nouns), results in count denotation but not necessarily denoting a plural individual (I will henceforth use the
word “unit” to refer to count standard instance of something). This is illustrated in (76)-(79). The classifier properties of this morpheme have been noted and illustrated previously by Zabbal (2002) as well as Fassi-Fehri (2003).

<table>
<thead>
<tr>
<th>Bare: 'batch/type' reading</th>
<th>-AH- affixed: 'unit-of' reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>76. ūSaSar-t teffeeH</td>
<td>77. ūSaSar-t teffeeH-ah</td>
</tr>
<tr>
<td>squeezed-1ps apple</td>
<td>squeezed-1ps apple-(AH)</td>
</tr>
<tr>
<td>← I squeezed a whole apple</td>
<td>← I squeezed a whole apple or</td>
</tr>
<tr>
<td>or more</td>
<td>more</td>
</tr>
<tr>
<td>← I squeezed less than an</td>
<td>← I squeezed less than an apple</td>
</tr>
<tr>
<td>apple</td>
<td></td>
</tr>
</tbody>
</table>

The process is productive and occurs in new borrowed words that fall within the lexical field of batch nouns (i.e. nouns that denote foods, liquids, materials, etc.)

80. a. krwasan    →    krwason-eh
     croissant     croissant-\(AH\)
     ‘croissant’ (food type) ‘a croissant’

     b. skotš       →    skotš-eh
     scotch-tape    scotch tape-\(AH\)
     ‘adhesive tape’ ‘A piece of adhesive tape’

Two more things point to \(-AH\)'s role as a classifier, and to the fact that the nouns it attaches to are syntactically and semantically mass. First, when the quantifier ktiir, which
is ambiguous between ‘much’ and ‘many’, is interpreted as ‘many’, it must be followed by a plural marked noun. When interpreted as ‘much’, it requires no marking on the noun. This is illustrated in (81). Batch nouns, like mass nouns, occur bare with ktiir. When -AH is affixed, on the other hand, a count non-plural structure is formed, and occurrence with ktiir is ungrammatical, as illustrated by (82):

81. a. ktiir may; b. ktiir Hubb; c. ktiir maṣrifeh;
   much water       much love       much knowledge

d. *ktiir annineh; e. *ktiir siyyaarah; f. *ktiir telefon;
   much bottle      much car        much telephone

82. a. ktiir tefeeH; b. ktiir Tabšuur; c. ktiir samak
   much apple       much chalk       much fish

d. *ktiir tefeeH-ah18 e. *ktiir Tabšuur-ah; f. ktiir samk-eh
   much apple-AH    much chalk-AH    much fish-AH

Secondly, the addition of a cardinal numeral like ‘one’ is perfectly grammatical and felicitous for nouns containing -AH, and gives a unit interpretation (83). It is marginal with batch nouns when bare, and if coerced, can only give a type reading, i.e. ‘one kind of apple’. This is illustrated in (84).

18 In all these cases, the examples in column are grammatical if adjectival, with ktiir meaning ‘very’, e.g. ktiir tefeeH-ah means ‘very apple-like’ (usually derogatory).
83. a. akalet tefeeH-ah waHdeh (be-z-zabet)
   ate.1s apple_{AH} one.F (to-the-exact)
   ← I ate exactly one apple (even if each half was a different type)
   ⇔ I ate more than or less than one apple (even if all of same type)

   b. saami štara Tabšuur-ah waHdeh (be-z-zabet)
   Sami bought chalk_{AH} one.F (to-the-exact)
   ← Sami bought exactly one piece of chalk
   ⇔ Sami bought more than, or less than, one piece of chalk

   c. Maryam zarfet šajar-ah waHdeh (be-z-zabet)
   Maryam planted tree_{AH} one.F (to-the-exact)
   ← Mary planted exactly one tree
   ⇔ Mary planted more than or less than one tree (even if same type)

84. a. ? akalet tefeeH weeHed (be-z-zabet)
   ate.1s apple one.M (to-the-exact)
   ← I ate exactly one type of apple (regardless of amount)
   ⇔ I ate more than one type of apple (even if total is exactly one apple)

   b. ? saami štara Tabšuur weeHed;
   Sami bought chalk one.M
   ← Sami bought exactly one type of chalk (regardless of amount)
   ⇔ Sami bought more than one type of chalk (regardless of amount)

   c. ? Maryam zarfet šajar weeHed
   Maryam planted tree one_M
   ← Maryam planted exactly one type of tree (regardless of amount)
   ⇔ Maryam planted more than one type of tree (regardless of amount)
The facts above support a view that a count interpretation involves more morphological and syntactic complexity than a mass interpretation. In all of these examples, it is precisely the presence versus absence of -\textit{AH} that is crucial for a grammatical and truth conditional contrast to emerge between count and mass, much like classifiers in Mandarin Chinese.

I therefore take -\textit{AH} to have the denotation of a classifier, with the additional specification that it denotes standard units (and not just any divisions)\textsuperscript{19}.

\begin{equation}
[-\textit{AH}] = \lambda P_{<e,D}\cdot \lambda x_e. P(x) \text{ and } x \text{ is a standard unit or of kind } P
\end{equation}

Paraphrase: Given a predicate \( P \), return a predicate that is true of individuals that \( P \) is true of which are standard units of the kind of things \( P \) is true of

Syntactically, given the facts that -\textit{AH} encodes countness, the structure for a noun phrase containing -\textit{AH} is expected to be like the structure of count nominals in (74). The structure is given in (86) for -\textit{AH}:

\begin{itemize}
  \item Arabic count structure, -\textit{AH}:
\end{itemize}

\begin{equation}
86. \quad \text{Arabic count structure, -\textit{AH}:}
\end{equation}

\begin{itemize}
  \item (D\textsuperscript{max}
  \item D)
  \item #\textsuperscript{max}
  \item #
  \item Div\textsuperscript{max}
  \item Div
  \item N\textsuperscript{max}
  \item -\textit{AH}
  \item \triangle
\end{itemize}

\textsuperscript{19} It also encodes feminine grammatical gender, but this contribution is syntactic and non-semantic, and does not have any effect on the denotation.
2.2. The puzzle: A plural and a classifier together

2.2.1. Co-occurrence

Given that -\textit{AH} is a count morpheme, and thus taken to be an instantiation of Div (cf. (86)), and plural marking is also assumed to be an instatiation of Div (cf. section 1.2), Borer’s exoskeletal model predicts that the two should compete for the same structural (and semantic) slot, and never co-occur (87). This is supported by T’ sou’s universal generalization stating that cross-linguistically, classifiers and plural markers do not co-occur (c.f. page 46). As it turns out, however, -\textit{AH} and plural marking do co-occur in Arabic. A few examples are given in (88)

87. \[
(D_{\text{max}}^{\text{max}})
\]

88. a. štre-t tlat teffeeH-aat
bought-1s three apple-\textit{AH}-pl
‘I bought three apples’

b. ken fi sett \textit{Tabšuur}-aat be-l-ʕelbeh
was exist six chalk-\textit{AH}-pl in-the-box
‘There were six pieces of chalk in the box’
c. štar-o sabʕ šajr-aat
  bought-3p seven tree-\textit{AH}-pl
  'They bought seven trees'

The grammaticality of the examples in (88) and the analysis of plural marking as heading Div are in conflict. Four possibilities arise:

89. Possible explanations for the plural forms in (88):

A. \textit{-AH} is not a count morpheme and does not merge in Div (but the tests in section 2.2 point to the contrary)

B. There is no co-occurrence of \textit{-AH} and plural marking. The plural marking that appears to be occurring on top of \textit{-AH} is actually merging with on the bare stem, and the appearance of co-occurrence is a coincidence.

C. Contra Borer (2005), plural marking is not in actuality a count morpheme, and T'sou's (1976) generalization is false.

D. The marking that co-occurs with \textit{-AH} while it looks like other instances of plural marking in the language, is not syntactically or semantically the same as other plural marking in the language. So it is specifically this plural marking that is not a count morpheme, and other occurrences of plural in the language are.

I argue that it is specifically the plural marking that co-occurs with \textit{-AH} that is not a count morpheme (possibility 89D). I have shown in section 2.1 that \textit{-AH} is a count morpheme, ruling out possibility (89A). The remaining of this section investigates and rules out the possibility that the co-occurrence of \textit{-AH} and plural marking is not real (possibility 89B), showing that to co-occurrence is real, as is the puzzle. I then show in section 2.3 that the plural marking that co-occurs with \textit{-AH} behaves differently from any other plural marker in Arabic, suggesting this as evidence for (89D).
2.2.2. The co-occurrence is real

While I glossed the plural forms in (88) as -AH followed by plural marking, this analysis is not phonologically self-evident. It is possible given the phonology of the plural forms in (88) to assume that the plural marker, specifically the sound feminine plural marking -eet/-aat, attaches directly to the batch noun resulting in the desired count reading without an intermediate -AH affixation, as glossed in (90). Such an analysis would do away with the puzzle described in section 2.2.1: if the plural nominals laymuuneet 'oranges' or djeejeet 'chickens' do not involve the merger of -AH, there is no co-occurrence of -AH and plural, and therefore no counter-example to T'sou's generalization or to Borer's prediction: The competition schematized in (87) would not occur.

90. a. tlat Tabšuur-aat
    three chalk-\textsubscript{pl}\textsubscript{F}
    ‘three chalks’

    b. sett samk-eet
    six fish-\textsubscript{pl}\textsubscript{F}
    ‘six fishes’

    c. sabī djeej-eet
    seven chicken-\textsubscript{pl}\textsubscript{F}
    ‘seven chicken’
As I will show directly, however, the co-occurrence is real, as is the puzzle. Looking at the possibilities for plural marking on batch nouns, most batch nouns have two plural marked forms: One that is broken plural as listed in (91B), which typically denotes types or batches. The other plural form is a sound feminine plural form as listed in (91D), which denotes units, but never types\textsuperscript{20}.

In the remainder of this section I show that the forms in (91D) are the result of the attachment of sound feminine plural marking to the -\textit{AH} affixed forms in (91C), and not the

\begin{tabular}{|l|l|l|l|}
\hline
91. & A. & B. & C. & D. \\
\hline
 & Batch noun & Broken (BR) plural & Batch noun + -\textit{AH} & Sound feminine (SF) Plural \\
 & (all masculine) & (all masculine) & (all feminine) & (all feminine) \\
\hline
a. Tabšuur & Tbaašiir & Tabšuur-ah & Tabšuur-aat \\
chalk & chalk-pl\textsubscript{BR} & chalk-\textit{AH} & chalk-\textit{AH}-pl\textsubscript{SF} \\
 & ??pieces of chalk & piece of chalk & pieces of chalk \\
 & bunches of chalk & *(different) types of chalk & *(different) types of chalk \\
 & (different) types of chalk & & \\
\hline
b. samak & asmeek & samk-eh & samk-eet \\
fish & fish-pl\textsubscript{BR} & fish-\textit{AH} & fish-\textit{AH}-pl \\
 & ??fishes & a fish & fishes \\
 & heaps/types of fish & & *heaps/types of fish \\
\hline
c. raml\textsubscript{M} & rimeel & raml-eh & raml-eet \\
sand & sand-pl\textsubscript{BR} & sand-\textit{AH} & sand-\textit{AH}-pl\textsubscript{SF} \\
 & *grains of sand & grain of sand & grains of sand \\
 & heaps/types of sand & & *heaps/types of sand \\
\hline
\end{tabular}

\textsuperscript{20} For reasons that are unknown, a few nouns, like \textit{teffeeH} ‘apple’, do not have a broken plural form. Despite this fact, the sound feminine plural form is restricted in all the ways that it is for the words that have two plural forms listed in (91), cf. section 2.2.2.2 for more discussion.
result of direct attachment of sound feminine plural marking to the bare form of the batch nouns in (91A). In order to do this, I first show that the gender difference between the sound feminine plural forms in (91D) and the broken plural forms in (91C) is genuine, and crucially, that it is not due to the choice of plural marker itself, but rather to the gender of the stem to which it attaches (2.2.2.1). Then I illustrate the contrast in interpretation (between multiple kinds/batches and multiple units), and show that it too is not due to the choice of plural marker, but rather to the stem (2.2.2.2).

### 2.2.2.1. Argument from Gender:

Consider the masculine batch nouns in (91A). The fact that they are masculine can be shown through the masculine agreement on adjectives modifying them (92). Recall from chapter 1 section 1.3.1 that adjectives agree in gender with singular nouns in Lebanese Arabic: Since adjectives modifying the batch nouns in (91A) must all be masculine in form and cannot be feminine marked, we can conclude that these nouns are masculine.

92. a. TabšuurM kbiir/*kbiir-eh; b. samak nay/nayy-eh
   chalk big-∅/*big-F fish raw-∅/*raw-F
   c. raml abyaD/*bayD-ah
   sand white-∅/*white-F

Similarly, the broken plural forms of the batch nouns in (91C) are masculine. The grammatical gender of plural expressions can be deduced from the use of pronominal gender in singular partitives. This test is needed because adjectives modifying plural-marked nouns in Lebanese Arabic do not show any gender distinction\(^{21}\) (cf. chapter 1 section 1.3.4), so the fact that the plural forms in (91C) are masculine cannot be demonstrated through adjectival agreement. Specifically, the word corresponding to 'one'

\(^{21}\) This lack of gender distinction in adjectives is also true for Standard Arabic for nouns with non-human denotes, which is the case for all batch nouns.
in expressions such as 'one-of-the-X' is gender-marked as masculine (weeHed) or feminine (waHdeh). By assumption, this gender marking corresponds to the gender of the stems of the plural marked noun occurring in the partitive construction. (93) illustrates how the test works, showing that the grammatical gender of the stem is preserved: when the stem is masculine, like kalb 'dog' in (93a), 'one' in the partitive construction must be in the masculine form. When the stem is feminine, like madiineh 'city' in (93b), 'one' in the partitive construction must be in the feminine form.

93. a. weeHed/*waHdeh men el-karaasii stem: kersi (masculine)
    one.M/*one.F of the-chair-plBR
    One of the chairs

    b. waHdeh/*weeHed men el-mudun stem: madineh (feminine)
    one.F/*one.M of the-cities
    ‘one of the cities’

Applying this test to the broken plural forms in (91B) and the sound feminine plural forms in (91D), we observe that the former are masculine while the latter are feminine. The test indicates that the two plurals have different stems. This is illustrated in (95) for Standard Arabic22, where only a masculine form of 'one' is acceptable with broken plurals, and a feminine one is not. And in (95)-(96) for the sound feminine plurals in (91D) where the feminine form of 'one', waHdeh, is required and the masculine form gives rise to ungrammaticality, in both Standard (95) and Lebanese Arabic (96).

94. a. aHadu/*iHdaa l-asmaak  b. aHadu/*iHdaa l-aHjaar

22 Adding a partitive to the broken plural forms in (91C) results in oddity in Lebanese Arabic with either gender, for reasons that are poorly understood. But no such oddity emerges in Standard Arabic. As expected, the masculine form of 'one' is systematically required.
‘one type of fish’  
‘one type of stone’

95. a. iHdaa/*aHadu  s-samak-aat  
    one.F/*one.M  the-fish-pl_{SF}  
    ‘one of the fish’

b. iHdaa/*aHadu  l-Hajaraat  
    one.F/*one.M  the-stone-pl_{SF}  
    ‘one of the stone’

c. iHdaa/*aHadu  r-raml-aat  
    one.F/*one.M  the-sand-pl_{SF}  
    ‘one of the grains of sand’

96. waHdeh/*weeHed  men s-samk-eet/ l-Hajr-aat/ r-raml-eet  
    one.F/*one.M  of  the-fish-pl_{SF}/the-stone-pl_{SF}/the-sand-pl_{SF}  
    ‘one of the fish/stones/grains of sand’

It might be tempting to propose that sound feminine plural marking, in and of itself, change the gender of the expression as a whole. But it can be shown that this is not the case. Recall from chapter one (section 1.3.2) that some masculine derived nominals and borrowed foreign nouns mark plurality with sound feminine marking (97). As (98) shows, the grammatical gender is conserved after pluralization: Systematically, despite the presence of the sound feminine plural, the masculine form of ‘one’, weeHed, is required when creating a partitive for masculine derived nominals and borrowed nouns, despite the feminine plural marking.

97. a. ittiSaal  Tawiil  →  ittiSaal-eet;
call\textsubscript{M} long-\emptyset call-pl\textsubscript{SF}

\begin{itemize}
  \item b. computer mniH $\rightarrow$ computer-aat
  computer\textsubscript{M} good-\emptyset computer-pl\textsubscript{SF}
\end{itemize}

98. a. weeHed/*waHdeh men el-ittiSaal-eet stem:ittiSaal (masculine)
    one.M/*one.F of the-phonecall-pl\textsubscript{SF}
    'one of the phonecalls'

b. weeHed/*waHdeh men el-computer-aat stem:computer (masculine)
    one.M/*one.F of the-computer-pl\textsubscript{SF}
    'one of the computers'

Since feminine plural marking neither requires a feminine stem nor results in a feminine plural form (98); and since the sound feminine plural forms of batch nouns in (91D) are grammatically feminine, as demonstrated in (95) and (96); then the sound feminine plural forms in (91D) are the result of plural-marking merging with a nominal element that is already grammatically feminine.

Since the bare batch nouns in (91A) are masculine, then the sound feminine plural forms in (91D) cannot be the result of plural marking directly merging with the bare batch nouns in (91A)

The only remaining option is that the feminine sound plural forms in (91D) are formed from the grammatically feminine, already count, -\textit{AH} affixed nouns in (91B).

\textbf{2.2.2.2. Argument from Interpretation:}

The pluralization of (ontologically) mass things typically allows both a ‘kind’ interpretation or a ‘unit’ interpretation. For instance, \textit{soup}, \textit{juices}, and \textit{breads}, in English, can denote either different types of soup, juice, and bread, or multiple containers, or loaves.
As is natural, pragmatics sometimes favor one interpretation over the other. So, pluralizing the mass forms in (91A) should be predicted to allow both interpretations.

Indeed, the broken plural forms in (91C) can have both interpretations, with a strong preference for being interpreted as multiple kinds, or loads. This parallels the interpretations typically obtained from pluralizing (ontologically) mass things cross-linguistically. In contrast, the interpretation of the sound feminine plural forms in (91D) only allows a unit interpretation, regardless of the context. This is illustrated in (99).

99. a. fii arbaʕ Tbaašiir be-z-zabet ʕa-T-Taawlah
   exist four chalk-pl_br in-the-exact on-the-table
   ↹ There are exactly 4 types of chalk on the table (more than 4 pieces)
   ↹ There are exactly 4 pieces of chalk on the table (even if < 4 types) (less favored)

   b. akalt xams asmeek be-z-zabet
   ate.1s five fish-pl_br in-the-exact
   ↹ I ate exactly 5 kinds of fish (e.g. if 2 of each kind, then 10 fish total)
   ↹ I ate are exactly 5 fish (e.g. 3 anchovies, and 2 smelts)

100. a. fii arbaʕ Tabšuur-aat be-z-zabet ʕa-T-Taawlah
   exist four chalk-pl_{sl} in-the-exact on-the-table
   ↹ There are exactly 4 types of chalk on the table (more than 4 pieces)
   ↹ There are exactly 4 pieces of chalk on the table (even if < 4 types)

   b. akalt xams samk-eet be-z-zabet
   ate.1s five fish-pl_{sl} in-the-exact
   ↹ I ate exactly 5 kinds of fish (e.g. if 2 of each kind, then 10 fish total)
   ↹ I ate are exactly 5 fish (e.g. 3 anchovies, and 2 smelts)
This unambiguous reading in (100) is peculiar given the usual behavior of plural marking, which typically allows both kind and unit interpretations. It is, however, precisely what one would expect from adding the plural marking on a noun that is already made count with a unit-forming count morpheme like -AH in (91B).

It might be tempting to think that sound feminine plural marking -aat, itself, like -AH, forces a unit interpretation. But as (102) shows, when sound feminine plural marking -aat is affixed to a non-batch noun that is conceptually and grammatically mass (101), such as metfah 'pleasure', and which cannot take -AH, the resulting nominal typically denotes multiple kinds of pleasures, and specifically it is possible, but harder, to conceive of it denoting multiple units/instances of it (102).

101. a. ktiir metfah; b. ktiir maHabbeh;
   much pleasure         much affection

c. ktiir musiiʔa;     d. ktiir maʔrifeh;
   much music            much knowledge

102. a. jarrab saamii ᵇeddet metf-aat (abel ma ytuub)
   tried.3sm Sami several pleasure-plSF (before that repent)
   ← Sami experienced several types of pleasure (physical, emotional...)
   ?? Sami repeated the same experience and felt the same type of pleasure multiple times

b. semfet maryam ᵇeddet musiiʔ-aat
   heard.3sf Mariam several music-plSF
   ← Mariam has listened to several kinds of music
   ?? Mariam has listened to several tracks of the same kind of music
Indeed, plural marking typically allows both a kind reading and a unit reading, and a preference for one over the other depends typically on pragmatics. The facts in (102) are also true for the English plural marker -s, as illustrated in (103).

103. a. John has experienced many pleasures in his life
   → John has experienced many types of pleasure
   →?? John has experience the same type of pleasure repeatedly

   b. Mary has listened to many musics over the last year
   → Mary has listened to many types of music over the last year
   →?? Mary has listened to many tracks of only one type of music over the last year

The structure for the DPs in the pluralized mass nouns in Arabic given in (102) and their English counterparts in (103), I assume, is the same: It is simply the DP structure in (74), repeated below in (104), with plural marking occurring in Div, and with no other classifier present.

104.  

(D_{max}^{D})  

  #_{max}^{D}  

  #  

  many_{max}^{Div}  

  D_{max}^{Div}  

  N_{max}^{s}  

  N_{max}^{aat}  

  pleasure  

  metfiah
So the particular interpretation associated with the sound feminine plural forms in (91D) does not result from independent semantic properties of the plural marker -eet/-aat, but rather, from those of the AH-affixed forms it attaches to.

The possibility of interpreting a plural marked noun as multiple kinds is, therefore, not dependent on the specific morphophonological realization of plural marking that is used. Rather, it is dependent on what, exactly, the plural marking is added on to.

### 2.2.2.3. Interim conclusion

I have established in this section that there are, indeed, two morphemes associated with the derivation of the forms in (91D): The dividing morpheme –AH, and the feminine sound plural morpheme –aat.

I will therefore put (-AH) in all glossing of these plurals from here on. The puzzle, then, stands as originally formulated: in a model that assumes that plural marking is an instance of Div, a morphological classifier (a dividing morpheme) such as -AH is predicted not to coexist with plural marking, as the two would compete for the Div node. But the two do co-exist in the forms in (91D). We must therefore assume that one or the other is not actually in Div, if common assumptions concerning phrase markers are to be adhered to.

In the next section, I show that the puzzle, in fact, can be resolved.

### 2.3. Two different plurals: Plurals of -AH-affixed nominals vs. other plurals

In this section, I show that the puzzle of co-occurrence of plural marking with a morphological classifier in Arabic can be resolved. I do this by showing that although -AH and -aat can, and do, coexist, these two morphemes do not in actuality compete for the same slot. As I have shown in section 2.4, -AH is a true morphological classifier, and hence, if one assumes a structure in which there is a unique merger site for classifiers, Div, -AH merges in Div. But the specific case of the sound feminine plural marking in (91D) (the -aat in Tabšuur-AH-aat ‘chalk-AH-pl’) is not. In order to show that the specific case of the sound feminine plural in (91D), which co-occurs with -AH, is not a count morpheme, and is not, in
fact, like any other plural in the language, I compare, in detail, the behavior of the plural forms in (91D) where plural marking and the morphological classifier -\(AH\) co-occur, with other plural forms in Arabic which do not contain -\(AH\). I show that there are significant distributional as well as interpretational distinctions between the two.

Note that I have already illustrated in section 2.2.2.2 one semantic property of the plural forms in (91D) that differs from all typical plural marked nouns: they never admit a kind reading. I now show that there are, in fact, more differences, including syntactic ones. In terms of distribution, I illustrate three distinctions:

A. Plural marked nouns in Arabic typically licit when bare, but nouns in which plural marking and the morphological classifier -\(AH\) co-occur cannot occur bare (section 2.3.1)

B. Plural marked nouns in Arabic are typically licit following quantifiers, but nouns in which plural marking and the morphological classifier -\(AH\) co-occur cannot occur following quantifiers (2.3.2)

C. Plural marked nouns in Arabic do not typically require the presence of a definite determiner or cardinal numeral. Nouns in which plural marking and the morphological classifier -\(AH\) co-occur require the presence of a definite determiner or cardinal numeral. (2.3.3)

Finally, I provide another semantic difference between the nouns in which plural marking and the morphological classifier -\(AH\) co-occur and other plural marked nouns in Arabic. I show that in the context of partitive quantifiers (e.g. \(aghlab\) l- ‘most the-‘), plural marked nouns in Arabic typically allow both a specific partitive interpretation (akin to “most of the”) and a generic quantifier reading (akin to “most”). Nouns in which plural marking and the morphological classifier -\(AH\) co-occur only allow a specific partitive reading, and categorically do not allow a generic quantifier reading (2.3.4)
2.3.1. Bare plurals

Like Romance languages, Arabic allows bare plurals in weak contexts. This is true of plural forms in Arabic regardless of the choice of morphophonological realization of plural marking. This is shown in (105) for sound masculine plurals, (106) for sound feminine plurals, and (107)-(108) for broken plurals with masculine and feminine bases (respectively).

105. a. šeft mhands-iin bi-l-lab   b. šeft šeHHaad-iin ša-l-beeb
      saw.1s engineerSM in-the-lab   saw.1s beggarSM at-the-door
      ‘I saw engineers in the lab’  ‘I saw beggars at the door’
      base: mhandes (masculine)    base: šeHHaad (masculine)

106. a. šeft mhands-eet bi-l-lab   b. šeft šarik-eet bi-l-madiineh
      saw.1s engineerSF in-the-lab   saw.1s company-plSF in-the-city
      ‘I saw female engineers in the lab’  ‘I saw companies in the city’
      base: mhands-eh (feminine)    base: šarikeh (feminine)

107. a. šeft rjeel bi-l-uudah   b. šeft kleeb bi-šeereľ-na
      saw.1s man-plBR in-the-room   saw.1s dog-plBR in-street-us
      ‘I saw men in the room’  ‘I saw dogs in our street’
      base: rejjeel (masculine)    base: kalb (masculine)

108. a. šeft Sabaaya bi-l-salon   b. šeft šelab ša-l-baar
      saw.1s youth-plBR in-the-lounge   saw.1s box-plBR on-the-bar
      ‘I saw young ladies in the lounge’  ‘I saw boxes on the bar’
      base: Sabiy-eh (feminine)    base: šelbeh (feminine)

Surprisingly, unlike all other plural marked DPs in Arabic, DPs in which plural marking and the morphological classifier -AH co-occur can never be bare indefinites. This is
illustrated in (109) below. These examples sharply contrast with the forms in (106), also marked with the sound feminine plural marking, and which occur as bare indefinites.

109. a. *šeft Tabšuur-aat bi-d-derej
  saw.1s chalk{-AH}-pl in-the-drawer
  'I saw pieces of chalk in the drawer'
  base: Tabšuur{-AH}

b. *šeft samk-eet bi-l-baHer
  saw.1s fish{-AH}-plSF in-the-sea
  'I saw fish in the sea'
  base: samk{-AH}

c. *šeft manʔuuš-eet b-l-fern
  saw.1s calzone{-AH}-plSF in-the-oven
  'I saw calzones in the oven'
  base: manʔuuš{-AH}

d. *šeft Saxr-aat ʕa-š-šaTT
  saw.1s rock{-AH}-plBR on-the-beach
  'I saw rocks on the beach'
  base: Saxr{-AH}

Moreover, and crucially, the curious ungrammaticality of the forms in (109) as bare definites is not due to lexical properties of the roots or the base noun: As (110) shows, the broken plural forms formed from the same stems (the batch nouns, minus the classifier {-AH}) occur freely as bare indefinites.

110. a. šeft Tbaašiir bi-d-derej
  saw.1s chalk-plBR in-the-drawer
  'I saw chalk in the drawer'
  base: Tabšuur

b. šeft asmek bi l-baHer
  saw.1s fish-plBR in the-sea
  'I saw fish in the sea'
  base: samak

c. šeft mneeʔiš bi-l-fern
  saw.1s calzone-plBR in-the-oven
  'I saw calzones in the oven'
  base: manʔuuš

d. šeft Saxuru ʕa l-šaTT
  saw.1s rock-plBR on-the-beach
  'I saw rocks by the beach'
  base: Saxr
The restriction also cannot be attributed to morphological complexity: As shown by the derived nominals in (111), which are equally if not more morphologically complex than the forms in (109), and which are also pluralized with sound feminine plural, do occur as bare indefinites in the same context.

111. a. šeft xileef-eet bayn-un
    saw.1s disagreement-plSF between-them
    ‘I saw disagreements among them’

    b. ʕmelo ittiSaaleet bayneet-kon
        make connection-plSF between-you
        ‘Make connections with each other’

    c. šeft tanaaʔuDaat bi-kaleem-ak
        saw.1s contradiction-plSF in-speech-you
        ‘I saw contradictions in what you say’

So the forms in (109), in which plural marking co-occurs with plural marking, can never occur bare contrasts with the phonetically indistinguishable sound feminine counterparts in (106) which can. They contrast with their conceptual relatives, the broken plural forms of the same root in (110) which also can. They also contrast with nouns of similar morphological complexity also using sound feminine plural in (111) which also can. This contrast strongly points to a causal relation between the specific co-occurrence of the classifier -AH and plural marking, and the ungrammaticality of the forms in (109).

This is especially interesting when one considers the meaning of bare plurals in (110): Given the facts, the grammar of Arabic expresses, without determiners, something like 'various types of rocks' as a bare indefinite, but cannot express the simpler notion, ‘rocks’, in a bare indefinite DP. It is therefore very unlikely that this effect is the result of lexical semantics, or to a conceptual bias that makes forms like (109) dispreferred.
I therefore take these distinctions in acceptability in bare context to signal that the plural marking occurring in (109) is *syntactically* different from plural marking in the rest of language, including the morpho-phonologically identical forms in (106).

2.3.2. Plurals and quantifiers

Another property of plural marking in Arabic is that regardless of the morpho-phonological realizations of plural marking (sound masculine, sound feminine, or broken plural marking), a plural marked nominal can occur in the context of a quantifier, such as *ktiir* 'many' or *šway* 'few', which normally select a plural restriction. This is shown in examples (112) for sound masculine plural marking, (113) for sound feminine plural marking, and (114)-(115) for broken plural marking.\(^\text{23}\)

\begin{align*}
112. & \text{a. ſeft šwayt mhands-iin bi-l-lab} & \text{b. ſeft ktiir ſeHHaadiin ſa-l-beeb} \\
& \text{saw.1s few engineer-plSM in-the-lab} & \text{saw.1s many beggarSM at-the-door} \\
& \text{‘I saw a few engineers in the lab’} & \text{‘I saw many beggars at the door’} \\
& \text{base: mhandes (masculine)} & \text{base: ſeHHaad (masculine)}
\end{align*}

\begin{align*}
113. & \text{a. ſeft šwayt mhands-eet bi-l-lab} & \text{b. ſeft ktiir šarik-eet bi-l-balad} \\
& \text{saw.1s few engineer-plSF in-the-lab} & \text{saw.1s many company-plSF in-the-town} \\
& \text{‘I saw a few engineers in the lab’} & \text{‘I saw many companies in the town} \\
& \text{base: mhands-eh (feminine)} & \text{base: šarikeh (feminine)}
\end{align*}

\[^{23}\text{Effectively, Standard Arabic does not have determiner-like pre-nominal quantifiers, and the quantifiers correlating with ‘many’ (kathiir) and ‘few’ (qaliil) occur, when pre-nominal, exclusively in partitive constructions, requiring a syntactically definite restriction.}\]
114. a. šeft šwǎyṭ rjeel bi-l-uuḍah
    saw.1s few man-pl_{BR} in-the-room
    'I saw a few men in the room'  
    base: rejjeel (masculine)

   b. šeft ktiir kliēb bi šeeref-na
    saw.1s many dog-pl_{BR} in street-us
    'I saw many dogs in our street'  
    base: kalb (masculine)

115. a. šeft šwǎyṭ Sabaaya hon
    saw.1s few youth-pl_{BR} here
    'I saw a few young ladies here'  
    base: Sabiyy-eh (feminine)

   b. šeft ktiir ūlēb ūa l-baar
    saw.1s many box-pl_{BR} on the-bar
    'I saw many boxes on the bar'  
    base: ūlēbeh (feminine)

  Remarkably, as in the case of bare indefinites, nominals in which the classifier -AH and plural marking co-occur are illicit after the quantifiers 'many' and 'few', as shown in (116). This is again in striking contrast with the sound feminine plurals in (113) which are perfectly grammatical, despite the fact that the plural suffix is phonetically indistinguishable from the plural marking in the nouns in which the -AH-plural marking co-occurrence takes place in (116).

116. a. *šeft šwǎyṭ Tabšuur-āt honiik
    saw.1s few chalk(-AH)-pl there
    'I saw a few pieces of chalk there'  
    base: Tabšuur-\textit{AH}

   b. *šeft ktiir samk-ēet bi-l-baHer
    saw.1s may fish(-AH)-pl_{SF} in-the-sea
    'I saw many fish in the sea'  
    base: samk-\textit{AH}

   c. *šeft šwǎyṭ manʔuuš-eet hon
    saw.1s few calzone(-AH)-pl_{SF} in here
    'I saw a few calzones in the oven'  
    base: manʔuuš-\textit{AH}

   d. *šeft ktiir Saxr-āt ūa-l-šaTT
    saw.1s many rock(-AH)-pl_{BR} on-the-beach
    'I saw many rocks on the beach'  
    base: Saxr-\textit{AH}

  Additionally, again like in the bare indefinite context, the broken plural marked forms derived from the very same roots may occur with the plural selecting quantifiers as
illustrated in in (117), while the nominals in which the classifier -AH and plural marking co-occur, with the same root may not, as shown in in (116).

117. a. šeft šwayt Tbaašiir bi-d-derej b. šeft ktiir asmeek bi l-baHer
    saw.1s few chalk-plBR in-the-drawer saw.1s many fish-plBR in the-sea
    'I saw a few chalk in the drawer' 'I saw many fish in the sea'
    base: Tabšuur base: samak

c. šeft šwayt mneeʔiš bi-l-fern d. šeft ktiir Sxuur ʕa-l-šaTT
    saw.1s few calzone-plBR in-the-oven saw.1s many rock-plBR on-the-beach
    'I saw a few calzones in the oven' 'I saw rocks by the beach'
    base: manʔuuš base: Saxr

There are therefore two contexts that are otherwise perfectly compatible with all forms of plural marking in Arabic, and which are entirely incompatible with any nominal forms in which plural marking co-occurs with the classifier -AH. It is therefore very likely that it is specifically this co-occurrence that is the reason behind the incompatibility with plural-selecting syntactic contexts.

It is now worth noting that given the singular-like behavior of the classifier -AH observed in section 2.1, nouns ending with -AH and no plural marking would be predicted not to be compatible with the plural selecting quantifiers ktiir 'many' and šway 'a few'. Indeed, as (118) shows, they are not.

    many chalk-\textit{AH} few rock-\textit{AH} many fish-\textit{AH}
    'many chalks' 'a few rocks' 'many fish'

But if the structure for \textit{teffeeH\,-\,ah} 'apple-\textit{AH}' and for \textit{mhands-\,iin} 'engineer-pl' is the same one as shown in (87), repeated below in (119), then it is puzzling that one would be
compatible within certain contexts while another would not. I return to the specific structure of the forms with ‘-AH’ alone in section 2.4.3. The basic idea, however, is that plural marking, but not -AH, has a purely syntactic [pl] feature that can be verified, and that quantifiers like ktiir ‘many’ and shway ‘a few’, in a count context, require this feature.

119. \[
\begin{array}{c}
(D_{\text{max}} \\
\text{D}) \\
\text{\#}_{\text{max}} \\
\text{\#} \\
\text{Div}_{\text{max}} \\
\text{Div} \\
\text{N}_{\text{max}} \\
-\text{AH} \\
-\text{PL}
\end{array}
\]

2.3.3. A dependent plural: where the co-occurrence is licit

So far we know that nominals in which plural marking and the morphological classifier -AH co-occur cannot appear in two syntactic contexts in which plural marking is typically licit, and even required: they cannot occur as bare indefinites, and they cannot follow plural-selecting quantifiers such as ktiir ‘many’ and šway ‘a few’. We are now left with the empirical question of where exactly such nominals are licit.

As it turns out, when indefinite, the co-occurrence of -AH and plural marking is licit only in the context of cardinal numerals or numeral-like expressions (e.g. Sedde(t) ‘several’). This is illustrated in (120).

120. a. šeft xams Tabšuur-aat bi d-derej
    saw.1s five chalk(-AH)-pl in the-drawer  base: Tabšuur-AH
    ‘I saw five pieces of chalk in the drawer’
b. šeft tes‘ samk-eet bi l-jaaT
   saw.1s nine fish-\textit{AH}-pl_{SF} in the-bowl \textbf{base:} samak -\textit{AH}
   ‘I saw nine fish in the bowl’

c. šeft arba‘ Hajr-aat ‘a l-Tari‘ı
   saw.1s four stone-\textit{AH}-pl_{SF} on the-road \textbf{base:} Hajr-\textit{AH}
   ‘I saw four stones on the street’

Without a cardinal numeral or numeral-like expression (i.e. something that behaves similarly to a cardinal numeral), an indefinite pluralized divided nominal is ungrammatical. When definite, however, pluralized -\textit{AH}-divided nominals may occur without a cardinal numeral:

121. a. s-samk-eet mush hon
    the-fish-\textit{AH}-pl_{SF} not here
    ‘The fish(es) are not here’

   b. l-Hajr-aat nramo
    the-stone-\textit{AH}-pl_{SF} thrown
    ‘The stones were thrown’

   c. T-Tabšuur-aat xtafo
    the-chalk-\textit{AH}-pl disappeared
    ‘The chalks disappeared’
2.3.4. A contrast in interpretation

An interesting property of most quantifiers in Lebanese Arabic allows us to establish another contrast in interpretation between nominals in which plural marking co-occurs with the morphological classifier -\textit{AH}, and those in which plural marking occurs directly on the noun. Few of the Lebanese Arabic quantifiers that require plural restrictions (\textit{ktiir} 'many/much' and \textit{šwayt}/\textit{ʔalil} 'few/little') occur in clear determiner-like contexts (122), and as such, parallel cardinals (123). Other quantifiers, notably those corresponding to 'some', 'most' and 'all', do not occur in the same way (124), and rather have a partitive structure, as illustrated in (125).

\begin{center}
\begin{tabular}{ll}
122. & a. \textit{ktiir} Sebyeen & b. *\textit{ktiir} S-Sebyeen \\
 & many boy-pl\textsubscript{BR} & many the-boy-pl\textsubscript{BR} \\
 & 'many boys' \\
 & c. \textit{šwayt} Sebyeen & d. *\textit{šwayt} S-Sebyeen \\
 & few boy-pl\textsubscript{BR} & few the-boy-pl\textsubscript{BR} \\
 & 'few boys' \\
\end{tabular}
\end{center}

\begin{center}
\begin{tabular}{ll}
123. & a. sab\textit{ʕ} rjeel & b. *sab\textit{ʕ} r-rjeel \\
 & seven man-pl\textsubscript{BR} & seven the-man-pl\textsubscript{BR} \\
 & 'seven men' \\
 & b. tlat mhands-iin & d. *tlat l-mhands-iin \\
 & three engineer-pl\textsubscript{SM} & three the-engineer-pl\textsubscript{SM} \\
 & 'three engineers'
\end{tabular}
\end{center}
Crucially, while the restriction of these quantifiers, in both Lebanese and Standard Arabic, is always syntactically definite, the expressions in (125) are in actuality ambiguous. The restriction can be interpreted as either definite presupposing the existence of a unique relevant set, or as generic not involving any presuppositions. The two interpretations are illustrated in (126)-(128). When the restriction has a generic interpretation, the determiner is presumably a semantically vacuous, expletive, determiner (cf. Vergnaud and Zubizarreta 1992).

124. a. *kell/ baD/aghlab  Taawleet 
   all/some/most  table-plSF 

b. *kell/baD/aghlab  mhandsiin 
   all/some/most  engineer-plSM 

c. *kell/baD/aghlab  mudun 
   all/some/most  city-plBR 

125. a. kell/baD/?aghlab  T-Taawleet 
   all/some/most  the-table-plSF 

b. kell/baD/?aghlab  l-mhandsiin 
   all/some/most  the-engineer-plSM 

c. kell/baD/?aghlab  l-mudun 
   all/some/most  the-city-plBR 

126. bHebb  kell  T-Taawleet 
   like.1s  all  the-table-plSF 

← I like all of a mutually recognizable set of tables [Definite] 
← I like tables (no mutually recognizable set of tables) [Generic]
Recall that in the absence of a cardinal numeral, nouns containing -AH can be pluralized in definite DPs (121). It is therefore straightforward to predict that in the context of partitive quantifiers, since a definite determiner is always present, plural marked nouns containing -AH should be licit. Indeed this is verified.

Interestingly however, while grammatical, these examples are not ambiguous: They have an exclusively definite interpretation, as shown in (129)-(131), and absolutely exclude the generic interpretation.

The contrast established between the ambiguous (126)-(128) and the non-ambiguous (129)-(131) illustrates the fact that the definite determiner needed for licensing a noun containing -AH must be a semantically meaningful one, and cannot be a semantically vacuous expletive determiner.

129. bHebb kell l-teffeeH-aat
    like.1s all the-apple-AH-plSF
 ← I like all of a mutually recognizable set of apples [Definite reading]
 ← I like apples (there is no mutually recognizable set of apples) [*Generic reading: If there is no mutually recognizable set of apples, presupposition failure occurs]
130. kreht kell T-Tabšuur-aat
    hated.1s all the-chalk-\textit{AH}-pl_{SF}
\(\leftarrow\) I have come to hate all of a mutually recognizable set of chalks [Definite reading]
\(\leftrightarrow\) I have come to hate chalk [*Generic reading: If there is no mutually recognizable set of chalks, presupposition failure occurs]

131. mest‘edd ešteri ?aghlab s-samkeet
    ready buy.1s most the-fish-\textit{AH}-pl_{SF}
\(\leftarrow\) I am willing to buy most of a mutually recognizable set of fish [Definite reading]
\(\leftrightarrow\) I am willing to visit most fish (types) [*Generic reading: If there is no mutually recognizable set of fishes, presupposition failure occurs]

Indeed, the contrast between (128) and (131), derived from the same bare stem, but where (128) involves plural marking occurring directly on the noun and (131) involves co-occurrence of the classifier \textit{-AH} and plural marking, strengthens the point that this distinction is due to specifically this co-occurrence, and not to lexical properties of the noun. By the same logic, that this is not due to properties of the plural marker \textit{-aat} itself is shown through the contrast between (131) and the noun marked with the phonologically indistinguishable sound feminine plural marking in (126) without the intervention of the classifier \textit{-AH} in the latter.

It is therefore specifically the presupposition in the definiteness that is necessary for the licensing the co-occurrence of the classifier \textit{-AH} and what appears to be plural marking. I propose in the next section that what appears to be a plural marker occurring on top of the classifier \textit{-AH} is nothing but an agreement marker occurring in a functional structure that is licensed by cardinal numerals, call it \#. I propose that definiteness, only when not vacuous, i.e. when imposing a uniqueness presupposition, can also license the agreement plural that is able to co-occur with the morphological classifier \textit{-AH}.
2.4. Proposal: An agreement plural

2.4.1. Basic idea

I have established in section 2.3.3 that plural marked nouns containing \(-AH\) only occur with cardinal numerals and definite determiners. In addition, I have shown in section 2.3.4 that when the occurrence of the plural marker on top of \(-AH\) is licensed by definiteness, the definiteness must be semantic, and not just syntactic (i.e. not semantically vacuous definite marking). Given this, I propose that the specific plural marking that co-occurs with the morphological classifier \(-AH\) is in actuality an agreement marker that is dependent on the presence of a cardinal numeral or numeral-like element in # (henceforth \(AG\#\)).

Heim (1982) analyzes definite DPs, like pronouns, as discourse anaphors. They carry an index that can be bound or free, and the descriptive content in the DP adds the presupposition (Heim, in press). As Borer (2005) points out, as example (132) illustrates, this predicts that a definite DP would inherit not only reference, but also cardinality from its antecedent\(^{25}\). This means that the definite determiner can give value not only to D in the structure, but also to #.

132. \([\text{[the]}] \; \lambda P: P(g(i)). \; g(i)\]

\(^{24}\)In chapters 3 and 4, I will propose that the head of the functional projection # is a semantic function (also noted #). It is important to mention that \(-AG\#\) is not this function, but rather merely an agreement marker with the numeral that occurs in Spec#. This is important because while # is a functional projection expected to occur in the DP in any languages as a DP component, \(-AG\#\) is an agreement marker that is language-specific, and would only be expected to be visible in languages that are rich in agreement.

\(^{25}\)There are counter-examples to this, notably, from cases like (i), in which the behavior of the majority determines the outcome.

i. The students voted for John to lead the student council

\(\leftarrow\) 60% of the students voted for John and 40% voted against him

I assume that in these cases “the students” in actuality denotes “the student body”, with a cardinality of one.
133. Four cats and two dogs entered. The cats had eaten dinner already.  

(Borer, 2005)

← all four of the relevant cats had eaten.

↩ three of the relevant cats had eaten dinner, and the fourth had not.

I therefore propose that the emergence of the agreement marker in the case of definite DPs not explicitly containing cardinal numerals, follows from an analysis of a definite DP as a discourse anaphor inheriting the cardinality of a discourse antecedent, thus giving value to both D and # in its structure. The fact that only semantically contentful definiteness licenses the presence $AG_{#}$ is consistent with this: a semantically vacuous definite determiner cannot be anaphoric, and therefore cannot inherit cardinality.

### 2.4.2. Augmenting the structure

Recall, now, that quantifiers, unlike cardinal numerals, do not license the occurrence of this agreement plural as the paradigm in section 2.3.2 (example repeated below in (134a) vs. (134b)) shows.

134. a. *šeft šwayt Tabšuur-aat honiik  b. šeft xams Tabšuur-aat honiik

saw.1s few chalk(-AH)-pl there saw.1s five chalk(-AH)-pl there

‘I saw a few pieces of chalk there’  ‘I saw five pieces of chalk there’

base: Tabšuur-$AH$

The DP structure assumed in chapter 1 (section 1.2), repeated in (135) below, only has one location for both cardinals and quantifiers.

______________________________

26 It is also important to note that the inherited cardinality is not always explicitly mentioned or even known, yet I must assume it is always inherited from the antecedent in a semantically contentful definite DP. I do not have anything insightful to propose as a solution to this, but I assume that what is inherited can be an abstract $n \in \mathbb{N}$, where $n=|g(i)|$. The same problem is mentioned in Hackl (2001:163).
I propose that since cardinal numerals and definiteness on the one hand, and quantifiers on the other hand, have different licensing abilities for the agreement marker $AG#$ which co-occurs with the classifier $AH$, then cardinal numerals and quantifiers are syntactically distinct\(^{27}\). I therefore propose the augmentation of the structure to allow cardinal numerals and quantifiers to merge in different locations. Specifically, I propose a DP structure containing both a merger site for quantifiers $Q$, and a separate projection where cardinal numerals may merge, specifying cardinality ($\#$). The structure is schematized in (136).

\(^{27}\) One alternative would be to assume that in the same syntactic position $\#$, numerals, but not quantifiers, license the occurrence of $-AG#$. This alternative makes agreement entirely dependent on properties of the specific functional item merging in $\#$. One issue with this alternative is that definiteness behaves like numerals and not like quantifiers. If we assume definiteness licenses $-AG#$ by virtue of merging lower, it would remain unclear why definiteness, when it merges in the quantifier position, would behave like numerals and not quantifiers. I also present in 2.5 independent evidence for separating numerals and quantifiers structurally, I show in later chapters that numerals and quantifiers are of different semantic types, and need to compose with the rest of the DP differently (for more detail c.f. section 4.2.1).
2.4.3 Resulting structures

Given the augmented structure suggested in the previous section, the structure for a DP in which the plural marking merges directly with the noun, i.e. in Div, is as in (137). In this structure, the plural marker in Div performs the dividing function of a classifier. Both a kind and a unit interpretation are possible, and the quantifier (if any) merges in Q. This is the expected structure regardless of whether the noun is a batch noun or any other type of noun, and regardless of the morpho-phonological realization of the plural marking: sound feminine, sound masculine, or broken.
The specific plural-like agreement marking \(-\text{AG}\#\) that co-occurs with \(-\text{AH}\), which only occurs in the presence of a cardinal numeral or definite determiner, I propose, emerges only in a structure in which \# projects. For a noun marked with \(-\text{AH}\) as well as the agreement marker \(\text{AG}\#\), it is the classifier \(-\text{AH}\) that merges in Div, the merger site of classifiers. At this point in the derivation, the noun is divided: the resulting structure is count but is not plural marked. The cardinal numeral merges in the specifier of \#, and the noun moves to the head of \#, and is marked with \(\text{AG}\#\), and appears plural-like. This is illustrated for cardinal numerals in (138), and for the definite determiner in (139)\(^{28}\). In both of these structures, \(-\text{AH}\) is in Div and performs the dividing function. Given that \(-\text{AH}\) is

\(^{28}\) Note that definiteness, but not quantifiers like \(\text{ktiir} \text{‘many’}\) and \(\text{šway} \text{‘a few’}\), can inherit cardinality and can therefore merge in \#. I will argue in chapter 4 that this is due to the specific semantics of these quantifiers, which is different from that of numerals, yet incompatible with the semantics of numerals.
in morphological discord with the cardinal numeral in #, AG# is needed. The result is a co-
occurrence of -AH and something that looks like plural marking.

138. a. $D^{\text{max}}$

$D \quad Q^{\text{max}}$

$Q \quad \#^{\text{max}}$

$tlat$

three $\Rightarrow \text{šajr}-\text{AH-AG#}$

$\Rightarrow \text{šarjraat}$

$\Rightarrow \text{šajr-AG#}$

$\Rightarrow \text{šajar}$

Div$^{\text{max}}$

Div

N$^{\text{MAX}}$

$\Rightarrow b. \ tlat \ \text{šajr-ah-aat}$

three $\Rightarrow \text{tree-AG#}$

$\Rightarrow \text{tree}$

$\Rightarrow \text{tree-AG#}$

$\Rightarrow \text{three trees}$
Finally, I assume that in the presence of a cardinal numeral with non-batch nouns (e.g. *siyyarah* ‘car’), if a plural marker performs the division, $AG$ will be redundant and therefore will not double-mark the noun.
We are now left with singular DPs and other quantifiers. I assume, following Borer (2005), that certain quantifiers, such as each and every also instantiate both low and high functional projections (e.g. instantiating both Div as well as Q or D).

I assume that certain quantifiers, like ktiir ‘many’ and šway ‘a few’ require a syntactically plural restriction (cf. Hackl 2001 for motivations), and I assume that plural marking, while it instantiates Div and denotes countness, also makes the DP syntactically plural, which can be checked by ktiir and šway. Note, importantly, that unlike numerals, ktiir and šway cannot trigger an agreement marker AG#, because they can only merge in Q, and not in #. This syntactic plurality will appear again in the next chapter, and I will argue
that there are two sources for it in the DP: plural marking and #, and that they both trigger plural agreement on verbs, adjectives, and pronouns agreeing with the DP.

141. * 

\[
\begin{array}{c}
\text{D} \\
\text{Q} \\
\text{kttiir} \\
\text{Div} \\
\text{-AH} \\
\text{N}
\end{array}
\]

So far, I have established a motivation for distinguishing cardinal numerals and quantifiers, and I have proposed that this distinction is syntactic: cardinal numerals merge in #, licensing in Arabic a cardinal agreement marker that looks like plural AG#, and quantifiers do not. In the following sections I develop this idea further, providing independent empirical evidence for a syntactic distinction between cardinal numerals and quantifiers. In later chapters, I move to more semantic distinctions, arguing in chapter 4 that cardinal numerals and quantifiers are of different semantic types and must compose with the DP in different ways.

2.5. Cardinal numerals vs. Quantifiers: Null Pronominal Licensing

An interesting independent syntactic contrast between cardinal numerals and quantifiers, specifically relating to agreement, arises when we look at null pronominals. As (140) and (141) show, cardinal numerals allow a null pronominal restriction in indefinite contexts, as illustrated in (142) as well as in definite contexts, as illustrated in (143). In
contrast, null pronominal restrictions are never licit in the context of the quantifiers ktiir ‘many’ and šway ‘a few’ in indefinite contexts (144) or in definite contexts (145).

142. a. jebt tleeteh ?ebl-uu yej-uu
   brought.1s three accepted-3p come-3p
   ‘I brought three that would come along’

   b. tleeteh fall-uu
   three left-3p five
   ‘Three left’

   c. xamseh akal-uu
   ate-3p
   ‘Five ate’

143. a. jebt t-tleeteh lli ?ebl-uu yej-uu
   brought.1s the-three that accepted-3p come-3p
   ‘I brought the three that would come along’

   b. t-tleeteh fall-uu
   the-three left-3p
   ‘The three left’

   c. l-xamseh akal-uu
   the-five ate-3p
   ‘The five ate’

144. a. *jebt ktiir ?ebl-uu yej-uu
   brought.1s many accepted-3p come-3p
   ‘I brought many that would come along’

   b. *ktiir fall-uu
   Many left-3p
   ‘many left’

   c. *ktiir akal-uu
   many ate-3p
   ‘Many ate’

29 In English, many can have a null pronominal restriction. As I will suggest in later chapters, one possible explanation for this is that in English plural DPs, # always projects.
145. a. *jebt l-ktiir lli ?ebl-uu yej-uu
   brought.1s the-many that accepted-3p come-3p
   I brought the many that would come along

b. *l-ktiir fall-uu
c. *l-ktiir akal-uu
   the-many left-3p the-many ate-3p
   ‘The many left’ ‘The many ate’

NP null pronominals have been shown to be licensed through agreement in other languages (cf. Borer and Roy (2010), for recent work on agreeing adjectives). Assuming that cardinal numerals, but not quantifiers, may occur in #, would provide a nice explanation for this. Cardinal numerals merge in #, a node associated with an agreement plural marker on the noun (section 2.4). Quantifiers do not.

Taking the same structure as (139), suppose pro merges as N and moves up to Q as I proposed before for overt nominal heads. In the presence of #, when passing through #, pro will agree with the cardinal numeral that is in Spec# and will therefore be licensed. The relevant representations are in (146)-(147).30

30 Note that [def] in this case is realized on the numeral, on a par with (i)

i. t-tlat kleeb
   the-three dog-pl
   ‘the three dogs’
146. Definite:

a. \[ D_{\text{max}} \]

\[ D \quad Q_{\text{max}} \]

\[ \text{SpecQ} \]

\[ \text{tleeteh Q} \]

\[ \text{three} \quad \text{pro-AG} \]

\[ \text{tlat} \]

\[ \text{three} \quad \text{#} \]

b. \[ \text{tleeteh fall-uu} \]

\[ \text{three} \quad \text{left-pl} \]

‘Three left’
147. Indefinite:

a. $D_{\text{max}}$
   
   $D$ $Q_{\text{max}}$
   
   def $\Rightarrow t$-
   
   SpecQ tleeteh Q
   
   three pro-$AG^#$
   
   $tlat$ # 
   
   three pro#$Ag$
   
   Div$^{\text{max}}$
   
   Div
   
   pro
   
   N$^{\text{max}}$
   
   N
   
   pro

b. $\Rightarrow t$-tleeteh fall-uu
   
   the-three left-pl
   
   'The three left'

In contrast, quantifiers *ktiir* 'many' and *šway* 'few' do not trigger agreement, and in the presence of a quantifier in Arabic, # does not project (section 3.2). So in the presence of quantifiers, there is no agreement, and pro cannot be licensed. If not licensed, pro gives rise to ungrammaticality. The relevant structures are in (148) for definites and (149) for indefinites.
148. a. $D^{\text{max}}$

```
D
\downarrow
Q^{\text{max}}
\uparrow
SpecQ
\downarrow
ktiir Q Div^{\text{max}}
\uparrow
many pro
\uparrow
Div
\uparrow
N^{\text{max}}
\uparrow
pro
\uparrow
N pro
```

⇒ *pro remains unlicensed*

b. *ktiir fall-uu

many left-pl

'Many left'
This contrast between cardinal numerals and quantifiers provides independent motivation to take cardinal numerals to be associated with agreement, and quantifiers not. It also motivates treating cardinal numerals and quantifiers as distinct syntactic objects.

This syntactic distinction between cardinal numerals merging in # and quantifiers merging in Q shows itself, also, in post-nominal occurrences of quantificational expressions. While both cardinal numerals and quantifiers appear to occur post-nominally, post-nominal quantifiers behave syntactically like adjectives (Shlonsky 2004, Borer 2005) while cardinal numerals do not. This adjective-like behavior is marked by the presence of
adjective-like definiteness, number, and gender agreement on the apparent quantifier (150), which mirror the agreements that occur in adjectives illustrated in (151) for comparison.

150. a. tʕarraft ŋa-ban-eet ktaar
    acquainted on-girl-pl numerous-pl
    ‘I met many girls’

   b. tʕarraft ŋa-l-ban-eet l-ktaar
    acquainted on-the-girl-pl the-numerous-pl
    ‘I met the many girls’

151. a. tʕarraft ŋa-ban-eet azkiya
    acquainted on-girl-pl smart-pl
    ‘I met smart girls’

   b. tʕarraft ŋa-l-ban-eet l-azkiya
    acquainted on-the-girl-pl the-smart-pl
    ‘I met the smart girls’

Cardinal numerals, which also occur post-nominally, do not show number and gender agreement. I take the lack of number and gender agreement on post-nominal numerals to indicate that post-nominal numerals, unlike post-nominal quantifiers, are in fact cardinal numerals, and merge in #. Specifically, they are not adjectives.

I take post-nominal cardinal numerals to be cases of apposition with a null pronominal restriction, independently blocked in indefinite contexts.
152. t'arrapt ʕa l-ban-eet t-tleeteh → l-ban-eet, [DP t-tleeteh pro]
   acquainted on the-girl-pl the-three
   ‘I met the girls, the three of them’

Note that unlike 
ktaar ‘numerous’ and ʔleel ‘non-numerous’, which occur post-nominally and shows number agreement with the noun, 
ktiir ‘many’ and 
shway ‘a few’ in
Lebanese Arabic are not adjectives like numerous in English: First, numerous in English bars partitive constructions (Schwarzschild 2006), as illustrated in (153), while ktiir ‘many’ and shway ‘a few’ do not (154). Moreover, adjectives like ktaar ‘numerous’ and ʔleel ‘non-numerous’ in Lebanese Arabic show number and gender agreement with the noun, while
ktiir ‘many’ and shway ‘a few’ do not, and hence, adjectives in Lebanese Arabic license null pronominal restriction (155), while ktiir ‘many’ and shway ‘a few’ do not (144)-(145)\textsuperscript{31}.

153. *numerous of the boys

154. ktiir men s-sebyeen
   many of the-boys
   ‘many of the boys’

\textsuperscript{31} Interestingly, this pattern with quantifiers and adjectives in Lebanese Arabic is exactly the opposite to that pointed out for English in Kayne (2005b): While in English few and many license null pronominals and numerous does not (i), in Arabic, ktaar ‘numerous’ agrees in number with the noun and hence licenses a null pronominal. I do not have an answer for the question of why the quantifiers in English license null pronominals.

i. many linguists like phonology while many don’t (Solt 2014, Kayne 2005b)
155. a. tšarráft ʕa azkiyah
    acquainted.1s on intelligent-pl
    ‘I met smart people’

b. tšarráft ʕa-ktaar
    acquainted.1s on-numerous-pl
    ‘I met numerous people’

2.6. **Bulgarian** $AG_{\#}^{32}$

The existence of $\#$, and the agreement marker that is triggered in its contexts, is corroborated by a special cardinal ‘plural marking’ in Bulgarian. As it turns out, Bulgarian has two types of plural marking for masculine nouns, illustrated in (156). The first marking varies according to the choice of stem and occurs in all plural-marked contexts, with the exception of cardinals – I call this marking the ‘elsewhere’ plural marking. The second marking, only available in the context of cardinals, is -a regardless of stem. It is this second marking, -a, that I propose is an instance of $-AG_{\#}$. I gloss -a as -a since it is not really a plural marker. Much like the case of Arabic -aat, the Bulgarian marker -a cannot occur on bare nouns (157) or after quantifiers (158). In these contexts, regular plural marking is required. Moreover, the Bulgarian marker -a is **required** following numerals, and regular plural marking is barred (159).

\footnote{32 Thank you to Roumyana Pancheva (p.c.) for the data in this section, cf. also Wellwood et al (2012) for a discussion of some of these facts.}
156. **Noun** | ‘Elsewhere’ plural marking | Marking after numerals
--- | --- | ---
stol ‘chair’ | stol-ove | stol-a
kon ‘horse’ | kon-e | konj-a
tsar ‘king’ | tsar-e | tsarj-a
faks ‘fax’ | faks-ove | faks-a
telefon ‘phone’ | telefon-i | telefon-a

157. a. **V stajate ima** stol-ove/*stol-a  
   in room has chair-pl/*chair-\(\text{A}\)  
   ‘There are chairs in the room’

   b. **V stajate ima** kon-e/*konj-a  
   in room has horse-pl/*horse-\(\text{A}\)  
   ‘There are horses in the room’

158. a. mnogo/poveche/malo kon-e/*konj-a  
   many /more /few horse-pl/*horse-\(\text{A}\)

   b. mnogo/poveche/malo faks-ove/*faks-a  
   many /more /few fax-pl/*fax-\(\text{A}\)

159. a. V stajate ima pet konj-a/* kon-e  
   in room has five horse-\(\text{A}\)/*horse-pl  
   ‘The room has five horses’

   b. V stajate ima tri faks-a/*faks-ove  
   in room has three fax-\(\text{A}\)/*fax-pl  
   ‘The room has three faxes’
c. V stajate ima njakolko telefon-a/*telefon-i
in room has several telephone-A/*telephone-pl
'The room has several phones'

The behavior of -a is very similar to that of the Arabic agreement marker that co-occurs with classifiers. I propose that the ‘elsewhere’ plural marking is the usual kind of plural marking, instantiating Div, as in (160).


(many) horses

The -a marker, being exclusively restricted to nouns following cardinal numerals, I propose is an instance of Ag#, much like the Arabic –aat, and has the structure in (161). In these cases, I assume that either a ø morpheme instantiates Div, or kon, ‘horse’ moves to Div where it essentially licenses its own count interpretation. See Borer (2005) for some discussion of similar cases in Hebrew, as well as some relevant cases in Thai and Burmese following the discussion in Simpson (2005).


three horses

Interestingly, for some reason, the -a marker cannot occur with human masculine nouns, as illustrated in (162). But regular plural marking cannot occur with cardinal, as

---

33 For numerals 7 and 8, -ma is replaced by -na.
already shown by (159). The question is, then, how Bulgarian speakers say ‘five students’, if neither -a nor plural marking can occur on student ‘student’ following numerals.

162. a. *pet student-i Plural I
    five students

    b. *pet student-a Plural II
    five students

The answer to this question turns out to support the analysis of -a as agreement with a cardinal in #.

In Bulgarian, human masculine nouns following numerals must take the form in (163). In this structure, the noun is marked with the usual plural marker that occurs in non-cardinal contexts. But the DP is required to contain an expletive, ma. This ma expletive is clearly dependent on the cardinal, as it does not occur otherwise (164).

163. a. tri-ma student-i
    three-MA students

    b. (vsički) tezi tri-ma student-i
    (all) these three-MA students

164. a. *ma-student-i
    MA-students

    b. *mnogo/malo ma student-i
    many/few MA students

The most natural account for the facts would be to propose that ma serves either as the agreement marker in # akin to -a, or as an expletive meant to carry -a itself (note the final /a/ in ma). This is illustrated in the structure in (166). This, in addition, provides an
answer for why -a does not co-occur with regular plural marking on non-human masculine nouns: There is no syntactic restriction preventing this co-occurrence. Rather, a phonological restriction prevents the two affixes from co-occurring in the same word, so the first is omitted. When the agreement marker is expressed with an expletive morpheme, ma, the noun can be plural marked.

165. *tri-ma-student-a
    three-MA-students

166. [DP [QP cardinal [nP expletive-AGR-#] [DIV student+Pl I [student ] ]]]
    /ma/ /stuenti/

The facts in Bulgarian find a straightforward account in the presented proposal. It is only within the set of assumptions where Bulgarian regular plural marking merges in Div and Bulgarian -a appears in # as an agreement with the numeral that merges in #, that this natural explanation can be offered. This provides straightforward support for my proposal.

2.7. From Div to #

This chapter started by showing that there is a morphological classifier in Arabic, -AH, which appears to co-occur with plural marking. Noting that the interpretation of the nouns in which the co-occurrence takes place is more restricted than that of other plural nouns, I move on to illustrate other unusual behaviors of this apparent plural marker, when compared to other plural marking in the language: While all other forms of plural marking in Arabic can occur in bare indefinite context as well as following quantifiers such as ktiir ‘many’ and šway ‘few’, the plural marking that co-occurs with -AH cannot. In fact, this apparent plural marker can only occur following cardinal numerals and definite determiners, and only when the definiteness is non-vacuous.
I propose that this apparent plural marking is in fact agreement with a cardinal, and propose augmenting the DP structure proposed in Borer (2005), separating #, a functional projection that can host cardinal numerals, and Q, which hosts quantifiers like *ktii* 'many' and *šway* 'few'. I then go on to provide independent motivation to separating cardinal numerals and quantifiers syntactically, showing that cardinal numerals, but not quantifiers, can license null pronominals. Finally, I close with an empirical puzzle from Bulgarian, and show that it finds a very straightforward explanation given my proposal. The results from this chapter receive further support in the coming chapters, where I look more closely at the semantics of cardinal numerals, and their composition with the rest of the DP.
Chapter 3. When thirty boys is singular

3.1. Introduction

In chapter 2, I provided empirical evidence that cardinal numerals license agreement in two ways in Arabic where quantifiers cannot. I proposed the structure in (360), where the functional projection # can host a cardinal numeral but cannot host a quantifier like the Arabic ktiir 'many' or šway 'few', which merge in Q. This chapter and the next focus on the structure and properties of cardinal numerals in a DP, with special attention to collective and distributive interpretations of numeral containing DPs.

167.

As mentioned in chapter 1, I refer to “distributive” and “collective” interpretations in the sense that can be observed in (168). Insofar as each of the boys cannot gather by himself, (168a) is a sentence that only has a collective interpretation: a group of three boys gathered. Similarly, the most natural reading of (168b) is a distributive one in which each
boy got taller. Finally, (168c) contains a verb phrase that can be interpreted either collectively (three boys ate a cake together), or distributively (three boys each ate a cake), and indeed, both interpretations are available.

168. a. Three boys gathered/are a small group  
   b. Three boys got taller  
   c. Three boys ate a cake

Recall from chapter 1 (section 1.5.2) that Bennett (1974) proposes that collective and distributive interpretation depends on whether the DP denotes a plural individual (collective) or a set of non-plural individuals (distributive only). The opposing view (Dowty 1987) puts the weight in the predicate, distinguishing distributive predicates (168b), collective predicates (168a), mixed predicates (168c). One of the arguments for distinguishing between collective and distributive interpretations on the predicate itself is the fact that one can conjoin a distributive VP and a collective VP with the same subject DP (Dowty 1987, Lasersohn 1995). An example from Dowty (1987) in (169) illustrates the conjunction of a distributive predicate, a mixed one, and a collective one.

169. The students closed their notebooks, left the room, and then gathered in the hall after class (Dowty 1987)

Acknowledging this evidence for the role of the verb phrase in the interpretation of a proposition as collective or distributive, I argue in this chapter that the syntax of the DP plays an equally crucial role. I do this by looking specifically at numeral containing DPs, showing that restriction on collective versus distributive interpretation is not always contingent on the composition with a VP. I show that collective interpretation can be barred even when the DP provides multiple contextually salient participants, and I argue, along the lines of the first view, that a DP that results in a collective interpretation denotes something different from one that cannot be interpreted as collective. I propose,
specifically, that the former denotes a plural individual, and the latter multiple non-plural individuals. I revisit the example in (169) after presenting my detailed semantic proposal in chapter 4 (section 4.1.3).

In the rest of this chapter, I provide evidence from Lebanese Arabic that in some circumstances, numeral-containing DPs result in an obligatorily distributive interpretation, and I argue that this obligatory distributive reading is triggered by DP-internal conditions, specifically the absence of # in the structure in (360).

The structure of this chapter is as follows: The next section introduces the puzzle of Arabic transdecimal numerals (numerals larger than 10): When followed by non-plural marked nouns, these DPs allow both plural marked and non-plural marked adjectives, verbs, and pronouns. After showing that this marking optionality correlates with semantic effects, in section 3.3, I presents the core proposal: numerals do not necessarily result in a syntactically plural DP, nor do they necessarily result in the formation of a predicate of plural individuals. Rather, # is a function that takes a predicate of count individuals and returns a predicate of plural individuals, and it is necessary for a collective interpretation of the DP. In section 3.4, I present and argue against an alternative explanation putting the weight of the explanation on the semantics of plural marking and non-plural marking. In section 4.4, I argue against an alternative explanation positing a distributive operator in the VP. In section 4.5, I argue against an alternative explanation positing a distributive operator in the DP. Finally, in section 4.6, I argue against a split-DP analysis.

3.2. The puzzle of Arabic transdecimals

3.2.1. An unusual (dis)agreement

3.2.1.1. Transdecimals: The nouns

As illustrated in chapter 1 (section 1.3), Lebanese Arabic shows plural and dual marking on nouns (singular is non-marked). And it shows plural agreement on adjectives, verbs, and pronouns. Singular, in all of these cases, is simply left non-marked. Interestingly, following transdecimal numerals in Arabic DPs, nouns are not plural marked,
very much like singular nouns. This is illustrated in (170) which contrasts with the ungrammatical forms in (171).

170. a. tleetiin mhandes
    thirty     engineer-Ø
    ‘thirty engineers’

    b. xamstaʃʃar shanta
    fifteen     bag-Ø
    ‘fifteen bags’

171. a. *tleetiin mhands-iin
    thirty     engineer-pl

    b. *xamstaʃʃar shanat
    fifteen     bag-pl

3.2.1.2. A morpho-phonological explanation (for Standard Arabic)

Traditional grammarians (Siibawayh 796, Ghalayiini 1912) have proposed a morpho-phonological explanation for the lack of plural marking on nouns following transdecimal numerals in Standard Arabic. Assuming that the direct composition of a numeral with a noun must be in a construct state form (cf. section 1.3.3), the numeral must be able to take on a bound form, pronouncing any feminine markers as t, and dropping any nunation that might appear on the numeral, as illustrated in (172).
172. tisʕ-aʕ-u awlaad-in
    nine-f_{bound}-nom child-pl_{self}-gen
    'nine children’

Transdecimal numerals, Ghalayiini proposes, are inherently nunated (173). Unable to drop their nunation, they therefore cannot take on a bound form, which is necessary for the formation of a construct state.

173. a. ʕishrii^n
    twenty

    b. *ʕishrii
    twenty

    Instead, he proposes, transdecimal numerals occur in a reduced partitive construction with the nouns that follow them, in which the preposition plus the genitive are jointly realized as what appears to be accusative case (174). As such, there are two separate DPs, one that is headed by the numeral, and one that indirectly composes with it, and crucially does not compose directly with the numeral. As part of a separate DP, the noun is therefore not plural marked and not genitive.

174. ʕushruuna min walad-in → ʕushruuna walad-an
    twenty of child-gen twenty child-acc

    As I will briefly show in section 3.2.1.4, however, transdecimal numeral containing DPs do not behave like partitives, and do not behave like DPs headed by numerals (cf. page (108)). I will discuss this explanation, as well as other potential logical alternatives, and I will show that none of them would fully account for the data. I will not provide a better alternative, as I do not have one. Rather, I will simply assume a vanilla alternative, incorporating the intuitions in Siibawayh (796), Ghalayiini (1912), and Borer (2005).

    First, however, I present what turns out to be revealing new observations about agreement following transdecimal numerals.
3.2.1.3. Optional agreement following transdecimal-containing DPs

As it turns out, following transdecimal numerals, the lack of plural marking does not stop at the noun. It transcends the word level and spreads over to the rest of the DP, and even the rest of the sentence. Adjectives, verbs, and pronouns following transdecimal numerals can optionally be either plural marked (175) or non-plural marked (176)\textsuperscript{34}.

175. a. Adjective: tleetiin sabi mnazzam-iin (weSl-uu)
   thirty boy organized-pl (arrived-pl)
   ‘Thirty organized boys arrived’

   b. Verb: xamstaʃ shar shanta waʔaʃ-uu
   fifteen bag-Ø fell-pl
   ‘Fifteen bags fell’

   c. Pronoun: saʔalt ʃeshriin Sabi ʃan bayy-on
   asked.1s twenty boy-Ø about father-their
   ‘I asked twenty boys about their fathers’

176. a. Adjective: tleetiin sabi mnazzam (weSel)
   thirty boy organized-Ø (arrived-Ø)
   ‘Thirty organized boys arrived’

   b. Verb: xamstafʃ shar shanta waʃ-ʃet
   fifteen bag-Ø fell-f-Ø

\textsuperscript{34} A similar observation is mentioned in passing, but not discussed, in Siibawayh (796) for both verbs and adjectives.
‘Fifteen bags fell’

c. Pronoun: saʔalt ʔeshriin Sabi ʕan bayy-uḥ
asked.1s twenty boy-Ø about father-his
‘I asked twenty boys about their fathers’

Note that this optional agreement is not possible when the noun itself is plural marked, like when the DP contains a numeral between 3 and 10, or quantifiers like ktiir ‘many’. In that case, all agreement must be plural (177)-(178).

177. a. Adjective: tlat/ktiir Seby-een mnazzm-iin (weSl-uu)
three/many boy-pl organized-pl (arrived-pl)
‘Three/Many organized boys …’

b. Verb: tlat/ktiir Seby-een weSl-uu
three/many boy-pl arrived-pl
‘Three/Many boys arrived’

c. Pronoun: saʔalt tlat/ktiir Seby-een ʕan bayy-on
asked.1s three/many boy-pl about father-their
‘I asked three/many boys about their fathers’

178. a. Adjective: *tlat/ktiir Seby-een mnazzam ...
three/many boy-pl organized-Ø ...

b. Verb: *tlat/ktiir Seby-een xabbar ...
three/many boy-pl told-Ø ...

c. Pronoun: *saʔalt tlat/ktiir Sebyeen ʕan bayy-uḥ
asked.1s three/many boy-pl about father-his
One immediate conclusion from these facts is that the lack of plural marking on the noun cannot be a zero plural marker, because: (i) agreement following transdecimal numerals can be plural or non-plural as illustrated in (176), but must be plural following overtly plural-marked nouns, as illustrated in (178), and (ii) at least in the case of pronouns, since the lack of plural marking on the agreeing element does not always involve omission of a plural marker, but rather suppletion with the explicitly non-plural form of the pronoun: -uh 'his' (176c) vs. -on 'their' (175c).

In addition, since overt plural agreement on the adjectives, verbs, and pronouns may occur in the absence of plural marking on the noun (175 a-c), plural agreement cannot be dependent solely on the presence of plural marking on the noun itself.

I argue that this behavior of transdecimal numerals provides evidence that numerals do not in and of themselves result in a DP that can be interpreted collectively, and that the absence of a collective interpretation of a given numeral-containing DP is caused by the absence of pluralization. The analysis of this phenomenon turns out to support the structure proposed in chapter 2, in which # serves as a semantic pluralizer in that it takes predicates of non-plural individuals and returns predicates of plural individuals.

3.2.1.4. Morpho-phonological explanation revisited

I now return briefly to Ghalayini’s (1912/2003) partitive account of the non-plural marked nouns following transdecimals (cf. section 3.2.1.1, page 104). We are now in a position to test whether partitive DPs containing numerals, which Ghalayiini reduces transdecimal numerals to, behave like transdecimal numerals with respect to the rest of the sentence. As it turns out, the two do not behave alike. As (176) shows, transdecimal numeral containing DPs allow non-plural agreement on the verb, but as (179) shows, partitives do not allow non-plural agreement on the verb. In fact, whenever a DP is headed by the numeral, any agreeing verb must be plural-marked (180). This is the case for both Lebanese Arabic and Standard Arabic.
179. ʕeshriin men l-wleed weSl-uu/*weSel (Lebanese Arabic)
ʕushruuna min l-ʔawlaadi waSal-uu/*waSala (Standard Arabic)
twenty of the-child-pl arrived-pl/*arrived-ø
‘Twenty of the children arrived’

180. tleeteh/ʕeshriin weSl-uu/*weSel (Lebanese Arabic)
thalaathatun/ʕushruuna waSal-uu/*waSala (Standard Arabic)
three/twenty arrived-pl/*arrived-ø

In addition, recall that following transdecimal numerals, the noun is **obligatorily** non-plural marked. Even if the numeral and the noun are part of two different DPs, and hence the numeral cannot force plural marking on the noun, it is not clear why the noun would obligatorily remain non-plural marked. It is certainly not true of partitives that the noun must be non-plural marked (179). And it is also not true of grocerese nominals (Borer 2005), which are numeral-noun combinations in which the numeral does not take a bound form, like (181), and which Borer analyzes as multiple DPs (182) (grocerese nominals are typically used when ordering portions of food or counting portions of grocery items). As example (183) from Hebrew shows, grocerese nominals may be plural marked.

181. šneyi xalav
two milk
‘two portions of milk’

182. [#P šneyi [Div Ø-div [NP1 Ø [NP2 xalav]]]]
two milk
183. hizmanti šnayim zeytim
    ordered.1s two(not bound) olives
    ← I ordered two portions of olives: jars, cans, etc.
    # I ordered two olives (not false, odd)

Yet another reason to distinguish transdecimal numeral containing DPs from grocerese (and hence of partitives) is that while transdecimal numerals always mark the noun with accusative case in standard Arabic, nouns in grocerese DPs are marked with same case marking as the numeral (184).

184. waSala-nii ḡashr-at-u-n rijaal-u-n
    arrived-me ten-F-nom-n man.pl-**nom**-n

Moreover, recall from chapter 2 that there is a class of nouns in Arabic, which I call batch nouns, which are divided using a morphological classifier -**AH**. With these nouns, in grocerese, the noun not only remains non-plural, it also remains undivided altogether, as illustrated in (186). This is not the case for transdecimal numerals. An example revealing this contrast is given in (187).

185. xams teffeeH-aat iza betriid (non-grocerise, pre-decimal)
    fivebound apple-**AH**-pl if will.3ms
    ‘Five apples please’

186. xamseh teffeeH iza betriid (grocerise)
    five apple if will.3ms
    ‘Five apple please’
187. *xamseh  teffeeH-ah  iza  betriid
    five  apple-\textit{AH}  if  will.3ms

188.  ūshriiin  teffeeH-ah  iza  betriid  (non-grocerise, transdecimal)
    twenty  apple-\textit{AH}  if  will.3ms
    'twenty apples please'

So it is not evident that nouns following transdecimal numerals in Arabic are non-plural marked because they form a partitive construction with the numeral as explained in Ghalayiini (1912).

I note that it remains very reasonable to look for a uniform explanation for both the contrast in case marking, and the contrast in plural/non-plural marking between nouns following transdecimal numerals and nouns following numerals 3-10. Pesetsky (2010) proposes an explanation for very similar facts in Russian. Russian nouns following numerals smaller than 5 are non-plural marked and are genitive marked (189) whereas those following larger numerals are plural marked (190), and their case depends on the environment.

189.  ēt-i  dva  stol-a
    these-nom.pl  two-m.nom  table-gen.sg
    'these two tables'

190.  a.  ēt-i  pjat'  stol-ov
    these-nom.pl  five-nom  table-gen.pl
    'these five tables'
b. èt-im pjat-i stol-am
these-dat.pl five-dat table-dat.PL
'to these last five beautiful tables'

Proposing to reduce case marking to part of speech categories where Genitive = N, Accusative = V, Nominative = D, and Oblique = P, Pesetsky proposes that the facts in (189)-(190) are due to restrictions on where nouns can move in the context in different numerals. Case assignment, he proposes, occurs as follows: When A merges with B, if A has satisfied its complementation requirements, A copies its grammatical features, including case onto B, and these are realized on all lexical items dominated by B. After all movements, all but the outermost suffix is deleted. Two things allow a blocking of this feature copying: movement, which alters the structural relation between two objects, and the creation of a phase resulting in spell-out, which freezes earlier stages of the derivation.

Going back to numerals, Pesetsky (2010) proposes that the non-plural form in (189) is not singular, but rather numberless, and that numerals 2, 3, and 4 in Russian are instances of free standing number markers ‘NBR’: dual, trial, and quadral. He explains the obligatorily genitive case on nouns following numerals 2-4 by proposing that NBR moves to D, and forms a complement to D, taking on the nominative case of D (he calls this complement forming movement ‘undermerge’). Because it is NBR that satisfies the complementation requirement of D, nominative case is assigned to NBR, but not to the noun. The noun remains with its genitive case.

While this explanation cannot be carried over exactly as it is to the Arabic facts, it is reasonable to try to account for the Arabic facts in a similar way. Unlike Russian paucals (numerals 2, 3, and 4), transdecimal numerals are unlikely to be number markers, as they are often complex and made of multiple words. Perhaps, instead, the distinction in between numerals 3-10 and transdecimal numerals in Arabic is that numerals 3-10 merge as heads, and transdecimal numerals merge as specifiers (191), and that numerals 3-10 attract the noun to move to their position, where the noun agrees and is marked plural. Transdecimal numerals, on the other hand, do not, and the nouns therefore remain low (in Div), blind to whether the quantifying element is plural or non-plural, and thus marks its
countness with a non-plural classifier \((\text{AH} \text{ or } \emptyset)\) because the numeral is in the specifier not the head.

191. 

\[
\begin{align*}
\text{D}^\text{max} & \quad \text{Q}^\text{max} \text{ or } \#^\text{max} \\
\{11+\} & \quad \{3-10\} \quad \text{Div}^\text{max} \\
& \quad \text{N}^\text{max}
\end{align*}
\]

While this would provide a nice explanation for the contrast in plural marking on nouns following numerals 3-10 and transdecimal numerals, adopting it would require giving up the explanation in chapter 2 for the agreement plural occurring only in the context of numerals 3-10, which requires that they merge in the specifier.

So why, exactly, nouns following transdecimal numerals in Arabic are non-plural marked remains to be answered. I do not have an answer.

3.2.2. **A semantic distinction: towards explaining the optionality**

Looking at the facts in section 3.2.1.3 (summarized in (192)), it might be tempting to propose that plural agreement in Arabic is simply freely optional on the adjectives, verbs, and pronouns following DPs containing transdecimal numerals. This, however, would be inconsistent with the behavior of the language elsewhere: plural agreement is never optional anywhere else in the language, it is always either required or impossible (cf.
chapter 1 section 1.3.6). In addition, as I show in this section, there is a truth conditional difference in interpretation that depends on whether an agreeing element is plural marked or non-plural marked, something that is not present elsewhere in the language.

192. a. tleetiin Sabi mnazzam(-iin) weSl(-uu)
   thirty boy-Ø organized(-pl) arrived(-pl)
   ‘thirty organized boys arrived’

   b. saʔalt tleetiin Sabi ʕan bayy-uh/bayy-on
   asked.1s thirty boy-Ø about father-his/father-their
   ‘I asked thirty boys about their fathers’

To illustrate the difference in meaning between cases where agreement is plural and cases where it is non-plural in Lebanese Arabic, let us look again at example (168c), repeated below in (193a). This sentence can be interpreted either collectively, meaning three boys shared a cake, or distributively, meaning three boys each had a cake of his own. The same is true for the corresponding Lebanese Arabic sentence in (193b).

193. a. Three boys ate a cake

   b. tlat wleed akal-uu ʔaaleb gateau keemel
      three child-pl ate-pl pie cake whole
      ‘three boys ate a whole cake’
      ← Three children each ate one whole cake (3 cakes total)
      ← Three children shared one whole cake (1 cake total)

Similarly, for DPs containing transdecimal numerals, when the verb agreeing with the DP is plural marked, the interpretation of the DP can be either distributive or collective, as illustrated in (194).
194. a. tleetiin walad akal-uu ?aaleb gateau keemel
   thirty child-Ø ate-PL pie cake whole
   ‘Thirty children ate a whole cake’
   ← thirty children each ate a cake (distributive)
   ← thirty children all shared one cake (collective)

b. Hdaʃshar emm nazzam-uu Hafleh
   eleven mother organized-pl party
   ← eleven mothers each organized a party (Distributive)
   ← eleven mothers organized a party together (Collective)

Interestingly, however, despite the presence of a numeral in the DP, and despite the
pragmatic salience of multiple participants, when the verb agreeing with the DP is not
plural marked, the interpretation must be distributive, and cannot be collective (195). In
fact, collective verbs, both ones that have distributive sub-entailment like gather (196), and
‘pure cardinality’ ones, like be a big group (197) (Dowty 1987), are only possible with a
transdecimal numeral containing subject when the agreement on the verb is plural.

195. a. tleeti in walad akal ʔaaleb gateau keemel
   thirty child-Ø ate-Ø pie cake whole
   ‘Thirty children ate a whole cake’
   ← thirty children each ate a cake (distributive)
   ← thirty children all shared one cake (collective)

b. Hdaʃshar emm nazzam-et Hafleh
   eleven mother organized-F party
   ← eleven mothers each organized a party (Distributive)
   ← eleven mothers organized a party together (Collective)
196. a. tleetiin walad tjamma'-uu (... be-l-mal'ab)
    thirty child-Ø gathered-pl (... in-the-playground)
    ‘Thirty children gathered (in-the-playground)’

    b. * tleetiin child tjamma' (... be-l-mal'ab)
       thirty child-Ø gathered-Ø (... in-the-playground)

197. a. tleetiin walad byetla'-uu aktar men 'ashrah
    thirty child-Ø turnout-pl larger than ten
    ‘Thirty children turn out more numerous than (the needed) ten’

    b. False: tleetiin walad byetla' aktar men 'ashrah
       thirty child-Ø turnout-Ø larger than ten
       (only interpretation available is a metaphorical one in which there
        are thirty boys, and each boy turns out to be worth more ten, or
        turns out to be stronger than ten)

    The same generalization holds for adjectives (198)-(199) and pronouns (200)-(201).
    So when plural agreement appears on an adjective following a transdecimal numeral, the
    utterance allows a reading in which the adjective is true of each boy in (198a), and a
    collective reading where the adjective is true of the group of boys (198b), but when the
    agreement on the adjective is non-plural, only the distributive reading is available (199).

198. shefet tleetiin walad mnazzam-iin
    saw.1s thirty child-Ø organized-pl
    ← (a) I saw 30 children, and each was an organized person (distributive)
    ← (b) I saw 30 children who were organized as a group (collective)
199. shefet  tleetiin  child  mnazzam
    saw.1s  thirty  child-Ø  organized-Ø

← I saw 30 children, and each was an organized person (distributive)
← I saw 30 children who were organized as a group (collective)

Similarly, when a pronoun is plural marked and its antecedent is a DP containing a transdecimal numeral, as in (200), it can either co-vary with the antecedent (distributive reading), or it can refer to the collection as a whole (collective reading). When the pronoun is non-plural, however, it must co-vary, as illustrated in (201).

200. nejjaHet  ðeshriin  benet  baʃd-ma  SellaHet  mashruuf-Øn
    passed.1s  twenty  girl-Ø  after  graded.1s  project-their
          (...lli   ðamal-uu-h   lawaHd-on)
          (...which  did-pl-it  to-self-their)
‘I passed twenty girls after grading their project (that they did on their own)’
← I passed 20 girls after I graded each girl’s project which she did on her own (distributive)
← I passed 20 girls after I graded their group project which they did on their own (collective)

201. nejjaHet  ðeshriin  benet  baʃd-ma  SellaHet  mashruuf-Åh
    passed.1s  twenty  girl-Ø  after  graded.1s  project-her
          (...lli   amlet-uh   lawaHd-Åh)
          (...which  did-Ø-it  to-self-her)
‘I passed twenty girls after grading their project (that they did on their own)’
← I passed 20 girls after I graded each girl’s project which she did on her own (distributive)
← I passed 20 girls after I graded their group project which they did on their own (collective)
The fact that there is a semantic difference between the plural-agreeing verbs, adjectives, and pronouns, and the non-plural agreeing ones shows that the plural agreement following transdecimals is not simply optional. Rather, it signals a meaningful difference in the structure and the interpretation of the sentence, and in particular of the DP.

3.3. Basic proposal: Pluralizing function #

3.3.1. Not all numeral-containing DPs are syntactically plural or denote plural individuals

I propose that the structure of a sentence with a transdecimal numeral containing DP, in which verbs, adjectives, or pronouns agreeing with this DP are plural marked is different from the structure of a sentence in which they are not plural marked. I further propose that it is due to this difference in the syntax of the DP that the collective interpretation arises, and that in its absence, a collective interpretation of a numeral containing DP is not possible.

Specifically, I propose that there is a ‘pluralizer’ function that may occur in numeral containing DPs. This ‘pluralizer’ function is necessary for a collective interpretation and is necessary for triggering plural agreement on adjectives, pronouns, and verbs, in the absence of a plural marked noun. Crucially, this ‘pluralizer’ is optional and may be absent. In the absence of this ‘pluralizer’, the interpretation is strictly distributive, and no plural agreement is triggered. I propose that this ‘pluralizer’ is none other than #, the merger site for numerals in the structure proposed in chapter 2.

The tree for a numeral containing DP with # is given in (202), and the tree for a numeral containing DP without # is given in (203): As illustrated, when numerals merge in # as in (202), plural agreement is triggered, and a collective interpretation is available. When the numeral merges elsewhere – say in Q as in (203) – plural agreement is not triggered, and a collective interpretation is impossible.
Importantly, what I am proposing is that the meaning of the numeral is not, in and of itself, what makes a DP syntactically plural or denoting a plural individual (or a quantifier
over plural individuals), but rather that there is a mediating function, which composes with
the noun and the numeral, and which results in this plural individual interpretation and in
plural marking on agreeing elements. In its absence, the numeral cannot do this. This
mediating function, I propose, is #.

The exact semantics of # is discussed in detail in section 4.1, with specific derivations
of the collective and distributive interpretations of verbs, adjectives, and pronouns.
Relatedly, the semantics of numerals is discussed in detail in section 4.2, comparing four
possible semantic treatments of numerals.

The optional distributive interpretation in the context of plural marked verbs,
adjectives, and pronouns, is one that arises in the context of a plural individual. It is due, I
assume, to a pragmatic specification for non-purely-collective predicates that whenever a
predicate’s truth is verified of an individual, it is verified of a cover of this individual35.
Thus, whenever I say that a collective interpretation is available, what is meant is that a
collective, a distributive, or an in between interpretations are all available. I get back to this
in section 4.1.

35 where C is a cover of an individual A iff
a. C is a set of individuals whose minimal parts are all also minimal parts of A (there are
no smaller divisions)
b. Every minimal part of A is a minimal part of some element in C
c. C has no zero elements (vacuous assumption))
Note that if A is itself minimal, the only existing cover of A is the set that contains A itself.
This is modified from Schwarzschild’s (1996) definition into one that is compatible with my assumptions
(where predicates can only be true of individuals, and not of sets). Schwarzschild’s definition of a cover is: C
is a cover of A iff
(1) C is a set of subsets of A; and
(2) Every member of A belongs to some set in C; and
(3) ∅ is not in C.
3.3.2. Supporting evidence from restrictions

This proposal finds nice support from restrictions on the agreement patterns when multiple agreeing elements are involved. As it turns out, while agreement is only optionally plural following transdecimals on adjectives, verbs, and pronouns, when more than one of these occur, systematic restrictions surface, all pointing to the DP determining the plural marking, and pointing to the DP becoming syntactically plural at a later stage in the derivation.

Interestingly, all agreement outside the DP (verbs and pronouns) must be either uniformly plural or uniformly non-plural. This is shown in examples (204) for verb-pronoun combinations and (205) for verb-verb combinations, where the agreement on the verb and the marking on the pronoun must match.

204. a. tleetiin benet saʔal-uu-ni ʔan emm-on
   thirty girl asked-f-pl-me about mother-their
   ‘Twenty girls asked me about their mothers’

   b. tleetiin benet saʔal-et-ni ʔan emm-ah
   thirty girl asked-f-ø-me about mother-her
   ‘Twenty girls asked me about their mothers’

205. a. abel ma yxabber-ni xamsiin shabb safāl
   before PARTICLE tell-ø-me fifty guy asked-ø

   b. abel ma yxabbr-u-ni xamsiin shabb safāl-u
   before PARTICLE tell-pl-me fifty guy asked-pl

   As (206)-(207) shows, any mixing in the plural/non-plural marking on elements agreeing with the same DP leads to ungrammaticality.
206. a. *tleetiin benet₁ saʔal-uuí-ni ᵐan emm-ah₁
   thirty girl asked-f-pl-me about mother-her

   b. *tleetiin benet₁ saʔal-et₁-ni ᵐan emm-on₁
   thirty girl asked-f-Ø-me about mother-their

207. a. *abel ma yxabber₁-ni xamsiín shabb₁ saʔal-uuí
   before PARTICLE tell-Ø-me fifty guy asked-Ø

   b. *abel ma yxabbr-uuí-ni xamsiín shabb₁ saʔal₁
   before PARTICLE tell-pl-me fifty guy asked-Ø

This, it turns out, is not the case inside the DP. Inside the DP, adjectives (as well as relative clauses), show mixed agreement, as illustrated in (208). This mixed agreement is linearly restricted: only the adjectives closer to the noun can be non-plural marked, and as soon as any adjective is plural marked all following adjectives must be plural marked. This is illustrated in the contrasts between the grammatical (208) and the ungrammatical (209).

208. tleetiín telmiiz mnazzam kesleen-iin (... Htajj-uuí)
   thirty student-Ø organized-Ø lazy -pl (... complained-pl)
   ‘Thirty lazy organized students (complained)’

209. *tleetiín telmiiz mnazzam-iin kesleen (... Htajj-uuí)
   thirty student-Ø organized-pl lazy-Ø (... complained-pl)
   ‘Thirty lazy organized students (complained)’

Moreover, looking at noun-adjective sequences with an idiosyncratic meaning, as in (210), we note that the optionality of plural agreement is lost, and the adjective cannot be
pluralized following a transdecimal numeral while maintaining this idiosyncratic meaning, as illustrated in (211).

210. a. tleetin mhandes madani  b. arbʔiin tabiib sharʔi
   thirty engineer-∅ civil-∅ forty doctor legal-∅
   'thirty civil engineers'    'forty forensic medical examiners'

211. a. *tleetin mhandes madaniy-iin  b. *arbʔiin tabiib sharʔiy-iin
   thirty engineer-∅ civil-∅/civil-PL forty doctor legal-PL
   as: 'thirty civil engineers'    as: ‘40 forensic medical examiners’

Assuming that idiosyncratic interpretation is associated with a low merger (cf. Borer 2008, Marantz 2001, inter alia), and potentially with the formation of compounds, this, again, points to a structural restriction and not a morphological or lexical one against the pluralization of these particular adjectives, as the plural form is acceptable for the non-idiosyncratic interpretations ‘thirty civilized engineers’ and ‘forty legitimate doctors’ interpretations. More over, in the same noun-adjective sequences, but following numerals 3-10 and plural marked nouns, the adjective can pluralize while maintaining the idiosyncratic meaning, as illustrated in (212).

212. a. tlat mhands-iin madaniy-iin
   three engineer-PL civil-PL
   ‘three civil engineers’

   b. arbaʔ tabiib sharʔiy-iin
   four doctor-PL legal-PL
   ‘four forensic medical examiners’
This evidence from mixed agreement supports the proposed view in which the syntactic plurality of the transdecimal numeral containing DPs occurs outside of the noun, at a later point.

3.3.3. Alternatives

In the rest of this chapter, I argue for the basic idea proposed here. To do so, I proceed by eliminating four logical possibilities, which might seem like attractive alternatives to my proposal. I argue against each logical alternative separately, and compare it to the proposed view.

The first three logical alternatives that I investigate involve positing a distributor somewhere along the utterance. One of the core components of my proposal is that DPs that contain numerals do **not** all denote plural individuals. Ionin and Matushansky (2006) present an attractive proposal on the semantics of numerals, suggesting that numerals are modifiers of type $<<e,t>,<e,t>>$ which take a predicate of non-plural individuals and return a predicate of plural individuals, as illustrated in (213).

213. $[[\text{three}]] = \lambda P_{et}. \lambda x_e. \exists S_{et} [\pi(S)(x) \land \#S = 3 \land \forall s \in S P(s)]$

Paraphrase: *three* takes a predicate $P$, and returns another predicate which is true of individuals that, partitioned to three, each partition is such that $P$ is true of it

A semantics for numerals as functions that result in a predicate of plural individuals, like that shown in (213), entails that all numeral containing DPs denote plural individuals, which makes an explanation involving some sort of distributor necessary in order to explain the exclusively distributive interpretation in the context of transdecimal numerals presented in section 3.2.2. There are three logical possibilities for such a distributor, to
account for the obligatory distributive interpretation in the context of non-plural agreement following transdecimal numerals:

- The distributive interpretation comes from the non-plural marking on verbs, adjectives, and pronouns (discussed and argued against in section 3.4)
- The distributive interpretation comes from a distributor in the DP (discussed and argued against in section 3.5)
- The distributive interpretation comes from a distributive operator in the predicate (discussed and argued against in section 3.6)

The fourth logical alternative that I investigate is very different from the first three, and involves a split DP analysis in the sense of Sportiche (2005), where the noun merges internally to the VP, and the numeral (like a determiner), is introduced outside the VP, as illustrated in (214)-(215).

214. a. ... Q ... [ NP V... ]...
    b. ... [Q NP] ... [ NP V... ]...

215. [...]ʕeshriin  walad] ... [vPwalad  akal... ] ...]
      twenty  child   child  ate-∅

In this structure, when the noun is interpreted in its position before movement, what composes with the VP is a predicate of non-plural individuals. So a strictly distributive interpretation would emerge. When the noun is interpreted in its position after movement, the nominal element that composes with the VP is a plural individual (or a quantifier over plural individuals), and a collective interpretation would emerge. I discuss and argue against this alternative in section 3.7.
3.4. Against a semantics for plural-marking on verbs, adjectives, and pronouns

The first alternative that I investigate and argue against is one suggesting that the semantics of non-plural marking on verbs, adjectives, and pronouns, is semantically contentful and that it produces the obligatorily distributive interpretation observed following transdecimal numerals (described in section 3.2.2.1). First, I show how such a proposal would work (section 3.4.1), and how it would account for the facts observed so far (section 3.4.2). Then I will present data that is problematic for this account, showing that the account over-generates (section 3.4.3).

3.4.1. How it would work

Suppose that all DPs that contain numerals denote plural individuals. This is desirable if one were to assume a semantics for numerals like the one proposed by Ionin and Matushansky (2006) (cf. (213)). Suppose, additionally, that plural marking on adjectives, verbs, and pronouns, introduces no collective/distributive restrictions on interpretation, allowing both collective and distributive interpretation, but that non-plural marking forces a distributive interpretation36 (contrast between (a) and (b) in (216)-(218)).

216. a. \([\text{eat-pl}] = \lambda x. \lambda y. y \text{ eats } x\)

   b. \([\text{eat-}φ_{SC}] = \lambda x. \lambda y. \exists s : s = \Pi(x, |x|) \text{ and } \forall z \in s, y \text{ eats } z\)
      (all members of a partition of } x \text{ over into } |x| \text{ many parts eat } y)

36 This can be phrased conversely, whereby the default interpretation is distributive, and that is the reading obtained in the absence of plural marking on verbs, adjectives and pronouns. In this phrasing, is plural marking on the verb, adjective, or pronoun, that introduces collective interpretation. While the load of semantic denotation lies on -pl rather than on -φ in this alternative, this is an identical situation to one in which -φ forces a distributive reading and -pl is neutral.
217. a. $[[\text{tall-pl}]] = \lambda P. \lambda x. P(x)$ and $x$ is tall

b. $[[\text{tall-øSG}]] = \lambda P. \lambda x. \exists s: s = \Pi(x, |x|)$ and $\forall z \in s P(z)$ and $z$ is tall

(all members of a partition of $x$ over into $|x|$ many parts are tall)

218. a. $[[\text{they}]]^g = \lambda x. x$

b. $[[\text{he}]]^g = \lambda x: \exists s s = \Pi(x, |x|). s$

Suppose, also, that plural marking can occur on adjectives, verbs, and pronouns regardless of the marking on the DP (as long as the DP denotes a plural individual), whereas non-plural marking is only possible if there is no overt plural marking on the noun. The resulting sentence schemas would be as illustrated in (219).

219. a. Numeral + noun-ø + V-ø $\rightarrow$ Strictly distributive interpretation

b. *Numeral + noun-pl + V-ø $\rightarrow$ * (barred)

c. Numeral + noun-ø + V-pl $\rightarrow$ Collective interpretation

d. Numeral + noun-pl + V-pl $\rightarrow$ Collective interpretation

3.4.2. Accounting for the facts

Turning, now, to the distributivity effects observed in section 3.2.2.1, this alternative fits these facts immediately: The sentence in (220a) contains a plural marked verb, and a DP that denotes a plural individual (or a quantifier over plural individuals). Being plural marked, the verb can be interpreted collectively. The sentence in (220b) contains the same DP denoting a plural individual, but with a non-plural marked verb. Due to the non-plural marking, the distributive interpretation becomes obligatory. The composition for DP-VP is given in (221a-b) which results in the contrast observed in (220a-b).
220. a. tleetiin walad akal-uuʔaaleb gateu keemel
   thirty child-∅ ate-pl pie cake whole
   ‘Thirty children ate a whole cake’ ✔ distributive ✔ collective

b. tleetiin walad akal ʔaaleb gateu keemel
   thirty child-∅ ate-∅ pie cake whole
   ‘Thirty children ate a whole cake’ ✔ distributive ✗ collective

221. a. [[thirty kids]] = λQ. ∃x. Q(x) and |x| = 30 and kid (x)

b. [[eat-pl a cake]] = λx. x eats a cake
   [[thirty kids eat-pl a cake]] = 1 iff ∃x. x eats a cake and |x| = 30 and kid (x)
   Paraphrase: tleetiin walad akal-uuʔaaleb gateu is true iff there is a plural
                individual x of size 30 and x ate a cake

   c. [[eat-∅SG]] = λx.λy. ∃s: Π(x, |x|) ∀z∈s, z eats y
   [[thirty kids eat-∅SG a cake]] = 1 iff ∃x. ∃s: Π(x, 30) ∀z∈s, z eats a cake
      and |x| = 30 and kid (x)
   Paraphrase: tleetiin walad akal-∅ ʔaaleb gateu is true iff there a plural
                individual x of size 30 and every member of a 30-way
                partition of x ate a cake

3.4.3. Problematic facts: Multiple Agreeing Elements

Recall from section 3.3.2. that when more than one element agreeing with the same
DP occur, there are systematic restrictions on the plural/non-plural marking on these
agreeing elements: All agreement outside the same DP, for both verbs and pronouns, must
be uniform: Either all agreeing elements are plural-marked, or all agreeing elements are
non plural-marked. A summary of the facts is given in (222).
222. a. tleetin benet saʔal-et-ni ʕan emm-ah/*-on
   thirty girl asked-f-ø-me about mother-her/*-their
   ’Twenty girls asked me about their mothers’

   b. tleetin benet saʔal-uu-ni ʕan emm-on/*-ah
   thirty girl asked-f-pl-me about mother-their/*-her
   ’Twenty girls asked me about their mothers’

In fact, the uniformity of agreement across all agreeing elements outside the DP is true
regardless of the position of the DP in the sentence as shown for the subject DP in (222a-b),
object DP in (223)-(224), and PP in (225)-(226).

223. saʔalt ʕeshriiŋ benet ʕan emm-ah w ʕan bayy-ah/*-on
    asked.1s twenty girl-ø about mother-her and about father-her/*their
    ’I asked twenty girls about their mothers and their fathers’

224. saʔalt ʕeshriiŋ benet ʕan emm-on w ʕan bayy-on/*-ah
    asked.1s twenty girl-ø about mother-their and about father-their/*her
    ’I asked twenty girls about their mother(s) and their father(s)’

225. Hkiit mafi tleetin benet ʕan emm-ah w ʕan bayy-ah/*-on
    spoke.1s with thirty girl about mother-her and about father-her/*their
    ’I talked to twenty girls about their mothers and their fathers’

226. Hkiit mafi tleetin benet ʕan emm-on w ʕan bayy-on/*-ah
    spoke.1s with thirty girl about mother-their and about father-their/*-her
    ’I talked to twenty girls about their mother(s) and their father(s)’
The fact that these restrictions occur would force us to assume an interdependency between the semantically contentful agreement markers themselves (on verbs, pronouns, or adjectives). A direct dependency between the different agreement markers fails to find an interpretational motivation, since we know since Dowty (1987), from examples like (227), that we can conjoin multiple predicates, some of which are interpreted distributively, and others collectively. A direct dependency also fails to find a syntactic motivation, as the agreement markers can be syntactically very far from one another, and the matching requirement in (222)-(226) remains, as illustrated in (228), where one pronoun is deeply embedded in an adjunct, and the other is in the PP complement of the verb.

227. The students closed their notebooks, left the room, and then gathered in the hall after class (Dowty 1987)

228. baʃd ma ʔxadet ʔezen bent ext-ah, ...
   after that took.1s permission daughter sister-her, ...
   ... sa’alt tleetiin mara ʕan zowj ext-ah/*/on
   ... asked.1s thirty woman about husband sister-her/*their
   ‘After I got their nieces’ permission, I asked thirty women about their brothers in law’

We are then left only with the option that there is a common factor triggering uniform agreement on all agreeing elements: such a factor would have to be in the DP, which is the only thing that interacts with all the agreeing elements.

Even if the collective and distributive interpretations following transdecimal numerals are due to the semantics of non-plural marking on verbs, adjectives, and pronouns, we are forced to conclude that this marking is entirely dependent on the DP. By transitivity, the interpretation will be entirely dependent on the properties of the DP.

This leaves us with two options that are empirically indistinguishable:
(a) A purely syntactic property of the DP rigidly controls the marking on adjectives, verbs and pronouns. And the marking on adjectives, verbs, and pronouns determines whether they are interpreted distributively or collectively. Therefore a purely syntactic property of the DP determines whether adjectives, verbs, and pronouns are interpreted collectively or distributively.

(b) There is a syntactic property of the DP (plural vs. non-plural) that is associated with a semantic property (syntactically plural DP denotes a plural individual, syntactically non-plural DP denotes an atomic individual). This property determines both the plural/non-plural marking on adjectives, verbs, and pronouns, through agreement. It also determines whether they are interpreted collectively or distributively (where only a plural individual can be interpreted collectively).

While (a) and (b) make the same predictions empirically, (a) ends up being an ad hoc claim of syntactic properties in DPs controlling whether a distributor – a semantic operator – can occur in predicates, whereas in (b) the property in the DP that is controlling the interpretation is itself semantic, and hence is reasonably connected to semantic effects on the utterance as a whole.

3.4.4. Comparison with the proposed pluralizing # account

Option (b) at the end of the previous paragraph is exactly what my pluralizing # account proposes. Recall that the proposal I argue for claims that a numeral containing DP does not necessarily denote a plural individual (or a quantifier over plural individuals), and that it does not necessarily trigger plural agreement. Rather, I propose that a simultaneously syntactic and semantic ‘pluralizer’ in the DP is necessary for both a plural individual interpretation as well as for plural agreement on adjectives, verbs, and pronouns of these.
My account directly predict that all elements outside of a DP must either all be non-plural marked or all be plural marked. Specifically, if a DP contains #, it is syntactically plural and hence triggers plural agreement on all verbs and pronouns that agree with it. This is illustrated in (229). No verb or pronoun agreeing with it may be non-plural marked. In this case, since # is also a semantic function, the DP denotes a plural individual (or quantifier over plural individuals), and collective interpretation is possible.

229. PL ok, -ø not ok

\[
\text{[DP} ([Q] [tletiiin # [Div walad [N walad ]]])] \text{ akal-uu/*akal}
\]
\[
\text{thirty boy-ø ate-pl/*ate-ø}
\]
\[
\text{they/*he}
\]

(#: Pluralizing functional projection)

In the absence of #, no plural agreement is triggered, so no verb or pronoun agreeing with it may be plural marked. This is illustrated in (230). In this case, since there is no pluralizing semantic function, the DP does not denote a plural individual (but rather, a collection of atomic individuals), so only a distributive interpretation is possible.

230. No # -ø ok, PL not ok

\[
\text{[DP} [Q tletiiin [Div walad [N walad ]]]] \text{ akal /*akal-uu}
\]
\[
\text{thirty boy-ø ate-ø/*ate-pl he/they}
\]

(No #, no plural marking on noun → No plural agreement)

In neither of these cases can there be some agreeing elements outside the DP that are plural marked and others that are not. It therefore predicts that if there is plural agreement on any element agreeing with a numeral containing DP, # must be present and all other elements agreeing with it will also be plural marked. It also predicts that if any
DP-external element agreeing with a numeral containing DP is non-plural marked, # must be absent (otherwise it would have triggered plural agreement), and so there cannot be any other DP-external element agreeing with the same DP that is plural marked.

The fact that marking on all verbs following a given DP, and all pronouns coindexed with it, must be uniform is not only consistent with my proposal. It supports my basic idea that the marking on verbs, adjectives, and pronouns, and – relatedly – the interpretation depend on the internal structure of the DP and its denotation, rather than on VP-local, pronoun-local, or adjective-local factors.

Given that key components of my proposal will have to be assumed anyway for an alternative positing a semantics of plural and non-plural marking that control the distributive - collective interpretations, and that these assumptions – while they directly follow from my pluralizer #, become ad-hoc for the second alternative. This is illustrated in table (231).

<table>
<thead>
<tr>
<th>231. Property</th>
<th>My proposal: pluralizing # in the DP</th>
<th>Alternative 1: Semantically contentful plural/non-plural marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Accounts directly for the fact that non-plural marking on adjectives, verbs, and pronouns is associated with exclusively distributive interpretation</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>B. Accounts directly for the fact that collective interpretation and plural-marking go together on adjectives, verbs, and pronouns</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C. Accounts directly for the requirement of uniform agreement on all DP-external elements (verbs and pronouns)</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
3.5. **Against accounting for the facts through a possible distributor on the predicate**

The second alternative explanation that I argue against is one that involves a (silent) distributive operator on the predicate itself (the adjective, the verb, or the pronoun). Such an account would be in line with Dowty’s (1987) observation (and argument for a distributive operator in the VP) that collective VP and distributive ones can be conjoined following the same subject DP. Example (169), repeated in (232), illustrates the conjunction of a distributive predicate, a mixed one, and a collective one. Without some part of the distributive-collective distinction being specified in the VP, such a conjunction would not be possible.

232. The students closed their notebooks, left the room, and then gathered in the hall after class.

Describing the specific stipulations that would have to be added to this proposal in order to account for the Lebanese Arabic transdecimal data, I argue that these stipulations will be tantamount to assuming a specific distributor on the predicate that is entirely dependent on the properties of the noun or DP, which again becomes equivalent to the proposal that a DP-internal semantic property is what imposes the distributive interpretation or allows a collective one.

3.5.1. **How it would work**

Sauerland (1998) proposes an implementation of the distributor on predicate idea in which predicates are formed by moving the DP out of a clausal domain, where the movement creates new syntactic constituents as described in (233).
233. “When XP moves from a position inside YP to the sister-position of YP, the following operations take place:

a. XP is replaced with a variable x which doesn’t occur yet in YP.
b. A new node YP’ is formed with the two daughter nodes YP and λx.
c. A new node YP” is formed with the two daughter nodes YP’ and XP.”

(Sauerland 1998:187)

234.

![Diagram](image)

Given (233), when the DP moves out of a clausal (type t) constituent, a new constituent (a predicate of type <e,t>) is formed containing the YP (which now contains a variable x replacing the moved DP), as well as λx. This is shown in (234).

Assuming all numeral containing DPs must denote plural individuals (or quantifiers over plural individuals), the predicates formed by the movement of such a DP out of a clausal constituent can each have a distributor or lack one (for such distributors, see e.g. Link 1983 (Distr), Sternfeld 1998 (Δ-operator), Sauerland 1998 (*-operator), inter alia).

To account for the data presented in (194)-(201), and assuming plural marking is optional following DPs containing transdecimal numerals, one would have to assume that there is at least one distributive operator (call it DIST1) that is required in the absence of
plural marking on the predicate (235). Since only a distributive interpretation is available when the predicate is non-plural marked, one would also have to assume that DIST1 must have a semantics that is exclusively distributive, and does not allow other interpretations (e.g. that in (237a)). A full derivation for verbs is given in (236)-(238).

235.

```
DP       VP
      /
   /
 thirty child-Ø  DIST1
      /
   /
 ate-Ø DP
```

236. a. \[[[\text{thirty child-Ø}]] = \lambda P. \exists x. P(x) \text{ and } \exists S [\pi(S)(x) \text{ and } |S| = 30 \text{ and } \forall s \in S s \text{ is a child}]\]

b. Paraphrase: *tleetiin walad* takes a predicate (here the VP) and returns truth if there is an individual which this predicate is true of, and which, partitioned into 30 parts, each part is a child

---

37 This is similar, but not identical, to the proposal that it is the non-plural marking on verbs, adjectives, and pronouns itself that has the distributive denotation. A proposal placing the collective and distributive interpretation in the plural marking or non-plural marking itself, would have a one-to-one correspondence between meaning and marking. In contrast, with distributive operators occurring on top of the predicate, multiple DIST operators, and even the lack of one, can all be associated with the same marking on the predicate, and more specific restrictions can be posited.
237. a. \[ [[\text{DIST1}]] = \lambda P. \lambda x. \forall y. y < x \text{ and } |y| = 1 P(y) \]

b. \[ [[\text{DIST1 ate-Ø a cake}]] = \lambda x. \forall y. y < x \text{ and } |y| = 1, y \text{ ate a cake} \]

c. Paraphrase: “\text{DIST ate-Ø a cake}” denotes a predicate that is true of individuals whose parts of size 1 ate a cake

238. a. \[ [[\text{thirty child-Ø DIST1 ate-Ø a cake}]] = [[\text{thirty child-Ø}]]([[\text{DIST1 ate-Ø a cake}]])) \]
\[ = 1 \text{ iff } \exists x. \forall y. y < x \text{ and } |y| = 1, y \text{ ate a cake and } \exists S_{\in S} [\pi(S)(x) \text{ and } |S| = 30 \text{ and } \forall s \in S s \text{ is a child}] \]

b. Paraphrase: \text{tleetiin walad DIST1 akal gateau} denotes a true proposition iff there is an individual which partitioned into 30 parts, each part is a child, and each part ate a cake

In the absence of any distributor, the predicate in the context of transdecimals would have to be plural marked, as collective interpretation is only possible if the verb is plural marked (again, example (195)).

239.

There are two options for the cases in which DIST1 is absent.

The first option would be to assume that the absence of distributor does not result in a collective interpretation of the predicate. Rather, it is simply unspecified with respect to collective versus distributive. One way to formalize this would be to assume, following
Schwarzschild’s (1996), that saying that a predicate is true of an individual in actuality
stands for saying that it is true of a cover of that individual, as defined in (240) (Note that
this is a notational variant of Schwarzschild’s proposal (cf. fn 35, page 119)).

240. C is a cover of an individual A iff
a. C is a set of individuals whose minimal parts are all also minimal parts of A (there
are no smaller divisions)
b. Every minimal part of A is a minimal part of some element in C
c. C has no zero elements (vacuous assumption))

241. \[[\text{thirty child-}\varnothing \text{ ate-pl a cake}]] = \[[\text{thirty child-}\varnothing\]](\[[\text{ate-pl a cake}]])
   = 1 \text{ iff } \exists x, \exists C \text{ a cover of } x (\forall y y \in C, y \text{ ate a cake})
   \text{ and } \exists S \text{ s.t. } |\pi(S)(x)| \text{ and } |S| = 30 \text{ and } \forall s \in S s \text{ is a child}

Paraphrase: \text{tleetiin walad DIST akal gateau} is true iff there is an
individual which partitioned into 30 parts, each part is a
child, and all the members of a cover of that individual ate a
cake

This allows a collective interpretation in the special case where that cover is the
singleton set containing that plural individual (i.e. in (241), there is only one such y, and it
is the individual made of all thirty children). It also allows a range of co-distributive
interpretations by taking the cover to be a set made up of parts of that individual. And
finally, it allows a distributive interpretation by taking the cover to be the set of all the
minimal parts that make up that individual (i.e. in (241), C has exactly 30 members, and
each of them is a child).

The second option would be that in the absence of any distributor, collective
interpretation is required (e.g. (242) for verb phrases). This would require a different
distributive operator (call it DIST2) that is syntactically invisible (does not show any visible
distinctions from the collective cases), and does not block plural marking on the predicate it occurs. DIST2 can have either a semantics that allows both distributive and co-distributive interpretations, or a semantics like that of DIST1, which would require positing yet another operator, CO-DIST, to derive co-distributive interpretations.

242. \[[\text{thirty child-Ø ate-pl a cake}] \] = \[[\text{thirty child-Ø}]](\[[\text{ate-pl a cake}]])
\[= 1 \text{ iff } \exists x_e. x \text{ ate a cake and } \exists S_t \left[ \pi(S)(x) \text{ and } |S|=30 \text{ and } \forall s \in S s \text{ is a child} \right] \]

Paraphrase: *tleetiin walad DIST a kal gateau* is true iff there is an individual which partitioned into 30 parts, each part is a child, and that individual ate a cake.

This alternative therefore directly predicts the fact that collective interpretation is available when the predicate is plural marked. And with a stipulation, it can be adjusted to predict that exclusively distributive interpretation is possible in the absence of plural marking on the predicate.

### 3.5.2. Issues and additional stipulations

Regardless what option we take for the absence of DIST1, the restrictions in the presence of DIST1 remain problematic. One issue for DIST1 forcing non-plural marking on the predicate, is the fact that DIST1 would be unable to occur following just any plural DP. DPs containing numerals 3-10, where the noun is plural marked, for instance, never allow a non-plural marked adjective or verb, as illustrated in (243), and the same goes for all plural marked nouns in general, including plural DPs that do not contain numerals.
243. a. *tlat \ wleed \ akal \ aaleb \ gateau
    three \ child-pl \ ate-\Ø \ pie \ cake

    b. *\[DP \ [Q \ tlat \ [Div \ [N \ wleed]]]] \ [VP \ [DIST1 \ [v \ weSel]]]

So there would have to be a stipulation that DIST1, a semantic operator, is only licit if certain syntactic conditions are met in the DP. Specifically, it requires that the noun be non-plural marked.

Moreover, the same issues faced by the previous alternative comes up: when multiple DP-external predicates all compose with the same predicate, and any of them is non-plural marked (i.e. contains DIST1), all other DP-external predicates must also be non-plural marked and distributive. So whenever DIST1 occurs on any DP-external predicate, it must occur on all DP-external predicates in that sentence. This can be taken to be the result of a syntactic condition that requires all DP-external number marking on items agreeing with the same DP to be uniform (either all non-plural marked, or all plural marked). In other words, either all DP-external predicates see the DP as syntactically plural, and thus are plural marked, or all DP-external predicates see the DP as syntactically non-plural, and thus remain non-plural marked. So whenever the DP is syntactically non-plural, DIST1 must occur. This proposal would therefore require a DP-internal syntactic condition to control presence of a DP-external distributor.

But more strikingly, within a given DP, some adjectives can be non-plural marked and interpreted exclusively as distributive, and others plural marked and interpreted as either distributive or collective\(^{38}\). This is illustrated in (244a). This contrasts with DP-external predicates in (222)-(226) of the previous section. We would therefore have to conclude that it is a DP-internal condition that occurs somewhere along the derivation of the DP, that is requiring DIST1 on some adjectives but not others.

\(^{38}\) There is a strong preference for a collective interpretation.
Moreover, this mixed agreement is only licit if the non-plural marked adjective occurs closer to the noun, but not vice versa (contrast (244a) and (244b)). We are then faced with a syntactic property of the DP that requires DIST1 up to a certain point, then stops requiring it from there on. But what can be a function that stops requiring the occurrence of DIST1 from a given point in the DP and upwards, and simultaneously requires plural marking? We are left with a syntactically pluralizing function in the DP that bars the presence of DIST1 on predicates, and in its absence DIST1 is required on all predicates. This then becomes, again, equivalent to saying that there is a DP-internal object whose presence requires plural marking and allows collective interpretation, and its absence bars collective interpretation, which is exactly what my account proposes, with that DP-internal object being #.

3.5.3. **Comparison with the proposed pluralizing # account**

Recall that my own proposal posits an optional pluralizing function # in the DP, where only things that merge after the pluralizer can be plural marked, and can be interpreted collectively. This proposal accounts for the data straightforwardly, without the need for any mediating distributors:

Assuming plural agreement on adjectives, verbs, and pronouns requires either that the DP (or DP component) they compose with contain # be present in the DP, or that the noun itself be plural marked, non-plural agreement will only be possible following transdecimal numerals.
This gets the facts in (243): In a DP containing a transdecimal numeral, which is always followed by a non-plural marked noun, if the DP does not contain #, like in (245), there is nothing in the DP that would trigger plural agreement, and thus one would not expect plural marking on adjectives, verbs, and pronouns.

245. b. [D [Q tleetiin [Div walad [N ]]]] akal aaleb gateau
   thirty child-∅ ate-∅ pie cake

   No #
   No -pl

   In a DP containing a numeral between 3 and 10, where the noun following the numeral must always be plural marked, or in a DP containing a plural marked noun without a numeral, the plural marking on the noun triggers plural agreement. This is illustrated in (246a). Similarly, in a DP containing #, regardless of whether the noun is plural marked (as in (246a)) or not (as in (246b)), # would trigger plural agreement. So plural marking on adjectives, verbs, and pronouns agreeing with it would be expected, and there is no scenario in which no plural agreement is triggered.

246. a. [D [Q (#) tlat [Div wleed [N ]]]] akal uu/*akal aaleb gateau
   (#) three child-pl ate-pl/*ate-∅ pie cake

   b. [D [# # tleetiin [Div walad [N ]]]] akal uu/*akal aaleb gateau
   # thirty child-∅ ate-pl/*ate-∅ pie cake

   The table in (247) summarizes the facts to account for, and how my proposal and this alternative compare in accounting for them.
<table>
<thead>
<tr>
<th>247. Property</th>
<th>My proposal: pluralizing # in the DP</th>
<th>Alternative 2: Distributor on the predicate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Accounts directly for the fact that non-plural marking on adjectives, verbs, and pronouns, is associated with exclusively distributive interpretation</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>B. Accounts directly for the fact that collective interpretation and plural-marking go together on adjectives, verbs, and pronouns</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C. Accounts directly for the requirement of uniform agreement on all DP-external elements (verbs and pronouns).</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>D. Accounts directly for the fact that adjectives closer to the noun can be non-plural marked and exclusively distributive, and adjectives farther from the noun can be</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

### 3.6. Against a distributor in the DP

#### 3.6.1. Basic idea and how it works

The third alternative that I argue against is the exact converse of my proposal: Suppose that all DPs that contain numerals, by virtue of containing a numeral, are syntactically plural. They therefore require plural marking on all agreeing adjectives, pronouns, and verbs. Moreover, suppose all DPs that contain numerals denote plural individuals. They therefore always allow a collective interpretation, unless a distributor intervenes. This is illustrated in (248).
Suppose, in addition, that an optional distributor (DIST3) may occur in DPs containing transdecimal numerals, such that in the presence of that distributor, plural agreement on adjectives, verbs, and pronouns is blocked (so they are non-plural marked), and only a distributive reading is available (249).

This alternative would directly account for the fact that distributive interpretation is required when a given adjective, verb, or pronoun, is non-plural marked: In the presence of DIST3, anything merging with the DP after DIST3 will be both non-plural marked and will also be interpreted exclusively distributively. This alternative would also directly account for the fact that in the presence of plural marking, collective interpretation is possible: Plural marking is evidence of the absence of DIST3. There is therefore nothing that blocks collective interpretation.

Finally, this alternative correctly predicts that all verbs and pronouns outside a given transdecimal containing DP must be either uniformly plural-marked or uniformly non-plural marked: If the DP contains DIST3, everything outside the DP must be non-plural
marked and interpreted exclusively distributively. If the DP does not contain DIST3, everything outside the DP must be plural marked, and the interpretation may be collective.

### 3.6.2. Problematic facts: Adjectives Again

Given (249), this proposal predicts that if DIST3 occurs after a plural-agreeing adjective, it should license non-plural agreement on any following verb phrase or pronoun agreeing with the DP, expecting sentences like (250) grammatical, when they are not.

250. a. *sheft xamsiin benet mnazzam-iin tawiileh
    saw.1s fifty girl-∅ organized-pl tall-∅

b. Prediction:

\[
\begin{array}{c}
\text{[DP tawiileh [DISTRIBUTOR mnazzamiin [Q/# xamsiin [Div[\text{N benet}]]]]]}
\text{tall-∅ organized-pl fifty girl}
\end{array}
\]

\[
\begin{array}{c}
\text{DISTRIBUTIVE +}
\text{COLLECTIVE + PLURAL AGREEMENT}
\end{array}
\]

\[
\begin{array}{c}
\text{NON-PLURAL AGREEMENT}
\end{array}
\]

Moreover, it would predict that as soon as there is non-plural marking on an adjective inside the DP, that is evidence for the presence of the distributor, thus all agreement outside the DP must be non-plural, and all verbs and pronouns agreeing with the DP must be non-plural marked (251). This again is inconsistent with the facts.
251. Predicted bad, actually good: xamsiin Sabi mnazzam weSl-uu
    fifty boy-Ø organized-Ø arrived-pl

Again, the opposite of this is true: When the adjective inside the DP is non-plural marked, verbs and pronouns outside the DP can be either plural marked or non-plural marked, as illustrated in (252) for verbs and in (253) for pronouns.39

252. xamsiin Sabi mnazzam-Ø wessel/wesel-ou
    fifty boy-Ø organized-Ø arrived-Ø/arrived-PL
    ‘fifty organized boys arrived’

---

39 As Pesetsky (2013) points out, the facts I present on number agreement mismatch in Lebanese Arabic bare a striking resemblance to Russian gender mixed agreement facts (i)-(ii), something that is without a doubt telling about the cross-linguistic hierarchical and generalizable properties of UG.

i. Nov-yj vrač prišl-a
   new-M.NOM.SG doctor-NOM.SG arrived-F.SG

ii. *Nov-aja vrač prišél
   new-F.NOM.SG doctor-NOM.SG arrived-M.SG

Gender mixed agreement has gotten a significant amount of attention recently in the work of Pesetsky (2010), Asarina (2009), Matushansky (2011), among others.
And the exact converse is also true: When an adjective inside the DP is plural marked, any verbs or pronouns agreeing with the DP must be plural marked, as illustrated in (254) for verbs and (255) for pronouns.

Moreover, such a distributor also cannot exist in the context of numerals 3-10, which do not allow non-plural agreement anywhere. Why such a distributor would have to be absent in these cases would remain a stipulation. I therefore conclude that it is not the case that a non-plural agreement-enforcing distributor may optionally occur in DPs containing transdecimal numerals.

3.6.3. **Comparison with the proposed pluralizing # account**

The facts in the previous section, while problematic for the DP distributor alternative, serve to bolster the claim that the structure of the DP is a controlling factor for availability of a collective reading and plural marking on verbs and pronouns: There is a rigid unidirectional effect from the DP to the VP, but not the other way around: Plural agreement on
the adjectives, which are DP internal, restricts the agreement that may appear on the verb (254) or pronoun (255) that agrees with the DP. And the converse is not true for either verbs or pronouns (252)-(253).

My proposal accounts for these facts straightforwardly: As illustrated in (256), a proposal assuming a ‘pluralizer’ in the DP necessary for a collective reading and for plural marking on adjectives, verbs, and pronouns, predicts that in the presence of this ‘pluralizer’, after a certain point in the DP, plural agreement is triggered and a collective reading is available. No plural agreement is triggered on any adjective merging below that point (thus, non-plural marked adjectives), and no collective reading is available for it.

256. Until #, no plural; above #, all is plural

```
D
  V-pl/*V-Ø
    adjective-pl  predicate of plural individuals
      #
        adjective-Ø  predicate of atomic individuals
          noun-Ø  ...
```

⇒ Correct Prediction

As (257) illustrates, this is the case.

```
257. tleetiin telmiiz mnazzam kesleen-iin (... Htajj-uu)
     thirty student-Ø organized-Ø lazy -pl (... complained-pl)
‘Thirty lazy organized students (complained)’
```
The way my proposal accounts for this data parallels closely Pesetsky’s (2010) proposal for
gender mixed agreement facts in Russian: Like my pluralizing function #, Pesetsky’s
proposal has an optional null feminizing morpheme, Ж, which may merge at any point in
the DP, and once it does, the nominal counts as feminine for agreement purposes from that
point up the tree – thus all agreement must be feminine after that.

In contrast, an alternative assuming that plurality and collectivity come from the
numeral itself and that a distributor makes non-plural agreement possible and blocks the
collective reading, would specifically make the wrong predictions in the case of multiple co-
occurring adjectives (this bad prediction is shared with the distributor on the predicate
alternative, discussed in section 3.5): It would predict that it would be at least possible to
have non-plural marked adjectives following plural marked adjectives, provided the
distributor occurs between them. But this kind of example is out (258).

258. *tleetiin telmiiz kesleen-iin mnazzam (... Htaji-uu)
    thirty student-Ø lazy -pl organized-Ø (... complained-pl)
    ‘Thirty lazy organized students (complained)’

Another piece of evidence provides further support for the claim that non-plural marked adjectives compose directly with the noun, and are not the result of a distributor: It is infelicitous to plural-mark low adjectives which are interpreted idiomatically with the
noun. This is illustrated for ‘civil engineer’ and ‘forensic medical examiner’ in (259)-(260)

40. These facts, again, closely parallel the gender mixed agreement facts in Russian: Low adjectives
    modifying grammatically masculine nouns with feminine denotees must be masculine (Pesetsky 2010).

    i. Glavn-[-yj/*-aja] vrač poliklinik-i skazal-a ...
       ‘The (female) head doctor of the clinic said..’
259. a. tleetiin mhandes madani
   thirty engineer-∅ civil-∅
   ✓ 'thirty civil engineers'
   ✓ thirty civilized engineers

b. arbiin tabiib sharʔi
   forty doctor legitimate-∅
   ✓ ‘forty forensic medical examiners’
   ✓ ‘forty legitimate doctors

260. a. tleetiin mhandes madaniy-iin
   thirty engineer-∅ civil-pl
   × 'thirty civil engineers’
   ✓ 'thirty civilized engineers’

b. arbiin tabiib sharʔiy-iin
   forty doctor legitimate-pl
   × 'forty forensic medical examiners’
   ✓ ‘forty legitimate doctors’

The comparison table in (261) summarizes how my proposal and the alternative involving a distributor in the DP compare in accounting for the data.
### 261. Property

<table>
<thead>
<tr>
<th>My proposal: pluralizing # in the DP</th>
<th>Alternative 3: Distributor in the DP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A.</strong> Accounts directly for the fact that non-plural marking on adjectives, verbs, and pronouns, is associated with exclusively distributive interpretation</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>B.</strong> Accounts directly for the fact that collective interpretation and plural-marking go together on adjectives, verbs, and pronouns</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>C.</strong> Accounts directly for the requirement of uniform agreement on all DP-external elements (verbs and pronouns).</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>D.</strong> Accounts directly for the fact that adjectives closer to the noun can be non-plural marked and exclusively distributive, and adjectives farther from the noun can be</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>E.</strong> Accounts directly for the fact that in the presence of a plural marked adjective, all DP-external elements must be plural marked, but not vice versa</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### 3.7. Against Splitting The DP

#### 3.7.1. Basic idea

The fourth and last alternative I consider is one in which the DP is split, as in Sportiche (2005). Based on evidence from reconstruction effects and scope computation in trace theory and binding theory, Sportiche (2005) proposes that all DPs merge discontinuously in the sentence. Specifically, he proposes a structure like that in (262), where both subject and complement DPs involve N movement from within the VP to D, and where the verb moves from V to v.
Suppose that, like determiners, numerals like ‘thirty’ merge externally to the VP, in D, and that the noun merges internal to the VP, in N.

Suppose, in addition, that the noun can be interpreted either before movement or after movement, and that agreement depends on which copy of the noun is interpreted. So
when the noun is interpreted in its position before movement, what composes with the verb is a predicate of non-plural individuals, and a strictly distributive interpretation would emerge. In addition, non-plural marking is triggered on the verb.

When the noun is interpreted in its position after movement, the nominal element which composes with the verb is a plural individual (or a quantifier over plural individuals) composed of the numeral + noun, so a collective interpretation would emerge, and plural marking is triggered on the verb.

This is an attractive alternative that straightforwardly explains the syntactic and the semantic effects for verbs and adjectives without requiring any special stipulations on the semantics of functional projections, the semantics of plural marking, and it does not introduce any covert distributors or pluralizers. As I will shortly show, however, pronouns present a serious problem for this alternative.

3.7.2. How it would work

Adjectives may modify either the noun alone, merging either in the low position of the noun or in the high one. If they merge in the position before movement (264), they are interpreted distributively and get non-plural marked. The semantic derivation showing the distributive interpretation is given in (266). If they merge after the noun moves to D, they modify the noun and numeral together, as in (267). In this case, the adjective is plural marked, and the semantic composition occurs in a different order, resulting in a collective interpretation of the adjective. This composition is given in (268).

264. $[\text{tleetiin} \text{[walad mnazzam]} \quad [v \text{ [walad mnazzam]}\text{ weSel+e}} \quad ...
\text{ thirty child-Ø organized-Ø child-Ø organized-Ø arrived} \quad ...

265. a. $[[\text{mnazzam}]] = [[\text{mnazzm-iin}]] = \lambda P. \lambda x. P(x)$ and $x$ is organized
b. $[[\text{walad}]] = \lambda x. x$ is a child
c. $[[\text{tleetiin}]] = \lambda P_e. \lambda x_e. \exists S_e \pi(S)(x) \text{ and } |S| = 30 \text{ and } \forall s \in S \ P(s)$
266. a. \([[[\text{mnazzam}]]] ([[\text{walad}}]]) = \lambda x. [\lambda y. y \text{ is a child}(x) \text{ and } x \text{ is organized}]
\[
= \lambda x. x \text{ is a child and } x \text{ is organized}
\]

b. \([[\text{tleetiin walad mnazzam-}ø]] = [[\text{tleetiin}] ([[\text{walad mnazzam}})])
\[
= \lambda x. \exists S_{\text{set}}[\pi(S)(x) \text{ and } |S| = 30 \text{ and } 
\forall s \in S [\lambda x. x \text{ is a child and } x \text{ is organized}](s)]
\]
\[
= \lambda x_\epsilon. \exists S_{\text{set}} [\pi(S)(x) \text{ and } |S| = 30 \text{ and } 
\forall s \in S, s \text{ is a child and } s \text{ is organized}]
\]

c. **Paraphrase:** \text{tleetiin walad mnazzam-}ø denotes a predicate which is true of individuals that, partitioned to thirty, each partition is a child and is organized.

267. \([\text{tleetiin walad mnazzam-in}]  \text{ thirty } \text{child-}ø \text{ organized-pl } \text{ child-}ø \text{ arrived } ...
\]

268. a. \([[\text{tleetiin}}] ([[\text{walad}})]) = \lambda x_\epsilon. \exists S_{\text{set}} [\pi(S)(x) \text{ and } |S| = 30
\[
\text{ and } \forall s \in S [\lambda y. y \text{ is a child}](s)]
\]

b. \([[\text{tleetiin walad mnazzam-in}]] = [[\text{mnazzam}]] ([[\text{tleetiin mnazzam}})])
\[
= \lambda x. \exists S_{\text{set}}[\pi(S)(x) \text{ and } |S| = 30 \text{ and } 
\forall s \in S [\lambda x. x \text{ is a child and } x \text{ is organized}](s)]
\]
\[
= \lambda x_\epsilon. \exists S_{\text{set}} [\pi(S)(x) \text{ and } |S| = 30 \text{ and } 
\forall s \in S, s \text{ is a child and } s \text{ is organized}]
\]
c. Paraphrase: *tleetiin walad mnazzm-iin* denotes a predicate which is true of individuals that is organized, and partitioned to thirty, each partition is a child.

Verbs, too, can be straightforwardly accounted for: Either copy of the noun can be interpreted. Supposing that depending on which of the copies of the noun is interpreted, the verb will compose either with the NP *walad* 'child' alone, and be non-plural marked and interpreted distributively; or the verb will compose with the entire *tleetiin walad* 'thirty child-Ø', and be plural marked and interpreted collectively. The derivation for the collective interpretation is given in (270), and the derivation for the distributive interpretation is given in (271). For simplicity of the composition, I assume that when the noun is interpreted in its low position, the high copy of the noun only denotes an always true predicate, as illustrated in (269d). I also assume that there is a generalized quantifier $D$ composing the DP with the verb.

269. a. \([\text{walad}] = \lambda x. x \text{ is a child}\)

b. \([\text{akal aaleb gateau}] = \lambda x. x \text{ ate a cake}\)

c. \([\text{tleetiin walad}] = \lambda x. \exists_S \left[ \pi(S)(x) \text{ and } |S| = 30 \text{ and } \forall s \in S s \text{ is a child} \right]\)

d. \([\emptyset_{\text{pred}}] = \lambda x. 1\)

e. \([\text{tleetiin } \emptyset_{\text{pred}}] = \lambda x. \exists_S \left[ \pi(S)(x) \text{ and } |S| = 30 \right]\)

f. \([D] = \lambda P. \lambda Q. \exists x P(x) \text{ and } Q(x)\)
270. a. $[[\mathcal{D}\text{tleetiin walad akal-uu aaleb gateau}]]$

thirty boy ate-pl pie cake

$= [[\mathcal{D}]]( [[\text{tleetiin walad}]]( [[\text{akal aaleb gateau}]]))$

$= [[\lambda P. \lambda Q. \exists x P(x) \text{ and } Q(x) \ (\lambda y. \exists S_{\text{set}}[\pi(S)(y) \text{ and } |S|=30 \text{ and } \forall s \in S s \text{ is a child}])] \ ( [[\lambda x. x \text{ ate a cake}]]))$

$= 1 \text{ iff } \exists x \ \exists S_{\text{set}}[\pi(S)(x) \text{ and } |S|=30 \text{ and } \forall s \in S s \text{ is a child}]$ and x ate a cake

b. Paraphrase: 

tleetiin walad akal aaleb gateau is true iff there is a plural individual that, partitioned into 30 parts, each part is a child, and that plural individual ate a cake

271. a. $[[\mathcal{D}\text{tleetiin walad akal aaleb gateau}]]$

thirty boy-∅ ate-∅ pie cake

$= [[\mathcal{D}]]( [[\text{tleetiin } \emptyset_{\text{pred}}]]( [[\text{walad akal aaleb gateau}]]))$

$= [[\lambda P. \lambda Q. \exists x P(x) \text{ and } Q(x)](\lambda y. \exists S_{\text{set}}[\pi(S)(y) \text{ and } |S|=30])] \ ( [[\lambda x. x \text{ is a child and } x \text{ ate a cake}]]))$

$= 1 \text{ iff } \exists x \ \exists S_{\text{set}}[\pi(S)(x) \text{ and } |S|=30 \text{ and } \forall s \in S s \text{ is a child}]$ and x ate a cake

b. Paraphrase: 

tleetiin walad akal aaleb gateau is true iff there is an individual that, partitioned into 30 parts, each part is a child and each part ate a cake
This alternative therefore directly predicts the basic syntactic and semantic observations on adjectives and verbs following transdecimal numerals. Some fairly reasonable stipulations also allow us to predict the uniform agreements on DP-external elements agreeing with the same DP: If the noun is interpreted in its low position, all DP-external elements will be non-plural marked and interpreted as distributive, much like (270) for verbs. If the noun is interpreted in its high position, all DP external elements will be plural marked and interpreted as collective, much like (271) for verbs.

If an adjective merges after the numeral (composing with numeral + noun), as in (267), the higher copy of the noun must be interpreted, and all DP-external elements will be plural marked, and interpreted as collective.

If all adjectives merge modifying the lower copy of the noun, either copy of the noun can be interpreted, and DP external elements maintain the optionality of plural marking and collective interpretation.

3.7.3. Problem with pronouns

While this alternative would nicely account for both verbs and adjectives, it faces a serious problem when it comes to pronouns. Recall that a pronoun whose antecedent is a transdecimal containing DPs can be singular (272) or plural (273), even without any interaction with the VP, as shown in (274)-(275)

272. saʔalt tleetiin Sabi ʕan farD-uh
    asked.1s thirty boy-ø about homework-his
    ‘I asked thirty boys about their homework’

273. saʔalt tleetiin Sabi ʕan farD-on
    asked.1s thirty boy-ø about homework-their
    ‘I asked thirty boys about their homework’
274. nejjaHet ʕeshriin benet ba‘d-ma SellaHet mashuuf-di-ond
passed.1s twenty girl-∅ after graded.1s project-their
(...lli ʕamal-uu-h lawaHd-on)
(...which did-pl-it to-self-their)

‘I passed twenty girls after grading their project (that they did on their own)’
Distributive, collective

275. nejjaHet ʕeshriin benet ba‘d-ma SellaHet mashuuf-di-ah
passed.1s twenty girl-∅ after graded.1s project-her
(...lli ʕamlet-uh lawaHd-ah)
(...which did-∅-it to-self-her)

‘I passed twenty girls after grading their project (that they did on their own)’
Distributive only, no collective

These cases are problematic for a split DP account primarily because pronouns take full DPs as their antecedent, not predicates. Because this is the case, even if the noun is interpreted before the movement, it cannot be the antecedent to a pronoun because it denotes a predicate. So in the structure in (276), the antecedent for the pronoun will always be the DP, which will contain ʕeshriin ‘twenty’, and will therefore be plural. So this alternative would incorrectly predict that (272) and (275) should be ungrammatical, but they are not.
3.7.4. Comparison with the proposed # pluralizer

If we assume my proposal, where of a pluralizing functional element #, which makes the whole DP syntactically plural and makes a collective interpretation available, pronouns present no problem: If the functional projection # is present in a given DP, all pronouns agreeing with this DP with it will be plural marked. If no # is present in a given DP, all pronouns agreeing with this DP will be non-plural marked, thus deriving the facts in (272)-(275). The comparison table in (277) summarizes how this alternative fares with the data compared to my proposal.
<table>
<thead>
<tr>
<th></th>
<th>Property</th>
<th>My proposal: pluralizing # in the DP</th>
<th>Alternative 4: Splitting the DP</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Accounts directly for the fact that non-plural marking on adjectives, verbs, and pronouns, is associated with exclusively distributive interpretation</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>G</td>
<td>Accounts directly for the fact that collective interpretation and plural-marking go together on adjectives, verbs, and pronouns</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>H</td>
<td>Accounts directly for the requirement of uniform agreement on all DP-external elements (verbs and pronouns).</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>I</td>
<td>Accounts directly for the fact that adjectives closer to the noun can be non-plural marked and exclusively distributive, and adjectives farther from the noun can be</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>J</td>
<td>Accounts directly for the fact that in the presence of a plural marked adjective, all DP-external elements must be plural marked, but not vice versa</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>K</td>
<td>Accounts directly for the fact that pronouns as well as verbs can be optionally non-plural marked and interpreted distributively</td>
<td>Yes</td>
<td>No (predicts the opposite)</td>
</tr>
</tbody>
</table>

3.8. Summary

In this chapter, I argued for the proposal that the presence of a numeral in a DP does not automatically entail the availability of a collective reading in that DP, or the formation of a predicate of plural individuals. Rather, it is the presence of a functional projection #, which results in a syntactically plural DP (i.e. one that triggers plural agreement), and which also results in the formation of a predicate of plural individuals, thus making a collective interpretation available.
I argued against four possible alternatives to my proposal, and showed that while each of these alternatives fails to account for some of the data, my proposal straightforwardly accounts for all the data concerning transdecimal numerals.

Noting that my proposal requires numerals to go through a mediating structure to merge with the DP (either #, or Q, as in (278)), rather than merging directly with it (279), I propose that one of the possible merger sites for numerals, and thus one of the possible mediating functional projections for numerals is #, a pluralizing function which triggers plural agreement and creates prediates of pluralities, making collective readings possible. In the absence of #, no plural agreement is triggered, and no collective reading is possible.

278. [[Functional item or Determiner] Numeral] [Noun]
   (Present work, Zabbal 2005)

279. [Determiner] [ Numeral [Noun]]
   (Ionin and Matushansky 2006)

In the next chapter, I show the details of this proposal, illustrating how numerals compose with the rest of the DP. I provide a more explicit semantics of # and the composition of the numeral with the DP. I look at four semantic treatments of numerals, and argue for one that gives numerals the least semantic content, leaving them arguments to other functions rather than being functions themselves.
Chapter 4.   Boys eating cakes: semantics of numerals in DPs

4.1.   Details of the semantic proposal: numerals merge in two places

As the evidence in the previous chapter shows, numerals neither necessarily result in a syntactically plural structure which triggers plural agreement on adjectives, verbs and pronouns, nor always allow a collective interpretation. I therefore propose that numerals do not compose directly with nouns as in (281). Rather, they require a mediating function to compose with them, like the schema in (280). Depending on the function that mediates between the numeral and the rest of the DP, numerals then appear to behave either like determiners or like modifiers, although they are neither in and of themselves.

280.  a.  ( (Functional item or Determiner + Numeral) + Noun)   or

       b.  ( Numeral + (Functional item or Determiner + Noun))

       (present work, Link 1998: 105,
        Zabbal 2005:38, inter alia)

281.  (Determiner    (Numeral +    Noun ))

       (Ionin and Matushansky 2006:, 2011:1,
        also assumed in Partee 1986 inter alia)

I assume, now, a formal language consisting of three types: e, t, and n where e is the type of individuals, t that of truth-values defined over {0, 1}, and n is the type of numerals, defined over the set \( \mathbb{N} \) of natural numbers, and I take numerals to be of type n, denoting elements from the set of natural numbers (Scha 1981, Zabbal 2005). Scha (1981) regards numerals occurring in the DP as three types, but all of them are formed through composition from the more basic 'numbers', which denote elements from the set of natural numbers. Likewise, Zabbal (2005) treats numerals as their own basic type, with different mediating functional elements resulting in ordinal interpretation and cardinal interpretation. Similarly, Nouwen (2010), in a study on modified numerals, treats numeral
modifiers as degree modifiers, and hence numerals as degrees of type $d$ – a claim which is in essence the same as the claim that numerals are their own type $n$.

An immediate advantage of taking numerals to be arguments rather than functions (modifiers, determiners, predicates, etc.) is that this allows cardinal numerals to occur in more than one position, allowing them to appear either quantificational or modificational depending on where they merge (282). Crucially, if numerals are of type $n$, they can only be arguments to functions that take $n$-type arguments, which also limits the possible places they can occur in. For instance, they cannot compose with just anything (verbs, nouns, etc.)

282. Possible merger sites for cardinal numerals

So I take numerals to enter the DP simply as members of the set of natural numbers, as exemplified in (283).

283. a. $[\text{Three}] = 3$; b. $[\text{Twenty}] = 20$; c. $[\text{hundred}] = 100$;
In chapter 3, I proposed that the lower merger sites of cardinal numerals, #, is such that it makes a collective reading possible. Specifically, I propose that # is a function that creates a predicate of plural individuals, which triggers plural agreement and forms a predicate of plural individuals, making a collective reading possible. In this chapter, I give the semantic details of this proposal, and further argue for numerals as arguments.

The semantics of # is given in (284): it composes with a predicate and returns a predicate of pluralities of a certain size. The order of the composition, I propose, is as illustrated in (285), where numerals merge as specifiers of #.

284. a. $[[\#]] = \lambda P_{et} \cdot \lambda n. \lambda x. e. \exists S_{et} [\pi(S)(x) \text{ and } |S| = n \text{ and } \forall s \in S P(s)]$

b. Paraphrase: # takes a predicate P and a numeral n and returns another predicate which is true of individuals that, partitioned to n, each partition is such that P is true of it

285. D \rightarrow Collective interpretation

\[
\begin{array}{c}
Q \\
# \\
\text{twenty} \\
# \\
\text{Div} \\
N
\end{array}
\]

The semantics proposed for # is in the same spirit of a ‘cardinal operator’ proposed by Zabbal (2005), intended to mediate between numerals and the DP to provide a cardinal meaning to the numeral. The specific denotation is based on Ionin and Matushansky’s
(2006) semantics for numerals as modifiers, which allows me to avoid assuming that all non-plural nouns denote singulars.

As chapter 3 shows, however, cardinal interpretation is not always associated with the formation of a predicate of plurality. In fact, the Lebanese Arabic transdecimal followed by non-plural agreement in (286) is such a case.

286. tleetiin walad akal aaleb gateau
   thirty boy-Ø ate-Ø pie cake
   'thirty boys ate a cake

I propose that in these cases, # is absent, and the numeral merges directly in Q, restricting an existential quantifier. I propose that a complex existential quantifier like that in (287) mediates the composition between the numeral and the rest of the DP.

287. a. \[[\exists_N]\] = \lambda P_{<e,1>}. \lambda n. \lambda Q_{<e,1>}. \exists S. \forall x(x \in S \rightarrow P(x)=1 \land Q(x)=1) \land |S|=n

   b. Paraphrase: Given a predicate P (corresponding to the noun), a numeral n and a predicate Q (corresponding to the verb phrase), there are n individuals x such that P is true of x and Q is true of x. (cf. Hackl, 2001:83 entry for many)

Note that while this looks like a distributive operator, no predicate of plural individuals is formed at any point in the DP derivation. This is unlike a purely distributive operator that composes with (a predicate of) plural individuals, and a verbal predicate, in order to give the distributive interpretation.

Note, also, that definite determiners cannot combine with \( \exists_N \). This predicts that numerals should always behave like modifiers in definite DPs. This is, indeed, the case. As
(288) shows, definite DPs containing transdecimal numerals bar non-plural agreement on the adjectives, verb, and pronouns, and they always allow a collective interpretation\textsuperscript{41}.

288. a. t-tleetiin walad akal-uu/*akal aaleb gateau
\hspace{1cm} the-thirty child-Ø ate-pl/*ate-Ø pie cake
\hspace{1cm} ‘The thirty children together/each ate a whole cake’

\hspace{0.5cm} b. sheft t-tleetiin walad T-Tweel/*T-Tawiil
\hspace{1cm} saw.1s the-thirty child-Ø the-tall-pl/*the-tall-Ø
\hspace{1cm} ‘I saw the thirty tall children’

\hspace{0.5cm} c. xabbaret t-tleetiin waladʕan emm-on/*uh
\hspace{1cm} told.1s the-thirty child-Ø about mother-their/*his
\hspace{1cm} ‘I told the thirty children about their mother’

I assume here as well that the numeral merges in the specifier. The composition in the absence of # is given in (289). This composition gives rise to an exclusively distributive interpretation.

\textsuperscript{41} This is also predicted by the assumption in chapter 2 that definiteness always licenses #, so all definite DPs containing numerals will project # and thus be syntactically plural and allow a collective interpretation.
The two possible merger sites in (282) will therefore be associated with a pluralizing function in one case (#), and with (exclusively distributive) quantification in another ($\exists_N$).\[42\]

---

\[42\] To rule out co-occurrence of two numerals (one in Q as an argument to $\exists_N$ and one in # as an argument to the function #), we can assume that $\exists_N$ can only take as a complement a predicate of non-plural individuals, so not containing #. Another possibility is that the ban on the co-occurrence of two numerals is merely a pragmatic bias. The co-occurrence of two cardinal numerals in Lebanese Arabic, for instance, is not equally bad for all numerals: when the second numeral is a round number that is larger than the first, the DP becomes much more acceptable. Interestingly, insofar as (iii) is acceptable, the first numeral (\textit{xamsiin} ‘fifty’) only admits a distributive interpretation despite the plural agreement on the verb. This is consistent with a structure in which # projects, with \textit{miit} ‘hundred’, and $\exists_N$ also projects, with \textit{xamsiin} ‘fifty’, as in (iv). This discussion remains tentative as even (iii) involves some coercion and rarely occurs naturally (only a handful of genuine google hits return utterances using \textit{xamsuun} \textit{mi\text{"i}a} ‘fifty hundred’, and such examples are hard to get in other languages.

\[i.\] * sabʕ tlat wleed  
\textit{seven} \textit{three} \textit{children}  
\textit{‘seven groups of three children’}

\[ii.\] ?? tlat sabʕ wleed  
\textit{three} \textit{seven} \textit{children}  
\textit{‘three groups of seven children’}
The resulting syntax-semantics mapping of the DP will therefore be as in (290). In the presence of #, a predicate of plural individuals is formed and a collective reading is available. In the absence of #, no predicate of plural individuals is available, and only a distributive reading is available.

290. \[ D \quad Generalized\ quantifier\ or\ Individual \]
\[
<<e,t>,<<e,t>,t>>\ or\ e
\]
\[
Q \quad Generalized\ quantifier\ or\ Predicate
\]
\[
<<e,t>,<<e,t>,t>>\ or\ <e,t>
\]
\[
\{Quantifiers\} \quad # \quad Pred.\ true\ of\ plural\ individuals\ (293)
\]
\[
\{Numerals\} \quad <e,t>
\]
\[
\{Numerals\} \quad Div \quad Predicate\ true\ of\ count\ individuals\ (292)
\]
\[
\{Numerals\} \quad Div \quad Predicate\ true\ of\ count\ individuals\ (292)
\]
\[
\{Classifiers\} \quad N \quad Unspecified\ Predicate\ (291)
\]
\[
<e,t>
\]

291. \[ [N\ apple] ] = \lambda x.\ x\ is\ apple \]

292. \[ [Div\ [N\ apple]\ ] = \lambda x.\ x\ is\ some\ division\ of\ apple \]

\[\]

\[ iii.\ ?\ xamsiin\ miit\ walad\ (akal-uu\ Huut\ keemel)\n\]
\[ fifty\ hundred\ child-\emptyset\ (ate-pl\ whale\ whole)\n\]
\[ 'fifty\ groups\ of\ a\ hundred\ children\ ate\ a\ whole\ whale\n\]
\[ \leftarrow each\ of\ fifty\ groups\ consisting\ of\ a\ 100\ children,\ ate\ a\ whole\ whale\n\]
\[ \leftarrow Collectively,\ fifty\ groups\ of\ a\ hundred\ kids,\ together,\ ate\ a\ whole\ cake\n\]

\[ iv.\ [D\ [Q\ xamsiin\ \exists N\ [\#\ miit\ #\ [Div\ [N\ walad\ ]]]]]\]
293. \[ [\# \text{[div} \begin{array}{c}N \text{apple} \end{array}] ] = \lambda n. \lambda x. x \text{ is an individual with } n\text{-many parts, each of which is a division of apple} \]

The intuition presented here is not very different from Scha’s (1981) proposal about numerals, which assumes elements from the set of natural numbers come into the syntax as they are, and take part in forming the different types of ‘numerals’, which are, in essence either modifier-like (cf. \#) or determiner-like (cf. \(\exists N\)).

4.2. **Accounting for the observed: DPs containing transdecimal numerals**

The observations in (294) and (295) recapitulate the syntactic and semantic facts observed so far, respectively. The discussion in chapter 3 shows how my proposal, where collective interpretation and plural agreement on adjectives, verbs, and pronouns, both come from an optional pluralizing functional projection \# in the DP, accounts for the facts in (294). Now that the semantic proposal is spelled out, I illustrate in this section how the facts in (295) are derived given the proposal I describe. I do this by showing the semantic derivation of one example where plural agreement occurs and collective interpretation is available (i.e. with \#), and one example where plural agreement is absent and no collective interpretation is available (i.e. without \#), for each of verbs, adjectives, and pronouns.

294. a. In the context of a transdecimal numeral, the noun is non plural marked, and adjectives, verbs, and pronouns agreeing with the DP are optionally plural marked.

b. In case of multiple agreeing elements, there are restrictions on the optionality described in (a): all DP-external elements must be uniformly marked, and if any DP-internal element is plural-marked all higher DP-internal elements, and all DP-external elements must also be plural marked.
295. a. When a verb, adjective, or pronoun following a transdecimal containing DP is non plural marked, it only gets a distributive interpretation

b. When a verb, adjective, or pronoun following a transdecimal containing DP is plural marked, it gets the full range of collective and distributive (and even co-distributive) interpretations

4.2.1. VP composition with DPs containing transdecimal numerals

4.2.1.1. VP composition with a DP containing a transdecimal numeral without #

Take, first, a numeral containing DP that triggers no plural agreement and admits no collective interpretation. Assume, as proposed in chapter 4, that # triggers plural agreement on verbs, adjectives, and pronouns agreeing with any fragment containing #. The subject DP in (296) cannot contain #, since it does not trigger plural agreement on the verb akal ate-ø. Without #, no collective interpretation is predicted, and in fact, none is available.

296. Ṣeshriin sabi akal aaleb gateau
twenty boy ate-ø pie cake
← 20 boys each ate a cake
⇽ 20 boys shared a cake’

The semantics I propose in the previous section derives the semantics of this sentence straightforwardly. The structure of the sentence is given in (297), and the compositions are given in (298).
297.

\[
\text{VP} \\
\text{DP} \quad \text{V} \\
<et, t> \quad <e, t> \\
\text{QP} \\
\text{twenty} \quad Q' \\
n \\
\text{Q} \quad \text{DivP} \\
\exists \quad <e, t> \\
<et, n, ett> \\
\text{boy} \\
<e, t>
\]

\text{ate a cake}

298. 

a. \[[\text{twenty}]\] = 20

b. \[[\text{boy}]\] = \(\lambda x. x \text{ is boy}\)

c. \[[[Q']]\] = [[\exists N]]([[\text{boy}]])

\[
= [\lambda N_{et}. \lambda n_{et}. \lambda V_{et}. \exists S. |S|=n & \forall x(x \in S \Rightarrow N(x)=1 & V(x)=1)] (\lambda x. x \text{ is boy})
\]

d. \[[[(QP)]]\] = \[\lambda n_{et}. \lambda V_{et}. \exists S. |S|=n & \forall x(x \in S \Rightarrow x \text{ is a boy} & V(x)=1)] (20)

e. \[[[(VP)]]\] = \[\lambda V_{et}. \exists S. |S|=20 & \forall x(x \in S \Rightarrow x \text{ is a boy} & V(x)=1)] ([[\text{ate a cake}]])

which, after function application, yields:

f. \[[[(VP)]]\] = 1 iff \(\exists S. |S|=20 & \forall x(x \in S \Rightarrow x \text{ is boy} & [[\text{ate a cake}]](x))\)
g. Paraphrase: The sentence *seyshriin sabi akal aaleb gateau* is true iff there are twenty individuals that are each a boy who ate a cake (distributive reading only)

In the absence of #, the semantics of the DP will automatically result in a distributive reading, as no one constituent is formed to simultaneously denote all of the boys in question.

4.2.1.2. **DP-VP composition with #**

To illustrate, now, a numeral containing DP that does contain #, I use a counterpart of (296) in which plural agreement is triggered. Such an example is given in (299).

299. *seyshriin sabi akal-u aaleb gateau*

   twenty    boy    ate-pl    a cake
   ← 20 boys each ate a cake
   ← 20 boys shared a cake'

I have established in chapter 3, based on examples like (296), that (at least transdecimal) numerals cannot, themselves, trigger plural agreement. It is also safe to conclude, given the absence of agreement in (296), that in the absence of a plural marked noun, the noun itself cannot trigger plural agreement. Thus, since plural agreement is triggered on the verb in (299), the DP must contain #. Given the proposed semantics for # as a function that creates a plural individual, the derivation of the DP is as illustrated in (300). # composes with a count noun and with a numeral, resulting in a predicate of plural individuals whose size is the numeral. The detailed compositions are given in (300)-(301).
301. a. $\left[\left[\#\right]\right] = [\lambda P_e \cdot \lambda n \cdot \lambda x_e . \exists S_e [\pi(S)(x) \text{ and } |S| = n \text{ and } \forall s \in S P(s)]](\lambda x. x \text{ is a boy})$

$= \lambda n_n . \lambda x_e . \exists S_e [\pi(S)(x) \text{ and } |S| = n \text{ and } \forall s \in S s \text{ is a boy}]$

b. $\left[\left[\#P\right]\right] = \lambda x_e . \exists S_e [\pi(S)(x) \text{ and } |S| = 20 \text{ and } \forall s \in S s \text{ is a boy}]$

c. $\left[\left[(QP)\right]\right] = [\lambda N_e . \lambda V_e . \exists x N(x)=1 \& V(x)=1] (\lambda x_e . \exists S_e [\pi(S)(x) \text{ and } |S| = 20 \text{ and } \forall s \in S s \text{ is a boy}]$

d. $\left[\left[(VP)\right]\right] = [\lambda V_e . \exists x \exists S_e [\pi(S)(x) \text{ and } |S| = 20 \text{ and } \forall s \in S s \text{ is a boy and } V(x)=1]](\left[[\text{ate a cake}]\right])$

which, after function application, yields:
e. \[ ([\text{VP}]) = 1 \text{ iff } \exists x \exists S_{\text{set}} [\pi(S)(x) \text{ and } |S| = 20 \text{ and } \forall s \in S \text{ s is a boy and } [[\text{ate a cake}]][x] \]

f. Paraphrase: The sentence *Yeshriin sabi akal-uu aaleb gateau* is true iff there is a plural individual that can be partitioned to 30 parts that are each a boy, and the plural individual ate a cake

4.2.1.3. On the collective, co-distributive, and distributive interpretations of [[ate a cake]] and other predicates

I have intentionally left the denotations of the predicates open, in (298f) and (301e), as it remains so far open how exactly, in my proposal, both a distributive and a collective interpretation comes out when a predicate takes a plural individual as an argument, as is the case in (301e). In order to derive these interpretations, I adopt a version of Schwarzschild’s (1996) view on this matter, whereby for a predicate to be true of an individual it must be true of every member of some cover of that individual (the definition is modified to be compatible with the assumption that there are plural individuals, rather than only sets of individuals).

302. C is a cover of an individual A iff:
   a. C is a set of individuals whose minimal parts are all also minimal parts of A (there are no smaller divisions)
   b. Every minimal part of A is a minimal part of some element in C
   c. C has no zero elements (vacuous assumption))

To put it more informally, C must be a set of individuals that are formed from the same atoms as the plural individual we are interested in. This allows a collective
interpretation in the special case where that cover is the singleton set containing that plural individual. Take, for instance, the sentence denoted in (301e). In this example, x is a plural individual that consists of 20 boys, in other words it is the sum of twenty individuals each of which is a boy. Assuming an x, which is the sum of the individuals boy$_1$...boy$_{20}$ as in (303a), for [[ate a cake]] to be true of x, it must be true of every member of some set of individuals that are sums of the individuals boy$_1$...boy$_{20}$, which that the set satisfies the three conditions in (302). Three such sets are given in (303b-d).

303. a. $x = \text{boy}_1 + \text{boy}_2 + \text{boy}_3 + \text{boy}_4 + \text{boy}_5 + \text{boy}_6 + \text{boy}_7 + \text{boy}_8 + \text{boy}_9 + \text{boy}_{10} + \text{boy}_{11} + \\
\text{boy}_{12} + \text{boy}_{13} + \text{boy}_{14} + \text{boy}_{15} + \text{boy}_{16} + \text{boy}_{17} + \text{boy}_{18} + \text{boy}_{19} + \text{boy}_{20}$

b. $C_1 = \{x\}$

c. $C_2 = \{\text{boy}_1 + \text{boy}_2, \text{boy}_3, \text{boy}_4 + \text{boy}_5, \text{boy}_6, \text{boy}_7 + \text{boy}_8 + \text{boy}_9 + \text{boy}_{10}, \text{boy}_{11}, \text{boy}_{12}, \text{boy}_{13}, \\
\text{boy}_{14} + \text{boy}_{15}, \text{boy}_{16}, \text{boy}_{17}, \text{boy}_{18} + \text{boy}_{19} + \text{boy}_{20}\}$

d. $C_3 = \{\text{boy}_1, \text{boy}_2, \text{boy}_3, \text{boy}_4, \text{boy}_5, \text{boy}_6, \text{boy}_7, \text{boy}_8, \text{boy}_9, \text{boy}_{10}, \text{boy}_{11}, \text{boy}_{12}, \text{boy}_{13}, \\
\text{boy}_{14}, \text{boy}_{15}, \text{boy}_{16}, \text{boy}_{17}, \text{boy}_{18}, \text{boy}_{19}, \text{boy}_{20}\}$

If the predicate [[ate a cake]] is true of all members of the set C1 in (303b), which is the singleton set containing only the plural individual x itself, a collective reading arises.

If the predicate is true of all the members of the set C3 in (303d), which is the set containing 20 individuals, each of which is a boy, then the predicate will be true of 20 individuals, and a distributive interpretation arises.

Finally, if the predicate is true of all members of a set resembling C2 in (303c), which is a set of individuals of various sizes, whose size is less than 20 and more than 1 (here, 12), a co-distributive interpretation arises. An example of such a co-distributive interpretation is given by Sauerland (1998:181), where he provides a context in which the sentence in (304a) gets exactly an interpretation like that predicted with C2, described in (304b). The context is quoted in (304c).
304. a. These men weighed 300 lbs

    b. Scenario: There are three men, and two of them together weigh 300 lbs, and a third weighs 300 lbs alone

    c. “A long line of men is waiting in front of two elevators. One elevator has only 300 lbs. capacity, the other one 400 lbs. Your job is to arrange the men in groups such that the two elevators are used as efficiently as possible. So, you have them tell you their exact weights and group them accordingly. Then, the men weighing 300 lbs. stand on the left, the men weighing 400 lbs. stand on the right.” Sauerland (1998:181)

Note that this co-distributive interpretation – while odd – is indeed available as predicted when a predicate following a transdecimal containing DP is plural marked. And it is not available when it is non-plural marked. Suppose there are 30 kids, divided into small groups (say 5 kids each), and each group was given a cake. If some groups finished their cake, and others didn’t, such that exactly twenty kids belong to groups that finished their cakes, (305a) is true, but (305b) is false. (305b) requires that each kid have eaten a whole cake.

305. a. Ṣeshriin  walad akal-uu aaleb gateau keemel
twenty  child    ate-pl pie cake whole
‘twenty children ate a whole cake’

    b. Ṣeshriin  walad akal aaleb gateau keemel
twenty  child    ate-Ø pie cake whole
‘twenty children each ate a whole cake’
I take this to be the source of the collective/distributive ambiguity for all plural marked predicates (verbs, adjectives, etc.) after DPs containing transdecimal numerals. To avoid cluttering the denotations, I will not include this component for every single predicate in my calculations, but when I say in the metalanguage “x ate a cake” or “x is organized”, what is meant is “there is a cover of x such that every member of that cover ate a cake”, and “there is a cover of x such that every member of that cover is organized”, thus allowing various options of distributivity, collectivity, and co-distributivity whenever the individual x is plural, and vacuously only a one interpretation whenever the individual x is non-plural.

I refrain from following Kratzer (2008) and in assuming an inherent *-operator on the DP to derive the various interpretation because her account follows Krifka (1992) in assuming that all predicates are inherently plural, and thus all allow collective interpretation with no additional apparatus, but as the fact in (305b) shows, the lack of collective interpretation is associated with the lack of marking, and as the evidence in chapter 3’s sections 3.4-3.6 show, the categorical absence of collective and co-distributive interpretation is not due to the presence of a distributor anywhere in the derivation.

4.2.2. Noun-Adjective composition

4.2.2.1. Adjectives without #

Moving now to adjectives, I illustrate the composition of adjectives with nouns in a numeral containing DP that lacks #. The structure given in (307) is that of the sentence in (306), which does not contain #. The absence of # is evidenced by the lack of plural marking on adjective and the verb. The semantic composition is given in (308)-(309).

306. ʕeshriin bent mnazzameh wesslet
twenty girl organized-Ø arrived-Ø
‘twenty organized girls arrived’
307. \[
\begin{array}{c}
\text{VP} \\
\text{DP} \\
\text{QP} \\
\text{twenty} \\
\text{n} \\
\text{Q'} \\
\text{Q} \\
\exists_N \\
\text{organized} \\
\text{DivP} \\
\text{girl} \end{array}
\]

308. a. $[[\text{girl}]] = \lambda x. \ x \text{ is a girl}$

   b. $[[\text{organized}]] = \lambda P. \lambda x. \ P(x)=1 \text{ and } x \text{ is organized}$

   c. $[[\text{twenty}]] = 20$

   d. $[[\text{arrived}]] = \lambda x. \ x \text{ arrived}$

   e. $[[ \exists_N ]] = \lambda P_{<e,t>}. \lambda n. \lambda Q_{<e,t>}. \ \exists S. \ \forall x (x \in S \rightarrow P(x)=1 \ \& \ Q(x)=1) \ \& \ |S|=n$
309. a. \([\exists_N \text{twenty girl organized-ø]} = [\{D_E\} (\{\text{organized-ø girl}\}\}) (\{\text{twenty}\}]\) \\

\[= [\lambda P_{<e,t>}. \lambda n. \lambda Q_{<e,t>} . \exists S . \forall x (x \in S \rightarrow P(x)=1 \& Q(x)=1) \& |S|=n]\\
\]

\[= \lambda Q_{<e,t>}. \exists S . \forall x (x \in S \rightarrow x \text{ is organized and } x \text{ is a girl } & Q(x)=1) \& |S|=20\]

b. **Paraphrase:** Given a predicate, there are twenty individuals that are each a girl each is organized, and the predicate is true of each of them.

310. a. \([\exists_N \text{twenty girl organized-ø arrived-ø]} = [\lambda Q_{<e,t>}. \exists S . \forall x (x \in S \rightarrow x \text{ is organized and } x \text{ is a girl } & Q(x)=1) \& |S|=20] (\lambda x. x \text{ arrived})\]

\[= 1 \text{ iff: } \exists S . \forall x (x \in S \rightarrow x \text{ is organized and } x \text{ is a girl } & x \text{ arrived}) \& |S|=20\]

b. **Paraphrase:** *twenty girl-ø organized-ø arrived-ø* is true iff there are twenty individuals that are each a girl and each arrived.

4.2.2.2. **Adjectives with #**

4.2.2.2.1. **Adjectives merging above #**

In the presence of #, if the adjective merges above #, it is plural marked and admits a collective interpretation (and even favors the collective interpretation). One example is given in (311), its structure is given in (312), and the semantic composition deriving the interpretation is given in (313)-(314).
311. Šeshriin bent mnazzam-iin wessl-u
   twenty girl organized-pl arrived-pl
   ‘Twenty organized girls arrived’ or ‘An organized twenty girls arrived’

312. 

\[
\begin{array}{c}
<e,t> \\
\text{organized} \\
<<e,t>,<e,t>> \\
\text{twenty} \\
n \\
\# \\
\text{DivP} \\
<<e,t>,<n,<e,t>>> \\
girl \\
<e,t>
\end{array}
\]

313. a. \([[\text{girl}]] = \lambda x. \text{x is a girl}

b. \([[\text{twenty}]] = 20

c. \([[\text{organized}]] = \lambda P. \lambda x. P(x)=1 \text{ and } x \text{ is organized}

d. \([[\#]] = \lambda P_{et}. \lambda n. \lambda x_e . \exists S_{et} [\pi(S)(x) \text{ and } |S| = n \text{ and } \forall s \in S P(s)]

Note, importantly, that in (313c), when I put in the denotation of organized the metalanguage fragment “x is organized”, this is shorthand for “there is a set C such that C is a cover of x, and every member of C is organized”. In other words, adjectives, like verbs, and like any other predicates, are taken to be true of a plural individual when they are true of all members of some cover of that plural individual, as discussed in more detail in section 4.2.1.3. Along the same lines, whenever I say that an adjective has a collective
interpretation, what is meant is that a collective interpretation is available, as are co-distributive and distributive interpretations.

314. a. \([\text{twenty } \# \text{ girl organized-pl}]\)

\[
= \left[ \text{organized} \right] \left[ \text{twenty} \right] \left[ \text{girl} \right]
\]

\[
= \left[ \lambda P. \lambda x. P(x) = 1 \text{ and } x \text{ is organized} \right] \left( \lambda P_{\text{et}}. \lambda n. \lambda x_e. \exists S \pi(S)(x) \text{ and } |S| = n \text{ and } \forall s \in S P(s) \right) \left( \lambda x. x \text{ is a girl} \right)
\]

\[
= \lambda x. \exists S \pi(S)(x) \text{ and } |S| = 20 \text{ and } \forall s \in S s \text{ is a girl and } x \text{ is organized}
\]

b. Paraphrase: Given an individual, \textbf{twenty }\#\textbf{ girl organized-pl} is true of that individual if that individual can be partitioned to twenty parts, such that each part is a girl, and that individual is organized

\[\rightarrow \text{Collective interpretation}\]

\[\textbf{4.2.2.2.1. Two adjectives merging above and below }\#\]

Finally, I show the calculations for when two adjectives merge, one that is plural marked and another that is non plural marked. Taking the DP in (315): with one adjective plural marked and the other not, within the proposed account, the structure would be as in (316), where zakiyyeh ‘smart-\(\text{-}\text{F-\(\emptyset\)}\) merges below the pluralizer \#, and mnazzam-iin ‘organized-pl’ merges above \#. The order of composition is therefore such that zakiyy-\(\text{-}\text{F-\(\emptyset\)}\) ‘smart-\(\text{-}\text{F-\(\emptyset\)}\) composes with benet ‘girl-\(\emptyset\)’ directly, then \# composes with all of benet zakiyy-\(\text{-}\text{F-\(\emptyset\)}\) ‘girl-\(\emptyset\) smart-\(\text{-}\text{F-\(\emptyset\)}\), making it plural, and then the whole thing composes with \(\text{feshriin ‘twenty’}\). Finally, mnazzam-iin ‘organized-pl’ composes with the whole \#P, resulting in a collective interpretation.
315. šeshriin  benet  zakiyy-eh  mnazzam-ii
   twenty  girl-∅  smart-f-∅  organized-pl

316.  
   \[ \text{organized-pl} \quad \#P \]

   twenty

   \[ n \quad \# \]

   \[ <<e,t>,<n,e,t>> \quad \text{smart} \quad \text{DivP} \]

   \[ <<e,t>,<e,t>> \quad <e,t> \]

   \[ \text{girl} \]

   \[ <e,t> \]

317. a. \[[\text{smart-∅}]\] = \[[\text{smart-pl}]\] = \(\lambda P.\lambda x. P(x)\) and \(x\) is smart

   b. \[[\text{organized-pl}]\] = \[[\text{organized-∅}]\] = \(\lambda P.\lambda x. P(x)\) and \(x\) is organized

318. a. \[[ \text{organized twenty # smart girl} ]\]

   = \[[\text{organized}] \quad (\#)([\text{smart}][[\text{girl}]])([[\text{twenty}]])

   = [\lambda P.\lambda x. P(x)=1 \text{ and } x \text{ is organized}] \quad (\lambda P_{et}.\lambda n,\lambda x_{e}. \exists_S \pi(S)(x)

   \text{and } |S|=n \text{ and } \forall s \in S P(s)[\lambda P.\lambda x. P(x)=1 \text{ and } x \text{ is smart}] \lambda x. x \text{ is a girl} (20))

   = \lambda x. \exists_S \pi(S)(x) \text{ and } |S|=20 \text{ and } \forall s \in S s \text{ is a girl and } s \text{ is smart}

   \text{and } x \text{ is organized}
b. **Paraphrase:** Given an individual, *yeshrīn bennet zakīyy-eh mnazzam-iin* is true of that individual if that individual can be partitioned to 20 parts such that each part is a girl and each part is smart, and that plural individual is organized

→ distributive interpretation for smart, collective for organized

### 4.2.3. Deriving pronouns

I will assume that pronouns in sentences like (319) involve movement of the DP *xamstāfshar bennet* ‘fifteen’ girls, as in (320). Making the basic assumptions on denotations in (321), and assuming the predicate abstraction rule from Heim and Kratzer (1998:186) in (322), the denotation of the predicate composing with the moved DP is computed in (323). What remains, after this, is to show the difference of the DP with and without #, and how that affects the outcome when composing with this predicate. This is what sections 4.2.3.1 and 4.2.3.2 do for DPs containing #, and DPs not containing #, respectively.

319. Hanna sa?al xamstāfshar bennet ʕan mashrouʃ-ah
John asked fifteen girl about project-her
320.

321. a. I assume: \([\text{[Mary's project]}] = [\text{[the project of Mary]}]\)

b. \([\text{[asked]}] = \lambda x. \lambda y. \lambda z. \text{asked } x \text{ about } y\)

c. \([\text{[project]}] = \lambda x. \lambda y. y \text{ is } x\text{'s project}\)

d. \([\text{[the]}] = \lambda f. \text{i.e. } f(x)=1\)

322. “Predicate Abstraction Rule:

Let A be a branching node with daughters B and C, where B dominates only a numerical index i. Then, for any variable assignment a, \([A]^a = \lambda x. [C]^{a_{x/i}}\)

(Heim and Kratzer, 1998:186)
So for any variable assignment a:

\[
\lambda x. [[[\text{John asked } t_1 \text{ about her}_1 \text{ project}]]^a[1^x]]
\]

323.

\[
\begin{array}{c}
\text{S} \\
\text{DP} & \text{VP} \\
\text{john} \\
\text{V} & \text{PP} \\
\text{V} & \text{DP} & \text{P} & \text{DP} \\
\text{asked} & t_1 & \text{about} & \text{the} & \text{project of her}_1
\end{array}
\]

= \lambda x. [[[\text{asked } t_1 ]]^{[1^x]} ] ( [[[\text{about the project of her}_1 ]]^{[1^x]} ] ) (\text{John})

= \lambda x. [ [[[\text{asked} ]] ( [[[t_1 ]]^{[1^x]} ] ) ( [[[\text{the} ]] ( [[[\text{project of} ]] ( [[[\text{her}_1 ]]^{[1^x]} ] ) ) ) ) ] (\text{John})

= \lambda x. [ [[[\text{asked} ]] ( x ) ] ( [[[\text{the} ]] ( [[[\text{project of} ]] ( x ) ) ) ) ] (\text{John}) \quad \text{Variable Replacement}

= \lambda x. [ [[[\lambda h. \lambda i. \lambda j. \text{asked } h \text{ about } i ]] ( x ) ] ( [[[\lambda f. \text{if} (k)=1 ] ( \lambda y. \text{y is } x's \text{ project} ) ] ) (\text{John})

= \lambda x. [ [[[\lambda h. \lambda i. \lambda j. \text{asked } h \text{ about } i ]] ( x ) ] ( \text{if} k \text{ is } x's \text{ project} ) ] (\text{John})

= \lambda x. \text{John asked } x \text{ about } x's \text{ project}

b. Paraphrase: Given an individual, John asked that individual about that individual's project

4.2.3.1. Deriving pronouns with #

Taking the sentence in (324), and assuming the account proposed in chapter 3 and section 4.1.1, we know that the DP \textit{xamsta'ishar benet} 'fifteen girl' contains #, because
plural marking is triggered on the pronoun -un 'their'. The structure, then, will be as in (325), where the DP moves out.

324. Hanna saʔal xamstaʔshar benet ŋan mashrouf-un

John asked fifteen girl about project-their

‘John asked fifteen girls about their project(s)’

325.

\[
\begin{array}{c}
\text{John asked fifteen girls about their project(s)}
\end{array}
\]

326. a. \([\mathcal{D}] = \lambda P. \lambda Q. \exists x P(x) Q(x)\)

b. \([\#] = \lambda p \cdot \lambda n. \lambda x. \exists S \in [\pi(S)(x) \text{ and } |S| = n \text{ and } \forall s \in S P(s)]\)

c. \([\text{fifteen}] = 15\)

d. \([\text{girl}] = \lambda x. x \text{ is a girl}\)
Filling in the denotations from (327) and (323), and after function application the sentence in (325) gets the following interpretation.
329. a. \[([[325]]) = 1 \quad \text{iff} \quad \exists x, \exists S. [\pi(S)(x) \text{ and } |S| = 15 \text{ and } \forall s \in S \text{ s is a girl and John asked } x \text{ about } x's \text{ project}]

b. **Paraphrase:** The sentence *Hanna saʔal xamstaʔshar benet ñan mashrouf-un* is true if and only if there is a plural individual which, divided to 15, each part is a girl, and John asked that plural individual about its project

### 4.2.3.2. Deriving pronouns without #

I now look at the cases of sentences containing DPs with transdecimal numerals, but without #, i.e. where the pronoun is non-plural marked, like the sentence in (330). Like, (324), I assume the structure for this sentence is that in (331).

330. *Hanna saʔal xamstaʔshar benet ñan mashrouf-ah*

John asked fifteen girl about project-*her*

‘John asked each of fifteen girls about her project’
331.  
\[
\begin{array}{c}
\text{fifteen} \\
\exists_n \text{DP VP} \\
\text{girl} & \text{john} \\
\text{asked} & \text{t}_1 & \text{about} \\
\text{the} & \\
\text{project of her}_1
\end{array}
\]

332. a. \([\exists_n] = \lambda P_{<e,t>}. \lambda n. \lambda Q_{<e,t>}. \exists S. \forall x(x \in S \rightarrow P(x)=1 & Q(x)=1) & |S|=n\)

b. \([[\text{girl}]] = \lambda x. x \text{ is a girl}\)

c. \([[\text{fifteen}]] = 15\)

333.  
\[
\begin{array}{c}
\text{DP} \\
\text{fifteen} \\
\exists_n \text{girl} \\
= [[\exists_n]] [[[[\text{girl}]]] [[[\text{fifteen}]]]] \\
= \lambda Q_{<e,t>} . \exists S. \forall x(x \in S \rightarrow x \text{ is a girl} & Q(x)) & |S|=15
\end{array}
\]
334. a. \([[[331]]] = \)

\[
\begin{array}{c}
\text{DP} \\
\text{fifteen} \\
\exists_N \\
\text{girl}
\end{array}
\]

\[
\begin{array}{c}
1 \\
S
\end{array}
\]

\[
\begin{array}{c}
\text{DP} \\
\text{VP}
\end{array}
\]

\[
\begin{array}{c}
\text{john} \\
V \\
PP
\end{array}
\]

\[
\begin{array}{c}
V \\
\text{DP} \\
P \\
\text{DP}
\end{array}
\]

\[
\begin{array}{c}
\text{asked} \\
t_1 \\
\text{about}
\end{array}
\]

\[
\begin{array}{c}
\text{the} \\
\text{project of her}_1
\end{array}
\]

\[
[\lambda_{Q_{<t_1>}} \exists S. \forall x(x \in S \rightarrow x \text{ is a girl} \& Q(x)) \& |S|=15] (\lambda x. \text{John asked } x \text{ about } x's \text{ project})
\]

\[
= 1 \text{ iff } \exists S. \forall x(x \in S \rightarrow x \text{ is a girl} \& \text{John asked } x \text{ about } x's \text{ project}) \& |S|=15
\]

b. **Paraphrase:** There are fifteen individuals that are girls and John asked each of these individuals about her project

Filling in the denotations from (333) and (323) into (334), and after function application the sentence in (330) gets the exclusively distributive interpretation, where there are fifteen individuals that are girls and John asked each of these individuals about her project.
4.3. What numerals are: determiners, modifiers, predicates, or just numerals

As I have shown in chapter 3, numerals do not always allow a collective interpretation, and I argue that in the cases in which they don’t a predicate of plural individuals is never formed in the DP, because a distributive operator cannot be at play (sections 3.4, 3.5, and 3.6). Numerals also do not always involve existential quantification, as they may occur with definite determiners, which would otherwise be incompatible with existential quantification (335). I therefore assume for numerals a denotation that is independent both of pluralization and of quantification, and use it in the proposal described in section 4.1. In this section, I discuss alternative views on the semantics of numerals. I argue that because these alternatives build quantification and/or plurality into the semantics of numerals, they all either make the wrong predictions for Lebanese Arabic numerals, or they require much additional apparatus to accommodate it.

335. The three boys
   *the there is a boy

Several proposals have been posited to treat numerals as having usual semantic types: numerals have been viewed as determiners of type $<<e,t>,<<e,t>,t>>$ (van der Does 1993, Barwise and Cooper 1981), as modifiers of type $<<e,t>,<e,t>>$ (Ionin and Matushansky 2006, Landman 2000, Link 1998, inter alia), and as predicates of type $<e,t>$ (Partee, 1986). I briefly review some of these views below, and present some of objections to them, comparing each to the proposal that numerals enter syntax as objects of type $n$ (present work, Zabbal 2005, Scha 1981).

4.3.1. Numerals as determiners

One view of numerals treats them as determiners. Scha (1981) defines certain determiners that are formed by composing numerals with other functions, as do I in section 4.1. But others (e.g. Montague 1973, Bennett 1974, van der Does 1993) have
treated numerals, themselves, as determiners of type \(<e,t>,<<e,t>,t>\) that take predicates (nouns) and return generalized quantifiers of type \(<e,t>,t>\). Link (1998) argues against this proposal. He shows that determiners like any can precede numerals, but numerals cannot do the same. Moreover, assuming numerals to be determiners of type \(<e,t>,<<e,t>,t>\) builds existential quantification into the meaning of the numeral itself. But as illustrated in (336), the presence of a numeral in a DP does not always entail existential quantification: In the scope of another quantifier, in cases of negation, and following certain modifiers like at most, existential quantification is not necessary, and even inappropriate.

336. a. No three men have ever defeated an army
   Compatible with a situation in which there are no men

   b. Any three men will be acceptable
   Compatible with a situation in which there are no men

   c. I have not seen three men
   Compatible with a situation in which I have seen no men

   d. At most three men are left in the house (Link 1998)
   Compatible with a situation in which there are no men left in the house

If numerals are assumed to come into the DP as arguments to other functions that mediate their interaction with the rest of the DP, as proposed in section 4.1, all positions for numerals are predicted to be possible, including quantificational ones (through the mediating function \(\exists_n\)) and modificational ones (through the mediating function \#). I illustrate how this works for (336a).
337. Possible merger sites for cardinal numerals

The structure for (336a), repeated in (338a), is given in (338b), and the semantic derivation given an account treating *three* as a type *n* numeral is given in (338c-d). As this example illustrates, this account has no trouble dealing with the counter-examples militating against treating numerals as determiners.
338. a. No three men have ever defeated an army

b.\[ \lambda P. \lambda Q. [\forall x. P(x) \rightarrow \neg Q(x)] \]

c. \[
\llbracket \text{No three men} \rrbracket = \left[ \lambda P. \lambda Q. [\forall x. P(x) \rightarrow \neg Q(x)] \right] \left[ \lambda P_{et}. \lambda n_{n}. \lambda x_{e}. \exists S_{et} \left[ \pi(S)(x) \right. \right.
\left. \text{and } |S| = n \text{ and } \forall s \in S \ P(s) \left] \right] (3) \\
= \lambda Q. \exists x. \exists S_{et} \left[ \pi(S)(x) \text{ and } |S| = 3 \text{ and } \forall s \in S \ s \text{ is men} \right) \rightarrow \neg Q(x)\]

d. \[
\llbracket \text{No three men defeated an army} \rrbracket = \llbracket \text{No three men} \rrbracket \left[ \text{[defeated an army]} \right] \\
= 1 \text{ iff } \exists x. \exists S_{et} \left[ \pi(S)(x) \right. \text{ and } |S| = 3 \text{ and } \forall s \in S \ s \text{ is men} \left] \rightarrow \neg \text{ it is not the case that } x \text{ defeated an army} \right.
\]

e. Paraphrase: Given a predicate (here, defeated an army), for any three men, it is not the case that that predicate is true of that

Moreover, the quantifier-like behavior of numerals can also be derived with my account, using a numerized existential like \( \exists_N \) (287) or even using a combination of \# and \( \mathcal{D} \) in (326a). In fact, that is exactly what happens in examples like that given (296), and
derived in (297) and (298) in section 4.2.1.1, where I show how my proposal derives the semantics of a DP which contains a numeral but lacks the function #.

So while treating numerals as determiners is inconsistent with some occurrences of numerals, my proposal is consistent with both quantifier-like and modifier-like behaviors of numerals.

4.3.2. Numerals as modifiers

Ionin and Matushansky (2004, 2006) argue that all numerals are intrinsically pluralizing modifiers of type \(<<e,t>,<e,t>>\). Their denotation of a simple numeral is given in (339). With this denotation for simple numerals, they form complex numerals in a cascading structure within the DP as in (340), similarly to stacked adjectives.

339. a. \([\text{[two]}] = \lambda P_{et}. \lambda x_{et}. \exists S_{et} [ \pi(S)(x) \text{ and } |S| = 2 \text{ and } \forall s \in S P(s) ] \)

b. **Paraphrase:** ‘two’ takes a predicate \(P\), and returns another predicate which is true of individuals that, partitioned to two, each partition is such that \(P\) is true of it

340.

```
  two
 / \      \\
<<e,t>,<e,t>> hundert / \\
   / \\
<<e,t>,<e,t>> boys
   / \\
<<e,t>,<e,t>>
   / \\
<e,t>```

a. \[\text{[[two hundred boys]]} = \text{[[two]] ( [[ hundred]] ( [[boys]]))}\]

\[\lambda x. \exists S_\text{et} \; [\pi(S')(x) \text{ and } |S'| = 2 \text{ and } \forall s' \in S' \; \exists S_\text{et} \; [\pi(S)(s') \text{ and } |S| = 100 \text{ and } \forall s \in S \; [[\text{boys}]](s)]]\]

b. **Paraphrase:** Given an individual \(x\), there is a partition of \(x\) into two individuals, each of which can be partitioned into 100 individuals, each of which is a boy.

Numerals have received other treatments as modifiers: Partee (1986) treats numerals as predicates that type shift to modifiers, which then compose with nouns like adjectives do (more on Partee 1986 in section 4.2.3). Along the same lines, Landman (2000) argues that all indefinite DPs are predicates of type \(<\text{e, t}>\), requiring numerals to be adjectival. Link (1998:101-107) proposes that numerals are either adjectives, or modifiers merging in a Num head, from which they can move to compose with the determiner. Likewise, Zweig (2005) treats numerals as either adjectival or nominal i.e. as modifiers of nouns, or as predicates in and of themselves.

\[\text{NP} \; \text{[Det' D The Num three]} \; \text{[N' Numø \; [N' \text{ Adj surviving Nmen}]]}\]

In all proposals treating numerals as modifiers, numerals are taken either to operate on predicates of plural individuals (e.g. Link 1998), or to result in the formation of a predicate of plural individuals (Ionin and Matushansky, 2006). This means that they all predict that numeral containing DPs will behave like what one would typically expect of a syntactically and semantically plural DP: allowing collective interpretation.

To illustrate, I show the outcome for Lebanese Arabic transdecimal numerals if they are given Ionin and Matushansky's (2006) semantics of numerals. Given the denotation of ëeshriin 'twenty' in (343), regardless of the marking on the noun, the denotation of ëeshriin sabi 'twenty boy-ø' would be that in (344). Consequently, regardless of any agreement on
the verb, in the absence of a distributor, the interpretation of both of the sentences in (346a-b) will always allow a collective interpretation, as illustrated in (345), because the argument of [[ate a whole cake]] will be a plural individual, and the same predictions the proposal makes for (347) and (346b) will be made for (346a).

343. Cardinal numeral šeshriin ‘twenty’ as a modifier (Ionin and Matushansky, 2006):

\[ [[\text{twenty}]] = \lambda P_{et} \cdot \lambda x_e \cdot \exists S_{et} \left[ \pi(S)(x) \text{ and } |S| = 20 \text{ and } \forall s \in S P(s) \right] \]

344. a. \[ [[\text{twenty boy-ø}]] = [\lambda P. \lambda x. \exists S \left[ \pi(S)(x) \text{ and } |S| = 20 \text{ and } \forall s \in S P(s) \right]](\lambda y. y \text{ is a boy}) \]

\[ = \lambda x. \exists S \left[ \pi(S)(x) \text{ and } |S| = 20 \text{ and } \forall s \in S \left[ \lambda y. y \text{ is a boy} \right](s) \right] \]

\[ = \lambda x. \exists S \left[ \pi(S)(x) \text{ and } |S| = 20 \text{ and } \forall s \in S s \text{ is a boy} \right] \]

b. **Paraphrase:** Given an individual \( x \), \( x \) is a plural individual that, partitioned into 20 parts, each part is a boy

345. a. \[ [[\text{twenty boys ate cake whole}]] = 1 \text{ iff } \exists x: \exists S \left[ \pi(S)(x) \text{ and } |S| = 20 \text{ and } \forall s \in S s \text{ is a boy} \right] \text{ and } [[\text{ate-ø a whole cake}]](x) \]

b. **Paraphrase:** šeshriin sabi akal aaleb gateau keemel is true iff there is an individual \( x \) such that \( x \) can be partitioned into 20 parts each of which is a boy, and \( x \) ate a whole cake

But as know from chapter 3, some numeral containing DPs, like (347a), do not allow a collective interpretation (346a). This contrasts with other plural DPs in the language, which typically allow collective interpretations (347). And as I have shown in chapter 3 (section 3.4-3.6), positing an obligatory distributive operator would not be possible in order to account for the other restrictions associated with the non-plural agreement.
Rather, it must be that in cases like (346a), the DP itself does not provide a plural individual, thus barring a collective interpretation.

346. a. ʕeshriin sabi akal gateau keemel
twenty boy-∅ ate-∅ cake whole
← 20 boys each ate a cake
← 20 boys shared a cake

b. ʕeshriin sabi akal-uu gateau keemel
twenty boy-∅ ate-pl cake whole
← 20 boys each ate a cake
← 20 boys shared a cake

347. s-sebyeen akal-uu/*akal gateau keemel
the-boy-pl ate-pl/*ate-∅ cake whole
← The boys each ate a cake
← The boys shared a cake

Recall from sections 4.2.1.1 and 4.2.2.1 that my proposal correctly rules out the collective interpretation in cases like (346a): whenever no plural marking appears on a predicate, it is agreeing with a DP that lacks #. With #—a function necessary for the formation of a plural individual in numeral containing DPs—as absent, collective interpretation is not possible. In contrast, treating numerals as modifiers predicts that a collective interpretation will always be possible for sentences like (346a), which does not match the empirical evidence.
4.3.3. Numerals as predicates

Finally, let us look at the predictions of treating numerals as predicates. Partee (1986) proposes that numerals like *three* are <e,t> adjectives meaning ‘exactly three’ that apply to plural individuals as in (348). These can be type-shifted to become <<e,t>,<e,t>> modifiers (e.g. as in (349)), and can acquire determiner-like properties through an operator, $A$ as in (350), and that it is through this type shifting that they acquire their ‘at least’ interpretation (through the existential quantification).

348. a. Basic denotation of a numeral: $[[\text{three}]] = \lambda x. |\text{Atoms}(x)|=3$

   Type: <e,t> (predicate)

   b. $[[\text{three apples}]] = \lambda x. [[\text{three}]](x)$ and $[[\text{apples}]](x)$

   $= \lambda x. |\text{Atoms}(x)|=3$ and $\text{apples}(x)$

349. a. Type-shifting operator turning a predicate into a modifier:

   $[[\text{predicate-to-modifier}]]_{<e,t>,<e,t>,<e,t>,<e,t>}> = \lambda Q. \lambda P. \lambda x. P(x)$ and $Q(x)$

   b. Type-shifting operator composed with the numeral (the predicate *three*)

   $[[\text{predicate-to-modifier}]] ( [[\text{three}]] ) = \lambda P. \lambda x. P(x)$ and $|\text{Atoms}(x)|=3$

   Resulting type: <<e,t>,<e,t>> (modifier)

   c. Type-shifted numeral composed with the noun:

   $[[[\text{predicate-to-modifier}]] ([[\text{three}]] ) ] ([[\text{apples}]] )$

   $= \lambda P. \lambda x. P(x)$ and $|\text{Atoms}(x)|=3$ ([[apples]])

   $= \lambda x. |\text{Atoms}(x)|=3$ and $\text{apples}(x)$
350. a. \([A] = \lambda Q. \lambda P. \exists x [Q(x) \& P(x)] \quad \text{Partee (1986)}

b. \([A] \ (\ [[\text{three}] \ ([\text{apples}])])

\quad = \lambda Q. \lambda P. \exists x [Q(x) \& P(x)] (\lambda x. \ |\text{Atoms}(x)|=3 \& \text{apple}(x))

\quad = \lambda P. \exists x [\ |\text{Atoms}(x)|=3 \& \text{apple}(x) \& P(x)]

While this appears somewhat similar to the composition I describe in section 4.1, in which I derive the determiner-like behavior of numerals, the order of composition in Partee’s proposal is in fact different from mine. In (350b), the numeral does not type-shift into a determiner. Rather, the numeral composes with the noun first, and the resulting predicate of pluralities composes with \(A\) in order to yield an appropriate DP denotation. The order of composition for the numeral, noun, and \(A\) is therefore like that in (351a) (i.e. (281)), not (351b/c) (i.e. (280)).

351. a. \((\ A \ (\ \text{Numeral} \ + \ \text{Noun}))\) ← Partee (1986)

b. \((\ (A + \ \text{Numeral}) \ + \ \text{Noun})\)

c. \((\ \text{Numeral} + \ (A + \ \text{Noun}))\)

While the full composition is not spelled out in Partee (1986), the specific semantics of \(A\) she offers prevents it from composing with the numeral directly: \(A\) is of type 
\(<<e,t>,<<e,t>,t>>\), and composing it with a numeral of type \(<e,t>,\) followed by the noun, which is also of type \(<e,t>,\) would give the DP the denotation of a proposition (type t), as illustrated in (352a), which is not an appropriate denotation for a DP. Also, composing \(A\) with a numeral of type 
\(<<e,t>,<e,t>,\) would result in a type clash, as \(A\)’s first argument must be a predicate of type \(<e,t>,\), and not a modifier of type 
\(<<e,t>,<e,t>,\) (352b). So the only possible order of composition is one where the numeral composes with the noun first, then the whole thing composes with \(A\).
352. a. \[[A] \ (\ [\text{three}] \ ) \ (\ [\text{apples}] \ )\]

\[= [\lambda Q. \lambda P. \exists x \ [Q(x) \ & \ P(x)] \ (\lambda x. |\text{Atoms}(x)|=3)](\lambda x. \text{apple}(x))\]

\[= 1 \text{ iff } \exists x \ |\text{Atoms}(x)|=3 \ & \ \text{apple}(x)\]

b. \[[A] \ (\ [\text{apples}] \ ) \ (\ [\text{three}] \ )\]

\[= [\lambda Q. \lambda P. \exists x \ [Q(x) \ & \ P(x)] \ (\lambda x. \text{apple}(x)) (\lambda x. |\text{Atoms}(x)|=3)]\]

\[= 1 \text{ iff } \exists x \ \text{apple}(x) \ & \ |\text{Atoms}(x)|=3\]

c. *<e,t>, <e,t>, t> X <e,t>, <e,t> A \lambda P. \lambda x. P(x) \text{ and } |\text{Atoms}(x)|=3\]

By definition, predicate-type numerals of the kind in (348a) can only be true of plural individuals since they specify the number of atomic parts. Therefore, since the order of composition to be as it has to be in (351a), and given that the DP containing a numeral will always be expected to allow a collective interpretation: It will always have a denotation like that in (301e), never that of (297e). This is shown in (353).

353. a. \[[A] \ (\ [\text{twenty}] \ ([\text{boys}] \ )) \ ([\text{ate a cake}]\)\]

\[= \lambda Q. \lambda P. \exists x \ [Q(x) \ & \ P(x)] \ (\lambda x. |\text{Atoms}(x)|=20 \ & \ \text{apple}(x))[\text{ate a cake}]\]

\[= \lambda P. \exists x \ [|\text{Atoms}(x)|=20 \ & \ \text{apple}(x) \ & \ P(x)][\text{ate a cake}]\]

\[= 1 \text{ iff } \exists x \ [|\text{Atoms}(x)|=20 \ & \ \text{apple}(x) \ & \ [\text{ate a cake}]\]](x)\]

b. Paraphrase: The sentence three boys ate a cake is true if and only if there is a plural individual with three atomic parts which apple is true of, and this plural individual ate a cake.
This brings up the same problem faced by the alternative treating numerals as modifiers in section 4.3.2: As I have shown in chapter 3, a significant number of numeral containing DPs, like (354), can occur without allowing a collective interpretation. Recall also from chapter 3, the absence of a collective reading cannot be due to the presence of an obligatory distributor that bars both collective reading and plural agreement, as there are many properties of sentences like (354) which are inconsistent with a distributor-based account (cf. sections 3.4-3.6 for a detailed argumentation). This therefore constitutes a problem for the predicate account.

354. ʕeshriin sabi akal aaleb gateau
   twenty boy ate-∅ a cake
   ← 20 boys each ate a cake
   ↔ 20 boys shared a cake'

Like the alternative that treats numerals as modifiers, this alternative treating numerals as predicates would predict that collective interpretation be available in contexts in which it is not available, because it assumes that a DP containing a numeral always contains a predicate of plural individuals. This is something that the proposed alternative, which treats numerals as arguments of type n that take on quantifier-like and modifier-like behaviors based on the function that mediates between the numeral and the DP (∃_N or #), avoids.

4.3.4. Numerals as Predicates (version 2)

Unlike the account treating numerals as modifiers, an account treating numerals as predicates allows for a certain level of freedom due to its use of semantic functions like A, in the derivation. Therefore, such a proposal can be adjusted to account for the facts from Lebanese Arabic. Suppose we change the denotation of the type shifter A to be more like that in (355), and suppose we change the order of composition between the different
components of the DP in the determiner cases to be like that in (351b) or (351c), rather than that in (351a). As it turns out, with those two modifications, we can account for the same range of empirical facts as if we treat numerals as type $n$. The modifications are given in (355).

355. a. $[[A_{new1}]] = \lambda P_{<e,t>}. \lambda R_{<e,t>} . \lambda Q_{<e,t}>. \exists x. R(x) \text{ and } \forall y: y<x \text{ } P(y)=1 \& Q(y)=1$

b. $[[three]] = \lambda x. [|Atoms(x)| = 3 ]$

c. $[[three boys ate a cake]] = [ [ [A_{new1}] ([[three]]) ] ([[boys]]) ([[ate a cake]]) ] = 1 \text{ iff } \exists x. |Atoms(x)| = 3 \text{ and } \forall y: y<x, y \text{ is a boy and } y \text{ ate a cake}$

d. **Paraphrase:** *three boys arrived* is true iff there is an individual $x$ made up of three boys and each boy arrived (distributive interpretation)

356. a. $[[A_{new2}]] = \lambda P_{<e,t>}. \lambda R_{<e,t>} . \lambda Q_{<e,t}>. \exists x. R(x) \text{ and } \forall y: y<x \text{ } P(y)=1 \& Q(y)=1$

b. $[[three]] = \lambda x. [ |Atoms(x)| = 3 ]$

c. $[[three boys ate a cake]] = [ [ [A_{new1}] ([[three]]) ] ([[boys]]) ([[ate a cake]]) ] = 1 \text{ iff } \exists x. |Atoms(x)| = 3 \text{ and } \forall y: y<x, y \text{ is a boy and } x \text{ ate a cake}$

d. **Paraphrase:** *three boys arrived* is true iff there is an individual $x$ made up of three boys and that plural individual ate a cake (collective interpretation)

One slight limitation on this adjustment is that since all three of $A_{new}$'s arguments are predicates, any ordering restrictions among the three will have to be motivated purely syntactically. The semantics, left alone, would allow certain unavailable interpretations.
such as the one in (357). Such derivations would have to be ruled out in the syntax, which can be done with some simple stipulations limiting where numerals may merge.

357. a. ?? [[355]] = 1 iff ∃x boys (x) and ∀y: y<x, |Atoms(y)|=3 and y arrived

b. Paraphrase: three boys arrived is true iff there is an individual x which is a boy, and every atomic part of x is such that it arrived and it is of size three

That said, treating numerals as predicates in the way described in this section and treating them as simply members of the set of natural number in the way described in section 4.1, become very similar, and only some minor differences in the additional apparatus each one imposes to account for the facts remain. For one, the order of the composition would be the same for both alternatives, and there would be a need for a function to result in the modifier-like occurrences of numerals and another for the determiner-like behavior (potentially two in the predicate alternative). The remaining difference is that the semantic functions in the alternative I argue for are syntactically visible: In the presence of #, there is –not only collective interpretation– but also plural marking on the verb, adjective or pronoun. Similarly, in the absence of # there is –not only exclusively distributive interpretation– but also non plural marking on the verb, adjective, or pronoun. The table in (358) summarizes.

<table>
<thead>
<tr>
<th>358.</th>
<th>Correctly rules out collective interpretation when it should be</th>
<th>Rules out bad compositions on its own</th>
<th>Treats numerals ≠ adjectives</th>
<th>The semantic functions are syntactically visible</th>
<th>Does not add a new type to the formal system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numerals are &lt;e,t&gt;</td>
<td>✔</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✔</td>
</tr>
<tr>
<td>Numerals are n</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✗</td>
</tr>
</tbody>
</table>
4.4. Summary

In this chapter, I proposed a specific way of composing numerals with the rest of the DP, in which numerals enter the syntax as type n objects with no syntactic properties of their own, and then compose with functions in order to get both quantificational and existential interpretations without having to posit that all numerals are semantically ambiguous. I showed how this proposal derives the observed semantic facts from chapter 3. And finally, I looked closer at alternative views on the semantics of numerals, and argued for a semantics of numerals in which numerals enter the syntax as natural numbers, having their own type, type n. I reviewed and discussed previous semantic proposals claiming that numerals are intrinsically predicates of type <e,t> (Partee 1986), modifiers of type <<e,t>,<e,t>> (Ionin and Matushansky 2006, Landman 2000, inter alia), or determiners of type <<e,t>,<<e,t>,t>>, pointing out that only a predicate account can be modified to account for the new facts from Arabic, and that such a modification would make it very similar to the present proposal.
Chapter 5. Synthesis and Predictions

5.1. Recap of claims and assumptions

While much of the proposal is built primarily based on data from DPs containing numerals, it makes very specific predictions about numeral-less DPs. In order to explore these predictions, I list all the possible DP structures with and without numerals that can occur given the proposal, and show how they are derived. But first, I summarize all the claims, proposals, and assumptions made so far. The list is given in (359).

359. a. The noun merges into the DP with no syntactic information (e.g. its count/mass status) (assumed, following Borer 2005)

b. Div is a functional projection present in all count DPs, and no mass DPs (assumed, following Borer 2005, Doetjes 1997, inter alia)

c. For a DP to be count, it must contain a classifier or a plural marker (assumed, following Borer 2005, Kratzer 2008)

d. # is an optional functional projection that can occur in a DP, and result in plural agreement on anything that merges after it with the DP (proposed, chapter 3)

e. The semantic function associated with the syntactic functional projection # is that of pluralization: it is a function that takes a predicate and a numeral, and returns a predicate of plural individuals whose size is that numeral (proposed, chapter 4)

f. # is necessary for a collective interpretation of the DP

g. When it merges, # can license an agreement marker on nouns that looks like
plural marking, but which can co-occur with a classifier. I note this marker as $AG#$
(proposed, chapter 2)

h. In order to project, # requires the presence of a numeral, but the presence of a numeral does not automatically entail that # projects: the numeral can merge elsewhere (proposed, chapter 4)

i. Plural marking on nouns, aside from introducing countness by instantiating the dividing functional projection Div, carries an exclusively syntactic [+pl] feature that triggers plural agreement and that can be checked for purely formal reasons. (assumed, chapter 2, chapter 3)

j. In the absence of a numeral, # can project if the DP is definite. (proposed, chapter 2)

The DP structure associated with these claims and assumptions is given in (360). In this structure, adjectives are assumed to be able to merge anywhere below Q and above N. In the rest of this chapter, I will go through all the possible combinations, and hence all the predicted DP structures given this basic DP structure, and I will give examples of each.
5.2. Possible structures, predictions and derivations

5.2.1. Possible DP structures

Given the structure in (360) and the associated claims and assumptions in (359), a number of DP structure are predicted to be possible. These structures are listed below.
5.2.1.1. No #, with and without Div

5.2.1.1.1. Mass DP: No Div

First, it is possible to have a DP that lacks Div and # altogether, and possibly even quantifiers. This is represented in (361). Such a structure would be that of a mass DP, some examples are given in (362).

\[\text{D}^\text{max}\]
\[\text{(Q}^\text{max}\]
\[\text{(Quantifiers)}\]
\[\text{Q)}\]
\[\text{N}^\text{max}\]
\[\text{N}\]
\[\text{rabbit}\]

361.

362. a. There is \([\text{D}[\text{Q rabbit}]]\) in my soup

b. There is \([\text{D}[\text{Q too much banana}]]\) in this smoothie

c. There is \([\text{D}[\text{Q milk}]]\) in this coffee

d. wo mai-LE \([\text{D}[\text{Q hendo} \text{ mi}]]\) (Mandarin)

I buy-pfv a lot rice
5.2.1.1.2. **Count DPs with no #: Classifiers, plural marking, zero morphemes, and portmanteau morphemes**

It is possible, also, to have a DP structure projecting Div, but not #. Several options are possible for this structure, depending on whether the piece of morphology that is licensing Div is a classifier (363), a plural marker (365), a zero morpheme (367), or even a portmanteau morpheme like the English *a* or *each* which according to Borer (2005) specify both countness as well as quantification (369). The structure in (363) shows a DP structure where Div is filled with a typical Mandarin Chinese classifier, representing DPs like that occurring in (364).

363. Count DP, classifier in Div

```
  D_{max}
     /\                 /\                  /\                /\                /\
  Q_{max}  Qmax  Div_{max}  N_{max}  Nmax  N    mi    rice
         /\   /\  /\   /\   /\   /\   /\   /\   /\   /\   /\   /\   /\
```

---

(e. shtreet [b[Q ktiir [N mooz ]]]) (Lebanese)
bought.1s much banana
364. a. wo mai-LE [D[Q taiduo [Div gen [N xiangjiao ]]]]  
    I buy-pfv too_many CL banana  
    'I bought too many bananas

b. wo mai-LE [D[Q henduo [Div li [N mi ]]]]  
    I buy-pfv a_lot CL rice  
    'I bought many grains of rice'

The structure in (365) shows the same structure, but where Div is filled with a plural marker. This is the structure of a regular plural DP in a language like English. This, I propose, is the structure for bare plurals and quantified count DPs, like those in in (366).

365. Count DP, plural marking in Div

\[
\begin{array}{c}
\text{D}^{\text{max}} \\
\mid \text{Q}^{\text{max}} \\
\mid \text{Q} \\
\mid \text{Div}^{\text{max}} \\
\mid \text{Div} \\
\mid -\text{pl} \\
\mid \text{N}^{\text{max}} \\
\mid \text{N}
\end{array}
\]
366. a. There are \([D[Q \text{rabbit-s} [N \text{rabbit }))) in the garden

b. sheft \([D[Q \text{ghezl-een} [N \text{ghazeel }))) be-l-ghaabeh \text{ (Lebanese)}

saw.1s gazelle-pl in-the-forest

c. I saw \([D[Q \text{many} \text{bike-s} [N \text{bike }))) in the Netherlands

Likewise, the structure in (367) shows a count DP in which Div is instantiated by a zero morpheme that performs the function of a classifier. This is the structure of a singular DP in a language like Arabic. Examples having this structure are given in (368).

367. Count DP, zero morpheme in Div

\[
\begin{array}{c}
D_{\text{max}} \\
\quad Q_{\text{max}} \\
\quad \quad Q \\
\quad \quad \quad \text{Div}_{\text{max}} \\
\quad \quad \quad \quad \text{Div} \\
\quad \quad \quad \quad \quad \text{Ø} \\
\quad \quad \quad \quad \quad \quad N_{\text{max}} \\
\quad \quad \quad \quad \quad \quad \quad N \\
\quad \quad \quad \quad \quad \quad \quad \quad \text{kersi} \\
\quad \quad \quad \quad \quad \quad \quad \quad \quad \text{chair}
\end{array}
\]
Finally, following Borer (2005), I assume Div can be instantiated by a morpheme that also instantiates Q. By determining both the division in Div and the quantity in Q, morphemes like the English *a* and *each* give rise to a ‘singular’ interpretation. This structure is illustrated in (369), and a few examples having this structure are given in (370).

This structure predicts that these portmanteau morphemes would be incompatible with other quantifiers, as well as incompatible with other classifiers. This is indeed the case as the ungrammaticality of (370c-d) shows.
I propose that the behavior of the Lebanese Arabic classifier -\textit{AH} is very similar to that of the regular Mandarin Chinese classifiers in (363). But in addition, I assume that the Lebanese Arabic quantifiers that occur in Q: \textit{ktiir} ‘many’, and \textit{shway} ‘a few’, in the context of a count DP, require a purely syntactic [+pl] feature that is present in DPs containing a
plural marker for a classifier, but absent in DPs containing -AH in Div rather than a plural marker (cf. (359d)).

This predicts that the structure for DPs containing -AH will be like that in (363). A few examples are shown in (371). The requirement that many and few in Arabic require a syntactically plural complement predicts that they would be incompatible with nouns ending with -AH only, expecting the ungrammaticality of the examples in (372).

371. a. shtreet [D[Q[Div tefeeH-AH [N tefeeH ]]]]
   bought.1s apple-AH
   ‘I bought an apple’

   b. aSSeet [D[Q[Div shajr-AH [N shajar ]]]]
   cut.1s tree-AH
   ‘I cut a tree’

372. a. * shtreet [D[Q ktiir [Div tefeeH-AH [N tefeeH ]]]]
   bought.1s many apple-AH
   ‘I bought many apples’

   b. * aSSeet [D[Q shwayt [Div shajr-AH [N shajar ]]]]
   cut.1s a few tree-AH
   ‘I cut a few trees’

5.2.1.1.3. Quantifiers with -AH

I argue, in chapters 3 and 4, that quantifiers like ktiir ‘many’ cannot instantiate #. They therefore cannot participate in the formation of a predicate of plural individuals, and hence cannot be interpreted collectively. But I also assume that plural marking, while it
only denotes a count morpheme, has a +pl feature which is purely formal, and which triggers agreement. Hackl (2001) and Wellwood et al (2012) note that the comparative quantifier *more* in English, theoretically formed by combining *many* with -er, takes only plural marked nouns or mass nouns as complements. Assuming, then, that quantifiers like *many* require that their complement be syntactically plural\(^43\), they are incompatible with nouns marked with the classifier -AH alone, they are predicted to be incompatible with any count occurrence of words taking the classifier -AH. This is illustrated in the examples in (373).

373. a. *ktiir teffeeH-aat
   many apple-\textit{AH}-AG#

   b. *ktiir teffeeH-ah
   many apple-\textit{AH}

In Lebanese Arabic, when a transdecimal merges in #, the noun is not plural marked. It does, however, get the classifier -AH. While I do not provide an proposal for why this is the case in chapter 3, I refute three possible explanations, and I assume that in these cases, the overt noun is in a second DivP, which occurs in SpecN and acts as a modifier of $\varnothing$ in the head N position – leaving the question of why this happens, open. The structure is given in (374). In this structure, the overt noun does not interact syntactically directly with #, and so it need not be marked with the cardinal agreement marker AG#. The noun does,

\(^43\) Hackl (2001) also argues that *more* (and hence *many*) must compose with plural predicates (contra my proposal that they compose with a set of predicates of non-plural individuals), in order to give a cardinality-based interpretation rather than for example a volume-based interpretation, which is what is gotten when it composes with a mass predicate. This specific requirement, however, depends entirely on the semantics assigned to *many* and to *er*. Indeed the semantics of *many* + *er* in Hackl (2001) provides many insights on the working of comparatives, but it can be redefined in such a way to maintain the insights without requiring that the complement be a predicate of plural individuals. Rather, a set.
however, compose with # semantically, as described in chapter 4, because the denotation of the content of $N_{\text{max}}$ is the same regardless of whether the noun is in the head N position or in a modifier position of a Ø in the head N.

374. 

```
  D_{\text{max}}
     /     \
    D      Q_{\text{max}}
           /   \
          Q    #_{\text{max}}
             /   \
            tleetiin
               /     \
              thirty   D_{\text{iv}}{\text{max}}
                              /     \
                             ~AG_{#}  N_{\text{max}}
                                 /     \
                                SpecN  N
                                   /     \
                                  Div    Ø
                                     /     \
                                    N_{2}  Ø
                                       /     \
                                      N  walad
```
5.2.1.2. DPs projecting #

5.2.1.2.1. Numeral containing DPs

Given that # is semantically a pluralizer that takes predicates that are count and returns predicates of plural individuals, whenever # projects, Div must also project. There several possible DP structures in which # projects, depending on whether # is instantiated by a numeral or by definiteness\textsuperscript{44}, and depending on whether Div is instantiated by plural marking, a classifier, or a zero morpheme. The structure in (376) is one in which # is instantiated by a numeral, where Div is instantiated by plural marking. This structure results in regular numeral containing DPs, like those in (375).

\textsuperscript{44} I claim in chapters 3 and 4, as I repeat in (359), that # is necessary for a collective interpretation of a DP. This predicts that only definite DPs and numeral containing DPs can be interpreted collectively. The behavior of many in (i) is consistent with this prediction. But with certain predicates like gather, both DPs containing quantifiers like many as well as bare plural DPs, provide a challenge: despite not projecting #, they are consistent with these predicates like gather. (iii). Future work will focus on these cases specifically, discussing the distinction between the different types of collective predicates (cf. Dowty 1987, Brisson 2003, Hackl 2001, inter alia), and building an operator similar to Schein’s (2013) semidistributive operator into predicates like gather themselves.

i. Many boys ate a whole cake
   \rightarrow Many boys each ate a whole cake
   \leftrightarrow Many boys together ate a whole cake

ii. ??? Many boys are a complete football team

iii. a. Wolves gather around their prey before attacking it
       b. Many fielders have huddled in the outfield. (Schein 2013)
375. a. I ate

\[ [D_{Q[#three} [\text{Div} \text{apple-s} [N \text{apple}]]] ] \]

b. shtreet bought.1s four chair-pl

\[ [D_{Q[#arbaY} [\text{Div} \text{karaasii} [N \text{kersi}]]] ] \] (Lebanese)

c. il a mangé he has eaten four apple-pl

\[ [D_{Q[#quatre} [\text{Div} \text{pomme-s} [N \text{pomme}]]] ] \] (French)

376. Count DP, plural marking in Div, numeral in #

When Div is instantiated by a classifier other than plural marking, like the Arabic -AH,
depending on the language, # triggers an agreement marker on nouns moving to #. In
Arabic, this agreement marker looks like sound feminine plural marking, like that
discussed in chapter 2 (e.g. (377)). In other languages with classifiers, like Mandarin
Chinese, no such agreement appears (e.g. (378)). The structure in (379) is one in which # is instantiated by a numeral and Div is instantiated by the classifier. This structure results in the unusual examples of apparent co-occurrence of classifier and plural marking, discussed in chapter 2, and which I argue is not a genuine co-occurrence.

377. shtareet [D[Q[# tat teffeeH-aat [Div teffeeH-AH [N teffeeH ]]]]
bought.1s three apple-CL-AG#
‘I ate three apples’

378. wo mai-LE [D[Q[# san [Div gen [N xiangjiao]]]]
I buy-pfv three CL banana
‘I bought three bananas’
379. Count DP with a classifier, and with \# projecting thanks to a numeral

5.2.1.2.1. **Definite DPs**

The same structure as (379) is possible without a numeral if the DP is definite. In these cases, the definite determiner is taken to instantiate both \# and D. The structure would be that in (380), and the \# agreement marker would be possible in the absence of plural marking on the noun.
380. Count DP with a classifier, and with # projecting with definiteness

With definite DPs always projecting #, my proposal predicts that definite DPs always allow a collective interpretation. This is indeed the case as illustrated in (381), using collective predicates, as well as an ambiguous predicates which takes a collective reading after a definite DP. My proposal also predicts that definite DPs always trigger plural agreement on verbs, adjectives, and pronouns agreeing with them. In fact, all definite DPs do require exclusively plural agreement on verbs and pronouns, and adjectives following them. This is shown for in (382), where plural agreement is grammatical, and non-plural marking on the verb and/or pronoun render the sentence ungrammatical.
381. a. The boys are a good team
    b. The girls ate a whole cake
    c. The boys gathered
    d. The girls are a group of three people

382. a. t-tleetiin sabi weSl-uu (abel emm-on)
    the-thirty boy arrived-pl (before mother-their)
    ‘The thirty boys arrived’

    b. *t-tleetiin sabi weSel (abel emm-ah)
    the-thirty boy arrived-Ø (before mother-her)

This is also true for adjectives, as illustrated in (383). I assume that all adjectives, even ones merging below #, must be plural marked in definite DPs, because agreement inside a DP is mediated by D (Schoorlemmer 2009), such that only in definite DPs, D inherits plurality from #, and then passes it on to all adjectives which must then be plural marked even if they merge below the pluralizer.

383. a. t-tleetiin sabi l-mnazzm-iin (weSl-uu)
    the-thirty boy the-organized-pl (arrived-pl)
    ‘The thirty organized boys (arrived)’

    b. *t-tleetiin sabi l-mnazzm (weSl-uu)
    the-thirty boy the-organized-Ø (arrived-pl)
5.2.2. Where adjectives merge: More difference between numerals and quantifiers

In Arabic, as in many languages, numerals can get interpreted either before or after adjectives whereas quantifiers always get interpreted after over adjectives. This is illustrated in the contrast in interpretation between (384) and (385).

384. a. Hmelt tes? ?elab T’aal
   carried nine box-pl heavy-pl
   ← I carried 9 heavy boxes, each being heavy (nine > heavy)
   ← I carried a heavy set of 9 boxes, each of which was light (heavy > nine)

   b. shreet xams shanat ghalyiin
   bought five bag-pl expensive-pl
   ← I bought 5 bags that are each expensive (five > expensive)
   ← I bought 5 bags that together cost a lot, but each was cheap (expensive > five)

While numerals may merge above or below any given adjective, quantifiers are always above adjectives. I propose that the absence of the Adjective>Quantifier interpretation emerges from the fact that adjectives may not merge above Q (cf. Schwarzschild 2006 for independent motivations for adjectives merging lower than quantifiers).
385. a. Hmelt šwayt ?elab t’aal
   carried few box-pl heavy
   ← I carried a few heavy boxes, each being heavy (few > heavy)
   ⇔ I carried a heavy set of boxes, each of which was light (heavy > few)

   b. shreet ktiir shanat ghalyiin
   bought many bag-pl expensive-pl
   ← I bought many bags that are each expensive (many > expensive)
   ⇔ I bought many bags that together cost a lot (expensive > many)

Assuming the structure argued for in chapters 2 and 3, and allowing multiple possible merger sites for adjectives all below Q, the emerging structure is as in (386). This structure would predict the contrast between (384) and (385): In the presence of a numeral, if # projects, adjectives may merge either right above DivP, or right above #P. If an adjective merges right above DivP, it composes directly with the noun and it is interpreted distributively. If an adjective merges above #, it composes with all of #P, and it is interpreted collectively.
386. \[ D^{\text{max}} \]

\[ \begin{array}{c}
D \\
Q^{\text{max}} \\
\{\text{Quantifiers}\} \\
\{\text{numerals}\} \\
(\text{Adj2}) \\
\#P \\
\{\text{numerals}\} \\
(\text{Adj1}) \\
\text{Div}^{\text{max}} \\
N^{\text{max}}
\end{array} \]

387. Option 1 for numerals:

\[ \begin{array}{c}
[[\text{heavy}]] \\
(\begin{array}{c}
[[\text{three}]] \\
[[\#]] \\
\end{array}) \\
[[\text{boxes}]]
\end{array} \]

Option 2 for numerals:

\[ \begin{array}{c}
[[\text{three}]] \\
[[\#]] \\
(\begin{array}{c}
[[\text{heavy}]] \\
[[\text{boxes}]]
\end{array})
\end{array} \]
Option 3 for numerals:

amppa[

[[three]]

[[∃n]]

[[heavy]]

[[boxes]]

388. Only option for quantifiers:

amppa[

[[many]]

[[heavy]]

[[boxes]]

The contrast between the flexibility of numerals with respect to distributivity and the distributive nature of quantifiers is seen even more clearly in modal sentences where the subject noun phrase has what Li (1998) calls a quantity reading, where the collective interpretation is tantamount to specifying the number of participants necessary for a given task. This is possible for DPs containing numerals, but not for DPs containing quantifiers like ktiir ‘many’, as illustrated in the contrast between (389) and (390) for Arabic.

389. a. tlat Sebyeen byeHeml-ou ha-l-shaxtuura
three boy-plBR carry-ipfv-pl this-the-boat
← This boat is of a weight such that three boys can carry it
← There are three boys who can each carry this boat

b. xams baneet bixalls-ou ha-l-‘add gateau
five girl-plBR finish-ipfv-pl this-the-amount cake
← This cake is of a size such that five girls could finish it
← There are five girls who can each finish this cake
390. a. ktiir Sebyeen byeHeml-ou ha-l-shaxtuura
   many boy-plBR carry-ipfv-PL this-the-boat
   ← #This boat’s weight is such that many boys can carry it
   ← There are many boys who can each carry this boat

   b. šway baneet byeekl-ou ha-l-‘add gateau
   few girl-plBR eat-ipfv-pl this-the-amount cake
   ← #This cake amount is such that a few girls can finish it
   ← There are a few girls who can each finish this cake

The facts in (389) and (390) can be observed in other languages including e.g. Greek\(^{45}\), as illustrated in (391) and (392) which have the same felicity contrasts (two word orders are possible for each).

```
391. a. tris andresborun na metaferun afto to piano
   three men can.3pl.pres subj carry this the piano

   b. afto to piano borun na to metaferun tris andres
   this the piano can.3pl.pres subj it carry three men
   ‘three men can carry this piano’
```

← This piano is such that three men together can carry it.
← There are (specific) three men that can each carry the piano.

\(^{45}\) Thanks to Fryni Panayidou for the Greek facts.
5.2.3. Group nouns: A different kind of collective DPs

As (359) recapitulates, I propose that unless the noun itself already denotes a predicate of plural individuals, like committee-type nouns, # is necessary for the formation of a predicate of plural individuals, and hence for a collective interpretation. In fact, the two collective interpretations can co-exist, as example (393) shows.

393. Five families ate only a rice bowl for Christmas
    ← a. Five families each ate a rice bowl for Christmas
    ← b. Five families shared a rice bowl for Christmas
    ← c. Each of the members of five families ate a rice bowl for Christmas

I assume that the collective interpretation for group nouns like family and committee is in fact a singular interpretation of a noun that lexically denotes a predicate of plural individuals.

The interpretation in which a numeral alongside a group noun are both interpreted collectively, as in (393b), is simply a case of having the group noun in N with # projected, as
in (394b). The ‘collective’ interpretation of family comes from the meaning of the word itself, and the collective interpretation of the numeral comes from the formation, by #, of a predicate of plural individuals whose atoms are families. This composition is given in (396)

394. a. [D] [Q five] [Div families [N family ]]] ate a bowl of rice
b. [D] [Q # five # families ] [Div families [N family ]]] ate a bowl of rice
c. [D] [five families’ ] [Q Div members [N member ]]] ate a bowl of rice

395. Assumed denotations:
   a. [[D]] = λP.λQ. Π x P(x) Q(x)
   b. [[#]] = λP.λn. λx. Π S ∈ [π(S)(x) and |S| = n and ∀S ∈ S P(s)]
   c. [[family]] = λx. x is a family       [[five]] = 5
   d. [[∃N]] = λP.λn. λQ. λx. Π S. Π x(x ∈ S ! P(x)=1 & Q(x)=1) & |S|=n

396. a. 

\[
\begin{array}{c}
\text{QP} \\
\text{five} \\
\text{∃N} \\
\text{DivP} \\
\text{families}
\end{array}
\]

= [[∃N]] ([[families]]) I ([[five]])

= λQ. λn. λx. Π S. Π x(x ∈ S ! P(x)=1 & Q(x)=1) & |S|=5

b. Paraphrase: Given a predicate, there is a set of five individuals that this predicate is true of and each of these five individuals is a family → Reading (393a)
b. **Paraphrase:** Given a predicate, there is a plural individual that this predicate is true of, and that plural individual can be divided to 5 parts each of which is a family \( \rightarrow \) Reading (393b)

The distributive interpretation, which requires plural agreement in British English, involves a covert 'members', which is plural, in the head of the matrix DP, and that in this case, 'family' is only a possessor, as in (394c). In this way, (393c) is in actuality semantically equivalent to (398). Supposing *five families* raises leaving behind an individual denoting trace, the denotation of the utterance in (393) becomes (400).

398. The members of five families ate only a rice bowl for Christmas

399. a. \([[\text{member}]] = \lambda x. \lambda y. y \text{ is a member of } x \\

b. \([[\text{the}]]) = \lambda f. \forall S. f(x)=1 \\

c. \([[\text{five families}]] = \lambda Q. \exists S. \forall x \in S. x \text{ is a family } \& Q(x)=1 \text{ } \& |S|=5 \\

d. \([[\text{ate only a rice bowl for Christmas}]] = \lambda x. x \text{ ate only a rice bowl for Christmas} \)
400. a. \[[\text{the members of five families ate a rice bowl for Christmas}]\]
    \[=\left[\left[\text{five families}\right]\right] \left(\lambda x. \left[\text{the members of t1 ate only a rice bowl for Christmas}\right]\right)^a x \rightarrow 1\right)\]
    \[=\left(\lambda Q_{\text{e.g.}} . \exists S. \forall x(x \in S \rightarrow x \text{ is a family } \& Q(x) = 1) \& |S| = 5\right) \left(\lambda x. \forall y \in S y \text{ is a member of } x \text{ and } y \text{ ate only a rice bowl for Christmas}\right)\]
    \[= 1 \text{ iff } \exists S. \forall x(x \in S \rightarrow x \text{ is a family } \& \forall y \in S_2 y \text{ is a member of } x \text{ and } y \text{ ate only a rice bowl for Christmas } \& |S| = 5\]

b. Paraphrase: five families’ \text{MEMBERS ate only a rice bowl for Christmas}^{(393b)} is true iff there is a set of five individuals such that: each individual is a family, and all members of that individual ate only one rice bowl for Christmas


5.4. Conclusions

Through the exploration of two novel empirical puzzles in Lebanese Arabic, I have argued in this thesis for the existence of a functional projection \# which only projects in the presence of a cardinal numeral or definiteness (chapters 2 and 3). I argued in chapter 3 that this functional projection is associated with a semantic function necessary for a collective interpretation of the DP: the formation of a predicate of plural individuals. Relatedly, I argued in chapters 3 and 4 that numerals come into the syntax as type n

\(^{46}\) Steddy’s (2013) proposal is in many ways similar to the present proposal – but rather than assuming a covert ‘members’, and \# as a collectivizer, Steddy treats \# as a distribuvisor that affects interpretation.
arguments, and that they take on either modifier-like or quantifier-like appearances depending on the function that mediates their merger with the rest of the DP. I proposed that # is one such function, and that whether or not the numeral merges in # can be seen through agreement markers that only # triggers. When a numeral merges elsewhere (e.g. in Q), both the interpretation and the agreement markers on agreeing elements are different from when it merges in #.

In both chapters 3 and 4, I argued against a number of alternative explanations of the data, including semantic explanations such as a distributor in the DP or on the predicate the DP composes with, and syntactic explanations such as splitting the DP.

The syntactic proposal is developed throughout chapters 2, 3, and 4 culminating in a detailed semantic proposal in chapter 4. In chapter 4, I show how the observed data is derived using the proposal, and in chapter 5, I flesh out the possible DP structures predicted by the structure proposed, and show that it makes the right predictions both syntactically and semantically. Finally, I show in the end of chapter 5 that the collective/distributive distinction for numerals is separate and independent of the so-called collective/distributive distinction for group nouns, by showing that the two can interact within the same DP, resulting in a 3-way distinction in interpretation. I show how each interpretation is derived given the proposal presented in chapter 4.
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