

## Numeral differential constructions in Arabic\*

Peter Hallman

*Austrian Research Institute for  
Artificial Intelligence*

Submitted 2019-11-25 / First decision 2020-04-05 / Revision received 2020-09-25 /  
Second decision 2020-10-31 / Revision received 2020-11-27 / Accepted 2020-12-05 /  
Published 2020-12-14 / Final typeset 2022-08-29

**Abstract** In sentences like *Mary found three shells more than Joan did*, *three* appears to syntactically modify the object noun *shells* yet is interpreted as a specification of the difference between the number of shells that Mary found and the number that Joan found. Accordingly, syntactic and semantic analyses of such cases cast the numeral as a modifier of *more* in the transformational base for this construction. In this paper, I present evidence from Arabic indicating that the numeral is a direct modifier of the plural noun in the counterpart construction in that language. I propose that derivational processes sever its thematic relation to the plural noun and reintegrate it as a modifier of the differential argument of the comparative morpheme. What makes this possible is raising of the numeral together with late insertion of the comparative degree phrase (DegP), as previously proposed for superlative DegPs.

**Keywords:** comparative, differential, numeral, degree quantifier, Arabic

### 1 Introduction

The English comparative morpheme *-er* seen in (1a) is conventionally taken to denote a relation between two sets of degrees, one contributed by the *than*-clause and one contributed by the matrix clause (Cresswell 1976, Heim 1985,

---

\* I am grateful to three anonymous reviewers and to Louise McNally for helpful criticism and guidance. I also thank Mohammad Al-Kadamani, H. Al-Khaled, Samah Alouch, Bushra Al-Shalabi and Talal Al-Shlash for their contribution of empirical data on Syrian Arabic to this project, as well as the Austrian Science Fund (FWF), without whose support this research would not have been possible (grant no. P30409).

and many others). On such an analysis, example (1a) has the LF in (1b), in which *-er* has moved together with the *than*-clause to a peripheral position, and whose meaning is paraphrased in (1c).

- (1) a. Mary is taller than Joan.  
 b. [er [than Joan is *d*-tall]] [Mary is *d*-tall]  
 c. The degrees to which Mary is tall are a superset of the degrees to which Joan is tall.

As Hellan (1981), von Stechow (1984) and others point out, the comparative itself has a degree argument which represents the ‘differential’ of the two degree sets. This differential can be specified by a measure phrase like *three centimeters* in (2a). A natural syntactic account of differentials makes them a modifier of *-er*, as sketched in (2b).

- (2) a. Mary is three centimeters taller than Joan.  
 b. [[three centimeters] er [than Joan is *d*-tall]] [Mary is *d*-tall]

When *-er* modifies a plural count noun, a bare numeral may specify the differential argument of *-er*. I refer to such cases as ‘numeral differential constructions’. Bresnan (1973) attributes the base structure in (3b) to the sentence in (3a).

- (3) a. Mary swam five more laps than Joan swam.  
 b. [Mary swam [five [er [than Joan swam *d*-many laps]]]-many laps]

The variant in (4a) suggests that extraposition of the *than*-clause can take the comparative quantifier *-er* with it (in the form of *more*, which I take to be an allomorph of *-er*). It cannot, however, take the differential with it, as (4b) shows.

- (4) a. Mary swam five laps more than Joan swam.  
 b. \*Mary swam laps five more than Joan swam.

In the structure in (3b), the numeral does not actually modify the plural noun it precedes in the surface structure. It modifies the comparative morpheme *-er*, and is interpreted as a specification of its differential argument. (3a) only asserts that Mary swam five laps by accident of the fact that it asserts that she swam five laps more than an unknown quantity *n* and that  $P(n + 5)$  entails  $P(5)$  by virtue of the downward monotonicity of degree predicates (Heim 1985). The counterpart of (3a) with *fewer*, in (5), does not

assert that Mary swam five laps, nor does it deny she swam five laps, meaning there is no semantic impetus for the constituency of *swim five laps* in (5), or by extension (3a).

(5) Mary swam five laps fewer than Joan swam.

Syrian Arabic has a construction with the format seen in (4a). However, the construction has properties which suggest that it does not display the constituency in (3b), but rather that in (6), where the numeral modifies the plural noun it precedes directly and the entire degree phrase is adverbial (adjoined to VP). Nonetheless, as in English, the numeral is interpreted as a specification of the differential argument of the comparative. This situation seems paradoxical.

(6) Mary [swam five laps] [more than Joan]

I present an analysis of this situation with two main ingredients. One is Kennedy & Stanley's (2009) and Kennedy's (2013, 2015) analysis of numerals, which makes them degree quantifiers that may have scope external to the noun phrase that contains them in the surface structure. The constituency in (6) is transformed by movement into one in which the numeral is local to the comparative morpheme. This alone does not suffice to 'sever' the semantic relationship between the numeral and the plural noun. What accomplishes this is the second ingredient, namely a compositional step found in movement analyses of the superlative, in which a degree quantifier may be inserted between another quantifier and the associated abstraction index (Heim 1985, 1999). I claim, in effect, that *five* is integrated with the comparative at LF in (6) in the same manner as subjects of comparison are integrated with the superlative. Section 2 describes the Arabic data supporting the constituency in (6) (for Arabic) and Section 3 develops an analysis along the lines just sketched. Section 4 expands the empirical picture somewhat and Section 5 discusses the prospects for extending the analysis to other languages.

## 2 Comparatives and differentials in Syrian Arabic

The comparative morpheme in Arabic is the prosodic template  $aC_1C_2aC_3$ , where  $C_1$ - $C_3$  are the root consonants of the base adjective. By inserting the root consonants into the comparative template we derive, for example, *aṭwal* 'taller' from *ṭawīl* 'tall', *aftaḥ* 'brighter' from *fātiḥ* 'bright', *aṣṣyar* 'smaller' from

ṣayīr ‘small’, etc. Regular phonological rules occasionally distort the shape of the template, such as glide deletion in *aḥla* ‘prettier’ (underlyingly *aḥlaw*) from *ḥilu* ‘pretty’ (underlyingly *ḥilw*) or metathesis as in *aḏadd* ‘newer’ (underlyingly *aḏdad*) from *ḏdīd* ‘new’. The comparative combines with a standard phrase headed by the preposition *min* ‘from/of’, which I gloss as ‘than’ here to highlight its standard-setting role in comparatives. Thus, *aṭwal min nabīl* expresses ‘taller than Nabil’. This is a ‘phrasal’ comparative; when the preposition *min* is followed directly by a DP, no additional sentence fragments may follow, suggesting the standard phrase does not contain an elided clause (see Al-Bitar 2019 for detailed arguments to this effect and footnote 3 for an example of the clausal comparative in Arabic, which is morphologically distinguished from the phrasal comparative). The comparative term *aktar* ‘more’ is derived from the base adjective *ktīr* ‘much/many’, mirroring the composition proposed for English *more* by Jespersen (1949), Bresnan (1973), Hackl (2000, 2009) and others as *much+er*. Its antonym is *aʔall* ‘less’ (underlying *aʔlal*), based on the adjective *ʔalīl* ‘little’.

In Hallman 2016, I observe that the superlative morpheme in Syrian Arabic may appear at some distance from its scalar associate. This generalization applies to the comparative as well. Comparative *aktar* ‘more’ may occur with a standard (*min* ‘than’) phrase at the right clause edge, and find its scalar associate potentially at some distance to its left.<sup>1</sup> In (7), for example, the plural noun *warʔd* ‘flowers’ may function as the scalar associate for the comparative phrase *aktar min nabīl* ‘more than Nabil’ even though they are separated by the oblique indirect object *la-sāra* ‘to Sarah’. The dependency between the comparative phrase and its scalar associate is sensitive to certain syntactic boundaries. Although a plural (or mass) DP may function as scalar associate for the comparative phrase, the dependency may not reach *into* a DP and find a scalar associate there; the dependency is bounded by DP. For this reason, the adjective *ḥilu* ‘pretty’ is not accessible as a scalar associate for *aktar* in (7). Presumably, the gradability in quantity of *warʔd ḥilu* ‘pretty flowers’ is a feature of the DP itself, projected from the noun, so that the dependency between the comparative phrase and its associate in (7) does not actually cross over the DP boundary, while the unattested association with the adjective would have to do so. Consequently, the speaker may assert with (7) that

<sup>1</sup> The Syrian Arabic data reported here are the judgments of five Arabic speakers from Damascus who participated in the Austrian Science Fund research project no. P30409 as native speaker consultants, and have consented to the publication of the data they provide.

Muen gave more flowers to Sarah than Nabil did,<sup>2</sup> but not that the flowers he gave her were prettier than the ones Nabil gave her.<sup>3</sup>

- (7) muṣīn ṣaṭa war<sup>o</sup>d ḥilu la-sāra aktar min nabīl.  
 Muen gave flowers pretty to-Sarah more than Nabil  
 ✓‘Muen gave more pretty flowers to Sarah than Nabil.’  
 ✗‘Muen gave prettier flowers to Sarah than Nabil.’

In the course of interpreting (7), *nabīl* is made the subject of a predicate borrowed from the syntactic context, here *gave d-many pretty flowers to Sarah*. Example (8) shows that this predicate is copied from the constituent to which *aktar min nabīl* ‘more than Nabil’ is adjoined. The only gradable predicate in (8) is *ḥilwe* ‘pretty (FS)’. The comparative phrase *aktar min nabīl* ‘more than Nabil’ may adjoin to it, but then *ḥilwe* is the only predicate available to fill in the predicate position in the standard clause, and the resulting interpretation is the pragmatically odd assertion that the shell that Sarah found is prettier than Nabil is. An interpretation in which we assert that Sarah found a shell that is prettier than any shell Nabil found is not available because although in principle the phrase *aktar min nabīl* may adjoin to the verb phrase, as it apparently does in (7), it may not then take *ḥilwe* ‘pretty’ as an associate, since the dependency between *aktar* and *ḥilwe* would cross over the boundary of the DP *ṣadafē ḥilwe* ‘pretty shell’, which, as mentioned above (and as (8) shows), is not grammatical. I refer in what follows to the constituent consisting of the comparative morpheme *aktar* and the standard phrase *min*+DP

<sup>2</sup> Several other interpretations are available for (7) that are not notated here. One has Nabil as the alternative object, that is, (7) can mean that Muen gave more flowers to Sarah than he gave to Nabil. Also, the potential pluractionality of the verb *give* may function as a scalar associate for the comparative, so that (7) means that Muen did more flower-giving-to-Sarah than Nabil did, or that Muen did more flower-giving-to-Sarah than he did flower-giving-to-Nabil. The quantity comparative reading of (7) entails that Muen gave Sarah more flowers than Nabil did, regardless of how many times they gave her flowers.

<sup>3</sup> Syrian Arabic also employs a ‘clausal’ comparative, but this is morphologically distinguished from the phrasal comparative by the complementizer *ma* following the preposition. Assimilation with *min* produces the compound preposition/complementizer *mimma*. In the clausal comparative, Arabic tolerates ellipsis only of the scalar associate itself, as in (i), which paraphrases the meaning of (7).

- (i) muṣīn ṣaṭa war<sup>o</sup>d ḥilu la-sāra aktar mim-ma ṣaṭā-ha nabīl.  
 Muen gave flowers pretty to-Sarah more than-that gave-her Nabil  
 ‘Muen gave more pretty flowers to Sarah than Nabil gave her.’

as the ‘comparative phrase’. Examples (7) and (8) show that the comparative phrase may adjoin to VP in the surface structure in Arabic as long as no DP boundary intervenes between it and its scalar associate (though the scalar associate may itself be a plural DP, as it is in (7)).

- (8) s̄ara laʔi-t ʃadafe hilwe aktar min nabīl.  
 Sarah found-3fs shell pretty more than Nabil  
 ✓‘Sarah found a prettier shell than Nabil is.’ (!)  
 ✗‘Sarah found a prettier shell than Nabil found.’

As in English, a measure phrase can specify the differential argument of a comparative adjective in Syrian Arabic. But a measure phrase may not precede the comparative phrase on the model of English, as (9a) illustrates. Rather, it follows the comparative phrase in a prepositional phrase introduced by the preposition *b-* ‘by’, as (9b) illustrates. It is clear on the basis of (9b) that the comparative adjective *aṭwal* ‘taller’ has a degree argument corresponding to the differential of the two heights it compares. I therefore assume that the ungrammaticality of (9a) is traceable to a syntactic condition, probably related to the fact that Arabic is a relatively strongly head initial language.

- (9) a. \*s̄ara tlet s̄atiyyāt aṭwal min muṣīn.  
 Sarah three centimeters taller than Muen  
 (‘Sarah is three centimeters taller than Muen.’)  
 b. s̄ara aṭwal min muṣīn b-<sup>o</sup>tlet s̄atiyyāt.  
 Sarah taller than Muen by-three centimeters  
 ‘Sarah is taller than Muen by three centimeters.’

And as in English, in the quantity comparative, where the comparative has a plural count noun scalar associate, a numeral may specify the differential argument of the comparative, as (10) illustrates.

- (10) s̄ara laʔi-t tlet ʃadafāt aktar min nabīl.  
 Sarah found three shells more than Nabil  
 ‘Sarah found three more shells than Nabil.’

But in Arabic, there is evidence for a selectional relationship between the numeral and the following noun that belies an analysis of (10) along the lines of Bresnan’s approach to English. Consider a reduced version of (10) without the comparative or the numeral.

- (11) *sāra laʔi-t ʃadaf ʕa-f-ʃaṭṭ.*  
 Sarah found shell<sub>COLL</sub> on-the-beach  
 ‘Sarah found shells on the beach.’

The noun *ʃadaf* ‘shells’ in (11) is one of a large class of lexically collective nouns in Arabic. It is morphologically singular, but only pluralities fall under its denotation. Singular count nouns can be derived systematically from such collectives by the addition of the feminine singular suffix *-e* (underlyingly *-et*). In this manner, *ʃadafe* ‘shell’ is derived from *ʃadaf* ‘shells’, *warde* ‘flower’ is derived from *warʔd* ‘flowers’, *ʃaʒare* ‘tree’ from *ʃaʒar* ‘trees’, etc. Such singulars are sometimes referred to as ‘singulatives’ (Greenberg 1974, Ojeda 1992, Fassi Fehri 2018). These singulatives can also be pluralized in the regular manner for feminine singulars, which involves lengthening the vowel of the singular suffix (which then lowers slightly) and pronouncing the underlying *-t*. In this manner, the plurals *ʃadafāt* ‘shells’, *wardāt* ‘flowers’ and *ʃaʒarāt* ‘trees’ are derived from *sadafe*, *warde* and *ʃaʒare* respectively. The plurals of the singulatives have a different distribution from the underlying collectives. Crucially for the present purposes, the collectives may not be modified by a numeral; the plural of the corresponding singulative is used for this purpose, as (12) illustrates.

- (12) *sāra laʔi-t tlet ʃadafāt / \*ʃadaf ʕa-f-ʃaṭṭ.*  
 Sarah found three shell<sub>PL</sub> / \*shell<sub>COLL</sub> on-the-beach  
 ‘Sarah found three shells on the beach.’

That is, the numeral exerts a selectional effect on the morphological form of the following noun. This effect is found even in numeral differential constructions like (10), where the numeral appears to be specifying the differential argument of the comparative rather than the cardinality of the noun. The noun nonetheless appears in the form required by the numeral. A collective noun is impossible in the context in (10), as (13) shows.

- (13) *\*sāra laʔi-t tlet ʃadaf aktar min nabil.*  
 Sarah found three shell<sub>COLL</sub> more than Nabil  
 (‘Sarah found three more shells than Nabil.’)

Note that the comparative itself is compatible with a collective noun as a scalar associate, as (14) shows. It is the numeral that requires the plural of the singulative form of the noun.

- (14) *sāra laʔi-t ṣadaf aktar min nabīl.*  
 Sarah found shell<sub>COLL</sub> more than Nabil  
 ‘Sarah found more shells than Nabil.’

The selectional relationship between the numeral and noun has an additional facet: in Arabic, numerals above ten require their nominal restriction to be morphologically singular, or singulative if the base noun is collective. This fact carries over to numeral differential constructions, as (15) shows.

- (15) *sāra laʔi-t xamṣṭʔaʃar ṣadafe / \*ṣadafāt / \*ṣadaf aktar min nabīl.*  
 Sarah found fifteen shell<sub>SG</sub> / \*shell<sub>PL</sub> / shell<sub>COLL</sub> more than Nabil  
 ‘Sarah found fifteen more shells than Nabil.’

The selectional relationship between the numeral and noun seen in Arabic militates against an analysis along the lines of Bresnan’s (1973) analysis of similar constructions in English sketched in (3b). According to such an analysis, *tlet* ‘three’ would modify the comparative phrase in the base structure, as schematized in (16a). The surface structure would be derived by post-posing the comparative phrase, stranding the numeral, as in (16b). But in this analysis, *tlet* ‘three’ does not modify *ṣadafāt* ‘shells’ at any level of representation, and the selectional relationship between the numeral and noun is not expected.

- (16) a. Sarah found [[three [more than Nabil]] shells]  
 b. Sarah found [[three  $t_i$ ] shells] [more than Nabil]<sub>*i*</sub>

One possible way of reconciling the selectional restrictions the numeral places on the noun with the fact that the numeral seems to specify the differential argument of the comparative is to characterize the whole DP *tlet ṣadafāt* ‘three shells’ as a measure phrase modifying the comparative, so that (10) does not have the constituency in (16a) but rather that in (17).

- (17) Sarah found [[three shells] more than Nabil].

Here, although *three shells* is a constituent and therefore compatible with the selectional restrictions holding between the numeral and modified noun, the DP as a whole does not function as the object of the verb *found* but rather is functioning as a measure phrase specifier of *more*. But we have seen in (9a) that measure phrases in Arabic are disallowed in the pre-adjectival position. The pair in (9) demonstrate that measure phrases only occur following the

comparative phrase in a prepositional phrase headed by *b-* ‘by’. On the analysis of (10) that attributes the constituency in (17) to it, *three shells* is acting as a measure phrase in the pre-adjectival position, just what (9a) shows is excluded in Arabic. Nor can it follow the comparative phrase in a prepositional phrase, as (18) shows. The fact that *tlet şadafāt* ‘three shells’ precedes the adjective *aktar* in (10) points to the conclusion that it is not functioning as a measure phrase there, but rather as the object of the verb.

- (18) \*sāra laʔi-t aktar min nabīl b-ʔtlet şadafāt.  
 Sarah found more than Nabil by-three shells  
 (‘Sarah found three more shells than Nabil.’)

It supports this point that the constituency in (17) does not lend itself to a degree semantic analysis of the meaning of (10), a point that Bhatt & Homer (2019) and Homer & Bhatt (2020) have dealt with in detail. In order to provide the standard phrase with a predicate for Nabil, the entire phrase *three shells more than Nabil* in (17) must move out of the matrix verb phrase. Then, *three shells* describes the difference between the denotation of the remnant of movement of the form *Sarah found x* and the standard phrase *Nabil found x*. These phrases denote sets of things rather than degrees, whose cardinalities must be compared in some manner, and the sortal specification of the differential carried over to the whole comparison (otherwise (10) would mean that Sarah found as many things as Nabil, and in addition, three shells).

Bhatt & Homer (2019) pursue an analysis along these lines for French, where they also find evidence for the constituency of Numeral+NP in numeral differential constructions. They point out that while ordinary quality comparatives with differentials resemble English, as shown in (19a), in numeral differential constructions the comparative phrase, headed by *plus* ‘more’, must in turn be introduced by the preposition *de* ‘of’, as shown in (19b).

- (19) a. Jean est trois centimètres (\*de) plus grand que Marie.  
 Jean is three centimeters (\*of) more tall than Marie  
 ‘Jean is three centimeters taller than Marie.’  
 b. Marie a lu trois livres \*(de) plus que Jean.  
 Marie has read three books \*(of) more than Jean  
 ‘Marie read three books more than Jean.’

They present several reasons to believe that *trois livres* forms a constituent in (19b) and that this constituent functions as the object of the verb

*lire* ‘read’. For example, subextraction is only possible from direct objects in French, and is possible from *trois livres* in (19b) (their example (51), p. 287).

- (20) Jean a lu deux livres et Marie en<sub>i</sub> a lu trois t<sub>i</sub> de  
 Jean has read two books and Marie thereof has read three of  
 plus que lui.  
 more than him  
 ‘Jean read two books and Marie read three more than him.’

They conclude that *trois livres* in (19b) is a DP functioning as direct object of the verb, rather than as a measure phrase modifying *plus*, and deduce that the comparative phrase *de plus que Jean* is a modifier of *trois livres*. They propose that at LF, *trois livres de plus que Jean* undergoes quantifier raising, deriving the structure in (21), and develop a non-degree analysis of the interpretation of such LFs based on Li’s (2015) analysis of similar structures in Mandarin. Specifically, they posit a non-degree counterpart of *plus* that combines with three individual predicates: *que Jean a lu*, the set of things Jean read (the VP is recovered from the matrix clause; Bhatt and Homer analyse French comparatives as clausal comparatives with ellipsis), *trois livres*, the set of pluralities of three books, and finally the matrix clause *Marie a lu*, the set of things Marie read. *Plus* says that the second holds of the sum of things in the third that cannot be mapped to a counterpart in the first in a one-to-one manner. That is, if we exhaustively map the things Marie read to things Jean read, three books are left over. An additional condition requires that the mapping preserves the taxonomic level of the second argument *trois livres*, ensuring that the things Marie and Jean read are books.

- (21) [DP [DP trois livres ] [DegP de plus [CP que Jean a—lu—t ]]]<sub>i</sub> [Marie  
 three books of more than Jean has read Marie  
 a lu t<sub>i</sub>]  
 has read

Since this analysis does not make reference to degrees, it does not involve the normal comparative degree quantifier, nor the quantity adjectival base the comparative is built on in many languages (‘much’ underlying ‘more’). This is compatible with the morphologically opaque formative *plus* in French, though it posits an additional meaning for *plus* only found in numeral differential constructions. For Arabic, this step is particularly suspicious, since the comparative morpheme that occurs in such constructions is the same as that that occurs in ordinary comparative constructions, and this morpheme

is morphologically built on the quantity adjective *ktīr* ‘much/many’. Putative non-degree *aktar* in Arabic would have the same internal morphological composition as the true degree quantifier *aktar*, one based on a degree adjective *ktīr*. This suggests that eschewing degrees in the interpretation of quantity comparatives with differentials might be unwarranted, at least for Arabic.

In fact, Homer and Bhatt themselves reach this conclusion in a follow-up paper (Homer & Bhatt 2020). There, they point out that French comparatives display scope ambiguities that point to a degree quantifier analysis of the comparative, even in numeral differential constructions of the kind seen in (19b). Example (22a), for example, has a reading in which *plus* ‘more’ scopes over *veut* ‘want’, meaning the number of books Marie wants to read exceeds the number of books Jean wants to read by three, without entailing the existence of any particular books they want to read. The same can be said of the Arabic counterpart in (22b).

- (22) a. Marie veut lire trois livres de plus que Jean.  
 Marie wants read three books of more than Jean  
 ‘Marie wants to read three books more than Jean.’  
 b. sāra bidd-a ti-ʔra tlet kitub aktar min nabīl.  
 Sarah want-3FS 3FS-read three books more than Nabil  
 ‘Sarah wants to read three books more than Nabil.’

On a degreeless treatment, moving the DP *trois livres de plus que Jean* derives the structure in (23), which, on analogy to the discussion of (21) above, holds when three books are left over after we map the books Marie wants to read to the books Jean wants to read. To determine whether this holds, we must map particular books that Marie wants to read to particular books Jean wants to read, but the existence of such books is precisely what (22a) does not entail on the relevant reading. This supports a degree quantifier analysis of *plus* after all, even in numeral differential constructions. This fits well with Arabic, where the degree-based morphological composition of *aktar* is transparent.

- (23)  $[_{DP} [_{DP} \text{trois livres } ] [_{DegP} \text{de plus } ] [_{CP} \text{que Jean veut lire } t ] ] ]_i$   
 three books of more than Jean wants read  
 [Marie veut lire  $t_i$ ]  
 Marie wants read

Consequently, Homer & Bhatt (2020) propose that *plus* is a degree quantifier in these cases as elsewhere, defined in (24). It relates two degree predi-

cates and a differential (unnumbered  $D$  in (24), the role that *trois livres* ends up filling).

$$(24) \quad \llbracket \text{plus} \rrbracket = [\lambda D_1 \langle d, t \rangle \lambda D_2 \langle d, t \rangle \lambda D \langle d, t \rangle . D(\lambda d_d . D_2(d) \& \neg D_1(d))]$$

Movement of *trois livres de plus que Jean* leaves a degree denoting trace in an argument position. However, that trace is converted by a ‘degree to stuff’ operator ( $Op$  in (25)) into an individual whose cardinality corresponds to the degree denoted by the trace. This individual serves as argument of the verb. The LF of (19b) has roughly the form in (25) (after Homer and Bhatt’s tree (75), p. 295).

$$(25) \quad \llbracket [\text{trois livres de plus que Jean}] [\lambda d \text{ Marie a lu } Op(d)] \rrbracket$$

The standard phrase and the main clause are interpreted as degree predicates ( $D_1$  and  $D_2$  respectively in (24)), with an elided VP in the former case, identical to the matrix VP. *Plus* combines with these two degree sets and a predicate of degree sets (the unnumbered  $D$  in (24)), corresponding to the differential, *trois livres* in (19b). For its part, *trois livres* has a different meaning as a differential than as an ordinary quantifier. The differential *trois livres* is derived by the operator  $\mathcal{M}$  defined in (26) which takes the numeral *trois* and the noun *livres* as separate arguments. The noun argument serves merely to identify the units of the scale of measurement. The expression  $M(D)$  returns the size of  $D$  and  $n_p$  is the point on the  $P$  scale (of books in (25)) that corresponds to  $n$  (‘three’ in (25)). The degree quantifier  $\mathcal{M}(\text{trois})(\text{livres})$  holds of a degree set  $D$  when the measure of  $D$  is three on a scale whose units are books. Here we are using ‘book’ in an unconventional way, as the unit basis for a scale.

$$(26) \quad \mathcal{M} \rightarrow \lambda P \lambda n \lambda D \langle d, t \rangle . M(D) = n_p$$

As a result, (25) is true when the measure phrase  $\mathcal{M}(\text{trois})(\text{livres})$  holds of the set of degrees  $d$  such that Marie read stuff with cardinality  $d$  and Jean didn’t read stuff with cardinality  $d$ . The measure phrase *trois livres* sets the dimension on which the differential is measured to books. Homer and Bhatt claim that this dimension specification is transferred down to the degree-to-stuff operator, ensuring that the stuff that Marie and Jean read is also books. The nature of this transference mechanism is left unspecified but could perhaps be characterized as a kind of binding. More critically, it is unclear whether measuring stuff in book units suffices to ensure that the mea-

sured stuff is actually books. Canonical measure phrases like *three bottles* in *three bottles of wine* do not have this property; this phrase refers to wine, not bottles. By analogy, we do not expect *I read three books of stuff*, to the extent this is interpretable, to entail that I read books. But precisely such an entailment is at the heart of Homer and Bhatt’s analysis. For these two reasons, it is unclear whether making *trois livres* a measure phrase in (25) suffices to ensure that we are comparing Marie and Jean in terms of how many books they read, and whether the assumption that we can only use book-units to measure out books and not other things might preclude us from measuring out wine in bottles. Lastly, the analysis gives a different constituency and semantic interpretation to *trois livres* when it is used as a measure phrase than when it is used as a quantifier, in which *trois livres* is not actually a constituent, but rather, the numeral and noun are each arguments of a third, covert, element  $\mathcal{M}$ . Even this term is embedded under the degree-to-stuff operator in the base structure. It is unclear then whether we should expect the term  $Op(\mathcal{M}(\textit{trois})(\textit{livres}))$  to pattern like the ordinary object *trois livres* with respect to, for example, subextraction and other evidence Homer and Bhatt discuss implicating that *trois livres* acts as a syntactic object of the verb in (19b).

Particularly this last point makes Homer and Bhatt’s analysis difficult to carry over to Arabic. If *tlet* ‘three’ and *ṣadafāt* ‘shells’ do not form a constituent in (10), but rather function individually as arguments of  $\mathcal{M}$ , then we have no way of enforcing the selectional restrictions that are found between the numeral and the noun in Arabic. If we were to define  $\mathcal{M}$  to combine with the whole DP *tlet ṣadafāt* we are left with no easy way of excluding *tlet* from the specification of  $P$ , so that we would be measuring out shells in units of ‘three shells’. A solution to this problem, whatever it may be, would not allay the other concerns expressed above.

I conclude firstly that the hypothesis sketched for Arabic in (16a), where *tlet* ‘three’ directly modifies the comparative, is untenable because it does not capture the selectional relationship between the numeral and noun. Secondly, the hypothesis in (17), where *tlet ṣadafāt* ‘three shells’ modifies the comparative, is compromised by dissimilarities to bona fide differential modifiers (of comparative adjectives). Further, the semantic composition for this constituency proposed by Homer and Bhatt is both not easily reconcilable with the selectional facts of Arabic and has other potential drawbacks. These considerations warrant an at least cursory look at possible alternatives. I present such an alternative in the following section.

### 3 Analysis

I start with the premise motivated above that *tlet šadafāt* ‘three shells’ is a constituent in (10) and that the comparative phrase *aktar min nabil* ‘more than Nabil’ is functioning as an adverb, as the examples in (7) and (8) demonstrate for quantity comparative constructions in Syrian Arabic. This constituency is sketched in (27). But it is clear that *tlet* ‘three’ in this context is *interpreted* as a specification of the differential argument of the comparative. How is it possible for the numeral in (10), which selects the morphological form of the following noun, to semantically modify not that noun but the comparative *aktar* ‘more’? I claim here that existing tools of semantic analysis provide an answer to this question.

(27) Sarah [<sub>VP</sub> [<sub>VP</sub> found three shells] [<sub>DegP</sub> more than Nabil]]

Heim (2006) proposes that the core meaning of the comparative morpheme is a containment relation between the denotations of the matrix clause and of the standard phrase (headed by *than* in English), both interpreted as degree predicates. The English sentence *Sarah is taller than Muen* is true if and only if the degrees to which Sarah is tall properly include the degrees to which Muen is tall. As mentioned previously, the comparative constructions under investigation here are phrasal comparatives (clausal comparatives are marked differently; see footnote 3). Consequently, I amalgamate Heim’s (2006) proposal with an earlier proposal for phrasal comparatives (Heim 1985), where the comparative combines with two individuals and a degree relation (a relation between and degree and an individual). I define the Syrian Arabic comparative morpheme (the template *aCCaC*) accordingly as in (28), as a relation that combines with two individuals and a degree relation, but where the comparative claim is encoded as the superset relation between degree sets. I will later augment this definition with a differential argument. In all the formulas to follow, the symbols  $x$  and  $y$  represent variables of type  $e$  (‘ordinary’ individuals) and  $d$  is a variable of type  $d$  (for ‘degree’). All other variables are subscripted with their semantic type.

(28)  $[[aCCaC]] = \lambda y \lambda R_{\langle d, \langle e, t \rangle \rangle} \lambda x. \{d \mid R(x, d)\} \supset \{d \mid R(y, d)\}$

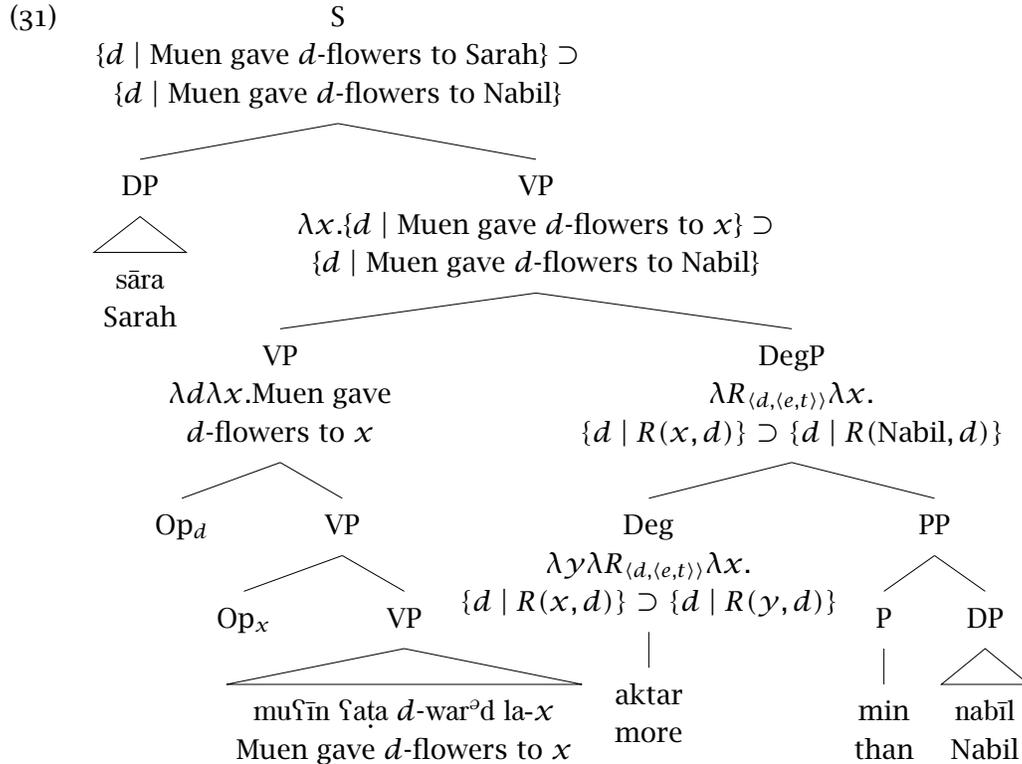
Example (7) is repeated in (29) without the adjective *ħilu* ‘pretty’, which is irrelevant to the present purposes. Two salient interpretations of this sentence differ in whether Muen or Sarah is the subject of the comparison, as illustrated in the two translations under (29).

- (29) muḥīn ʕaṭa warʕd la-sāra aktar min nabīl.  
 Muen gave flowers to-Sarah more than Nabil  
 (i) ‘Muen gave more flowers to Sarah than Nabil gave to her.’  
 (ii) ‘Muen gave more flowers to Sarah than he gave to Nabil.’

These interpretations are standardly assigned the same base structure, that in (30a), represented with English morphemes for perspicuity. The first interpretation is derived by extraction of *Muen* from VP, making *Muen* the subject of the comparison. The second interpretation is derived by extraction of *Sarah*. In both cases, the *aktar*-phrase moves to the level of VP, the constituent interpreted as a degree relation. VP is interpreted as a degree relation by virtue firstly of extraction of a DP (*Muen* or *Sarah*), which leaves an individual-denoting trace, and secondly extraction of the DegP *more than Nabil*, which leaves a degree-denoting trace.

- (30) a. [<sub>VP</sub> Muen gave [<sub>DegP</sub> more than Nabil]-flowers to Sarah]  
 b. [<sub>S</sub> Muen<sub>x</sub> [<sub>VP</sub> x gave *d*-flowers to Sarah] [<sub>DegP</sub> more than Nabil]<sub>d</sub>]  
 c. [<sub>S</sub> Sarah<sub>x</sub> [<sub>VP</sub> Muen gave *d*-flowers to x] [<sub>DegP</sub> more than Nabil]<sub>d</sub>]

The interpretation in e.g. (30c) composes as shown in the tree in (31), where movement of the subject of comparison *Sarah* and the degree quantifier *aktar min nabīl* ‘more than Nabil’ is in each case accompanied by insertion of an abstraction index (labeled *Op*), whose role is to derive a predicate over the remnant of movement; I expand on this below. This semantic analysis for the comparative is premised on the assumption that degree predicates are downward monotone; if a degree predicate holds of a degree *d* it holds of every degree less than *d*. I also assume the preposition *min* ‘of/from’ is vacuous. On these assumptions, if Muen gave Sarah five flowers and he gave Nabil three, then the sentence is true, because the set  $\{d \mid \text{Muen gave } d\text{-flowers to Sarah}\}$  is the set  $\{1, 2, 3, 4, 5\}$  and the set  $\{d \mid \text{Muen gave } d\text{-flowers to Nabil}\}$  is the set  $\{1, 2, 3\}$  and the first is a superset of the second.

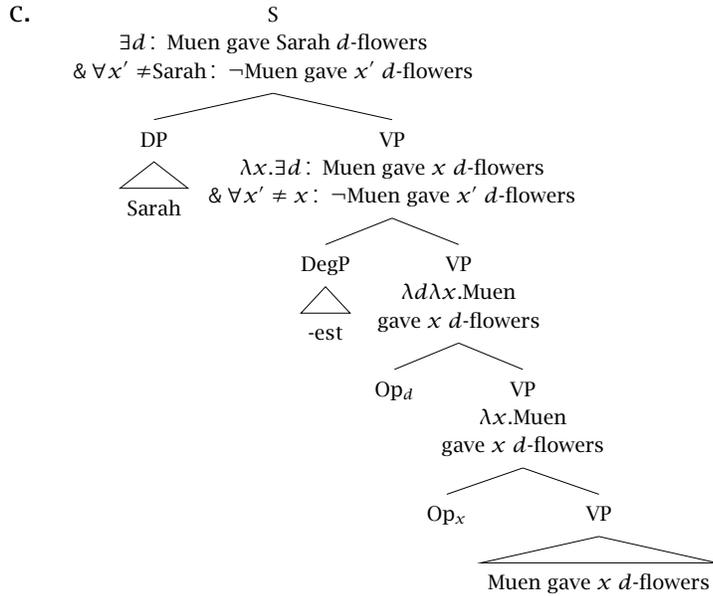


While the tree in (31) composes properly to derive the intended interpretation, it displays a derivational step that is unusual for quantifier raising but typical for movement analyses of degree quantifiers. Raising of the subject of comparison *Sarah* accompanied by insertion of the abstraction index  $Op_x$  is followed by raising of the DegP *aktar min nabīl* ‘more than Nabil’ accompanied by insertion of the abstraction index  $Op_d$ . But DegP-raising targets a position between the subject of comparison *Sarah* and its abstraction index  $Op_x$ . Inserting DegP in this position fails to ‘extend’ the tree in the way typical of syntactic movement (Chomsky 1993).

This same failure to extend the tree by DegP movement is found in movement analyses of the superlative. Heim (1999) attributes the meaning in (32a) to the English superlative morpheme *-est*, which combines with a degree relation and an individual. But in order to apply the superlative morpheme to a degree relation in a sentence like (32b) (on the interpretation indicated there), we need to insert the superlative and its abstraction index  $Op_d$  between the subject of comparison *Sarah* and its abstraction index  $Op_x$ , as (32c) shows.<sup>4</sup>

<sup>4</sup> Bhatt & Takahashi (2007) suggest that this movement step in phrasal comparatives and superlatives exemplifies a type of movement that Richards (1997) calls ‘tucking in’, in which

- (32) a.  $\llbracket \text{-est} \rrbracket = \lambda R_{\langle d, \langle e, t \rangle \rangle} \lambda x. \exists d : R(x, d) \ \& \ \forall x' \neq x : \neg R(x', d)$   
 b. Muen gave Sarah the most flowers (i.e., more than he gave anyone else).



The possibility of inserting a quantifier between a term and its abstraction index plays a crucial role in the analysis of numeral differential constructions I present below, as does an analysis of numerals as degree quantifiers to which I now proceed. [Kennedy & Stanley \(2009\)](#) and [Kennedy \(2013, 2015\)](#)

a constituent moves to a position directly subjacent to the constituent that moved in the previous movement step, which is either at the left clause edge or itself tucked in under a constituent at the left clause edge. Semantically, the cases of tucking in that Richards discusses (as well as [Bruening \(2001\)](#), who discusses quantifier raising in detail), involve inserting a quantifier *beneath* the abstraction index of the higher quantifier, not between the higher quantifier and its abstraction index. This means that the kind of movement discussed here and in [Bhatt & Takahashi 2007](#) is different from the classical cases of tucking in. One possibility though, is that tucking in may optionally target a position either above or below the abstraction index of the higher quantifier, on the condition that the result is interpretable. This condition rules out interpolation of ordinary generalized quantifiers. If movement of *someone* in (i), generating the lambda expression beginning  $\lambda y \dots$ , is followed by movement of *everyone* to a position between *someone* and its abstraction index, generating  $\lambda x \lambda y \dots$ , the result is a type mismatch. Therefore, this formulation of tucking in unifies degree operator movement with movement of other quantifiers that undergo tucking in without overgenerating (composable) interpretations.

- (i) someone everyone  $\lambda x \lambda y . x$  loves  $y$

analyze numerals as degree quantifiers that potentially display scope ambiguities with other quantifiers. The numeral *three*, for example, combines with a set of degrees  $D$  and asserts that the maximal degree in  $D$  is 3 (Kennedy 2013: p. 24).

$$(33) \quad \llbracket \text{three} \rrbracket = \lambda D_{\langle d,t \rangle} . \max\{n \mid D(n)\} = 3$$

Numerals defined on the model of (33) are scopally flexible. Kennedy (2013) points out that a sentence like (34a) (his example (36), p. 24) can be interpreted to mean that Kim must take exactly three classes, or that three is the minimum number of classes she can take. If *three* scopes below *required* the sentence asserts that in all worlds where Kim meets the requirement, the maximum number of classes Kim takes is three. This means she cannot take more than three classes, but neither can she take less than three — the assertion that the maximum number of classes she takes in all the ‘required’ worlds is three entails that she does in fact take three classes in those worlds. This is the ‘exactly three’ reading. If *three* scopes above the modal as sketched in (34c), it means that three is the maximum number  $n$  such that Kim takes  $n$ -many classes in *all* worlds where the requirement is met. This is compatible with Kim taking four or more classes in at least some (but not all) of those worlds. This the ‘minimum requirement’ reading.

- (34) a. Kim is required to take three classes.  
 b. required [ $\text{three}_d$  [Kim to take  $d$ -classes]]  
 c.  $\text{three}_d$  [required [Kim to take  $d$ -classes]]

The Syrian Arabic counterpart to (34) displays the same ambiguities, which I assume are derived in the same manner.

- (35) s̄ara l̄āzim t-āxud tlet mawādd.  
 Sarah must 3FS-take three classes  
 ‘Sarah must take three classes.’

The wide scope interpretation of the numeral is also found in numeral differential constructions. Suppose that Sarah and Nabil are collecting signatures for a petition, and they have set themselves the goal of collecting 100 signatures each. Nabil has already collected 90 signatures, and Sarah 87. In this situation, Sarah needs to collect three more signatures than Nabil needs to collect to reach her goal. The sentence in (36) describes this situation.

- (36) *sāra lāzim t-ḡammiḡ tlet tawāqīḡ aktar min nabīl.*  
 Sarah must 3FS-collect three signatures more than Nabil  
 ‘Sarah must collect three signatures more than Nabil.’

In this context, (36) has the same ‘upstairs de dicto’ interpretation that its English translation has, in which *tlet* ‘three’ and the comparative itself are interpreted above the modal, so that the degree predicates being compared include the modal (hence ‘upstairs’), but the restriction stays in situ, so that the degree predicates being compared include the restriction *tawāqīḡ* ‘signatures’ (hence ‘de dicto’; this terminology is due to Sharvit & Stateva (2002)). I conclude that as in English, numerals in Syrian Arabic may take scope independently of their restriction, i.e., they may move to a higher scope position, leaving their restriction behind.

Kennedy does not discuss the manner in which plurals are integrated into the argument structure of the verb. I assume that plural objects are integrated by Chung & Ladusaw’s (2004) ‘Restrict’ operation, after movement of the numeral (or type lowering — see below). This operation composes a one-place predicate (the object) with a two-place relation (the verb) by unifying the argument of the one-place predicate with the internal argument of the two-place relation and existentially closing the unified argument. I follow Cresswell (1976) and others in casting plural (and mass) nouns as relations between an individual and a degree representing its ‘measure’, simply its cardinality in the case of count nouns. The analysis I construct here is compatible with the idea that the degree argument of plurals is contributed by a covert morpheme, e.g., Kayne’s (2005) NUMBER or Rett’s (2006) COUNT and MEASURE (for count and mass nouns respectively). The base tree in (37a) for the VP *collect three signatures* (in English; Arabic is parallel) cannot be composed as such. But movement of the numeral *three* to a higher position (not notated) leaves a degree-denoting trace *d*’, which functions as argument of the plural noun, as illustrated in (37b). The result is combined with the verb by the Restrict operation, as (37b) illustrates. Henceforth, I abbreviate the denotation of plural NPs like *signatures* below as ‘ $\lambda d \lambda y$ .signatures( $y, d$ )’.



differentials in the context of *fewer*, which I discuss in Section 4. The symbol ‘ $\mu$ ’ in (38a) is a function that maps a set of things  $A$  to the set of degrees representing a tally of the things in  $A$ . If  $A$  has three things in it,  $\mu(A)$  is the set  $\{1, 2, 3\}$ .<sup>5</sup>

- (38) a.  $[\text{aCCaC}] = \lambda y \lambda R_{\langle d, \langle e, t \rangle \rangle} \lambda d' \lambda x. \{d \mid R(x, d)\} \supset \{d \mid R(y, d)\}$   
 $\& d' \in \mu(\{d \mid R(x, d)\} \Delta \{d \mid R(y, d)\})$   
 b. For all sets  $A$  and  $B$ ,  $A \Delta B = A \cup B - A \cap B$

Combining the comparative with the standard-setting individual  $y$  derives a degree relation modifier: a term that combines with a degree relation and yields a new degree relation. This new degree relation relates an individual to the maximum degree of difference between two degree sets. In treating the comparative phrase as a modifier, this analysis bears a resemblance to Kennedy & McNally’s (2005) modifier analysis of the comparative. There, the comparative phrase derives a scale whose minimum value is defined by the standard phrase. In the analysis in (38a), it is  $\mu$  that has the effect of recalibrating the scale to the difference between the two degree sets being compared. Also following Kennedy and McNally, I assume that when no overt description of the differential appears, either in the form of a numeral differential or otherwise, then the differential degree argument of the comparative in (38a) is closed by a covert existential quantifier. That is, when no overt differential phrase appears, the comparative requires the symmetric difference to be non-empty.

The last component of the analysis of the numeral differential constructions concerns the base structure position of the comparative phrase headed by *aktar* ‘more’. In the base structure postulated by Bresnan for examples like the ones under consideration here, sketched in (39a) (on the model of (3b) above), the constituent sitting in the degree argument slot of the plural *shells* is the whole comparative DegP *three more than Nabil*. According to that analysis, this DegP moves and binds a degree variable left behind in its base position, the degree argument slot of *shells*. The numeral sits in the degree argument slot of the comparative and if it moves, it binds a variable in that position. In the constituency motivated for Syrian Arabic though, shown

<sup>5</sup> I assume that sets of degrees may differ in how coarsely they measure out the stuff they correspond to. If  $A$  comprises non-discretely measurable material, then a dense set of degrees is put to use and  $\mu$  is a correspondence between the linear order of degrees and the subpart structure of  $A$ . I deal here only with discrete degree sets that model counting. In either case,  $\mu$  in (38a) ‘measures out’ the difference between  $A$  and  $B$  as a set of degrees.

in (39b), the numeral itself sits in the degree argument slot of the plural in the base structure.

- (39) a. Sarah found [three [-er than Nabil]] shells  
 b. Sarah found [three shells] [-er than Nabil]

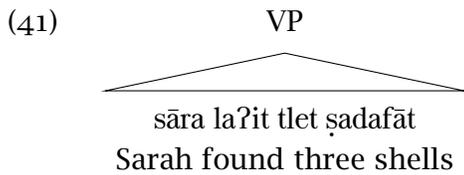
If (39b) is the correct base constituency for examples like (10), then the DegP corresponding to *-er than Nabil* is not base generated in the degree argument slot of the plural *shells*; that position is occupied by *three*. I show below how the DegP nonetheless manages to bind the degree variable argument of *shells* at LF. But in the base structure, the DegP *-er than Nabil* must be base generated in a higher position. The example in (29), where the entire DegP including both the comparative morpheme and the standard phrase occurs to the right of the second argument of the ditransitive verb *ṣaṭa* ‘give’, suggests that the DegP occurs in the surface structure at least as high as VP, just where it is interpreted, as illustrated in the tree in (31). I propose it is base generated there in numeral differential constructions.

In the numeral differential example (10), repeated in (40) below, the DegP *aktar min nabīl* ‘more than Nabil’ compares Sarah and Nabil in terms of how many shells they found. The numeral *tlet* ‘three’ is not part of this description; it is interpreted external to the constituent that DegP modifies. This situation is similar to the situation that Kennedy treats in (34): *three* is not part of the description of what Kim is required to do on one reading of (34). In this reading, *three* is displaced to a position outside of that description. I claim that similarly, in Arabic, *tlet* ‘three’ is removed by movement to a position outside of the VP to which the comparative DegP is adjoined. Recall now that that DegP is semantically a modifier: it maps a degree relation (whose degree argument specifies a number of shells in (40)) to another degree relation (whose degree argument specifies the differential). This sets up the possibility for displaced *tlet* ‘three’ to be re-integrated with the VP above the comparative DegP, since the VP derived by DegP adjunction has the same logical type as the underlying VP (that of degree relation  $\langle d, \langle e, t \rangle \rangle$ ).

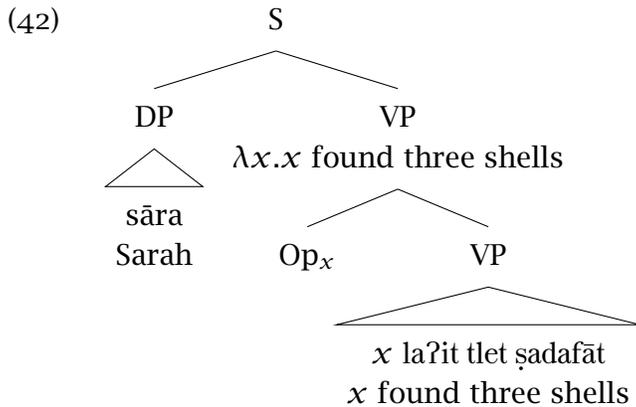
- (40) *sāra laʔi-t tlet ṣadafāt aktar min nabīl.*  
 Sarah found-3FS three shells more than Nabil  
 ‘Sarah found three more shells than Nabil did.’

I propose, then, that the numeral *tlet* in (40) moves out of the VP to a position where it saturates the degree argument of DegP (the specification

of the differential), which is itself adjoined to VP. What makes the semantic reintegration of the numeral as a specification of the differential argument of DegP possible is the fact that quantificational material — here DegP — may be inserted between a moved term and the associated abstraction index, as discussed above in connection with the integration of the phrasal comparative and superlative (see the discussion surrounding (31) and (32c)). There, the comparative or superlative DegP is inserted between a moved subject of comparison and its abstraction index. The constituent derived by adjunction of DegP is itself a predicate, which then takes the moved DP as argument. I propose something similar for numeral differential constructions, except that what moves is the numeral, itself a degree quantifier. The steps involved are spelled out in detail below. We begin the derivation of the sentence in (40) by constructing the VP in (41).



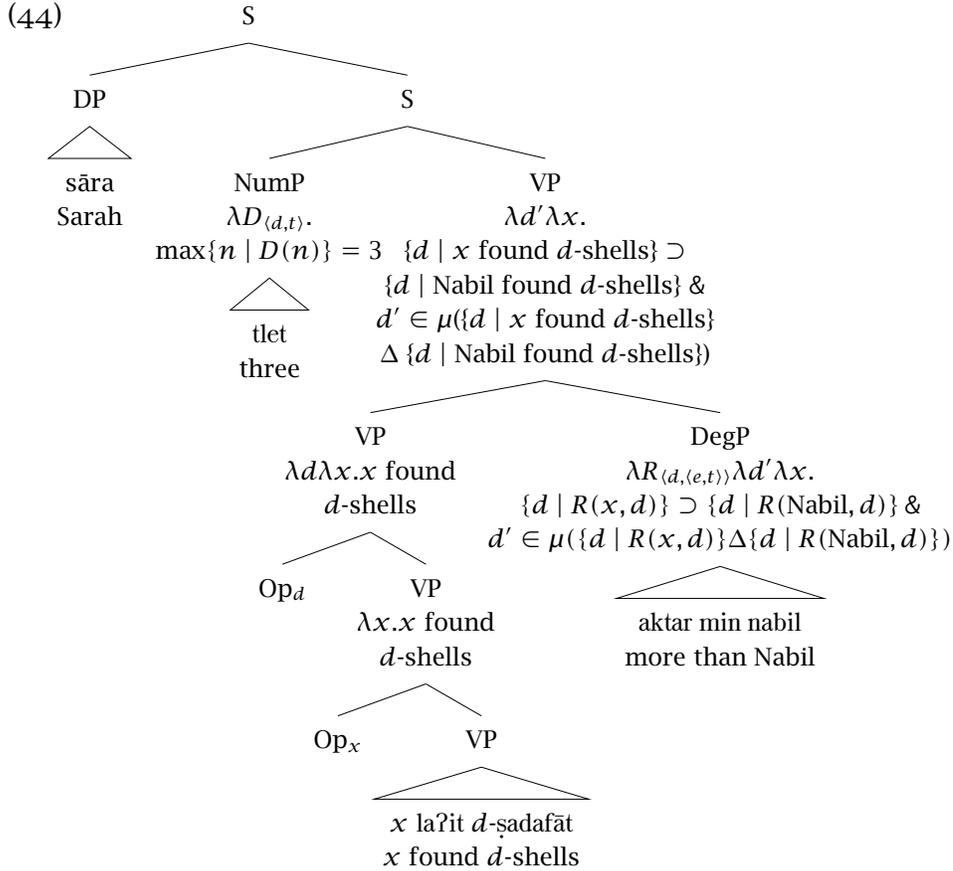
In the first derivational step, *Sarah* moves to a higher position, triggering insertion of the individual abstraction index  $Op_x$  in (42).



In the second step, the numeral *tlet* ‘three’ moves and adjoins to VP, interpolating itself between the moved subject *Sarah* and its abstraction index  $Op_x$  and triggering insertion of its own abstraction index  $Op_d$ , as illustrated in (43), on the model of movement of the comparative and superlative quantifiers in (31) and (32c) respectively. If numeral degree quantifiers are able



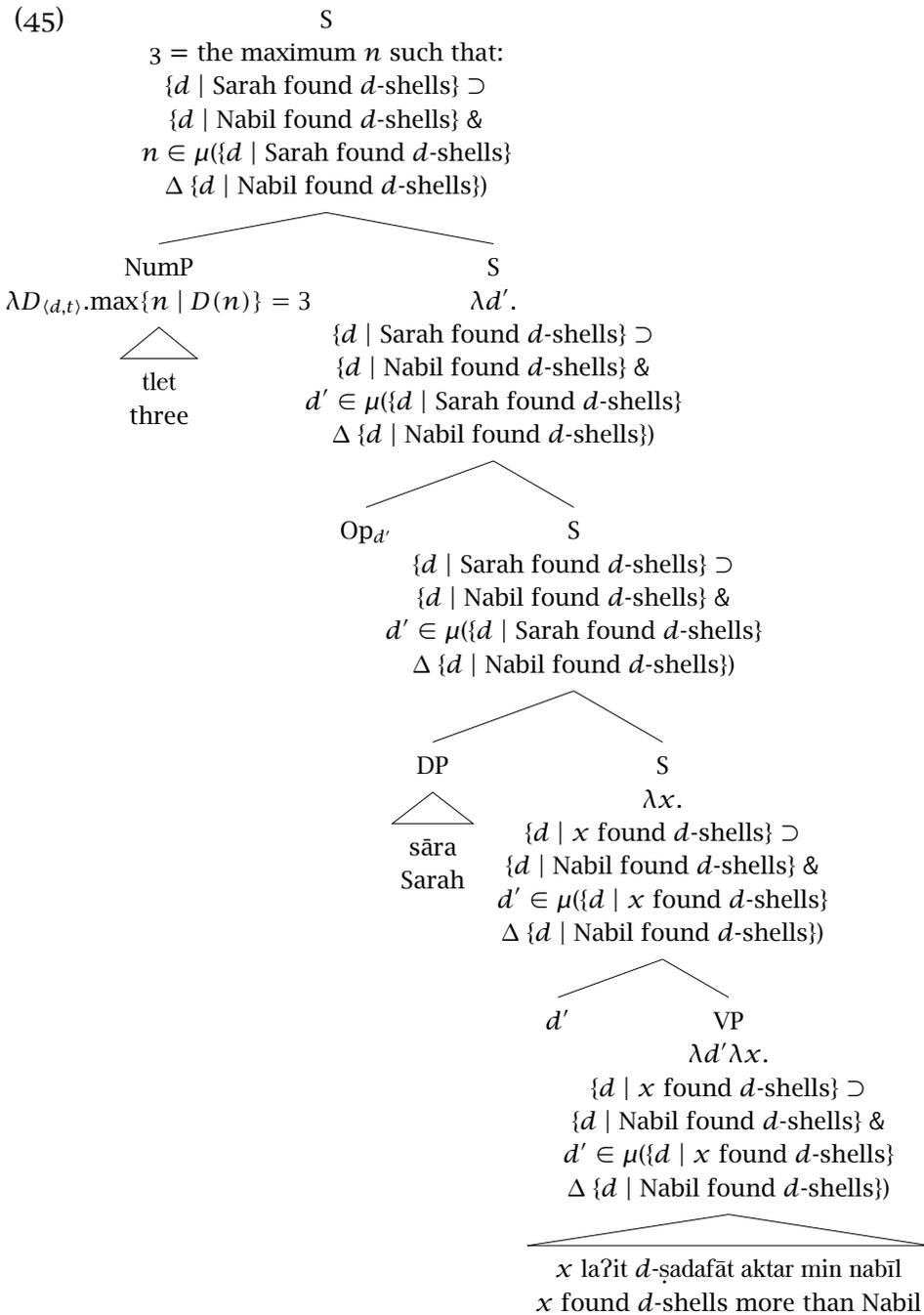
Numeral differential constructions in Arabic



The VP so derived is looking for a degree, but is combined with the degree quantifier *tlet* ‘three’. At this point, we can either lower the quantifier *tlet* to a degree-denoting expression, or move it, leaving a degree-denoting variable in its place, shown in (45). Now the whole tree can be composed, and this composition results in the desired reading according to which *tlet* ‘three’ is

be base generated in the degree argument position of the associated scalar predicate (the plural noun in the examples discussed above) because the numeral *tlet* ‘three’ is generated there, and movement of *tlet* derives the degree relation that the comparative is looking for, not movement of *aktar* ‘-er’ itself. This analysis does, however, have in common with Bhatt and Pancheva’s analysis that it orders a covert step (raising of *-er* in their analysis and of the numeral *tlet* here) before an overt step (merger of the standard clause in their analysis and of the whole comparative quantifier *aktar min nabil* ‘more than Nabil’ here). Bhatt and Pancheva invoke the copy theory of movement to accommodate this ordering disparity. According to the copy theory of movement, an overtly moved constituent may be pronounced in the position it moved from, mimicking covert movement (Chomsky 1995). On this view, the tree in (44) is derived prior to spell out, but the numeral *tlet* is pronounced at the ‘foot’ of the movement chain, adjacent to the noun.

interpreted as a differential. In this tree, *tlet* identifies the differential argument of *aktar* ‘more’ and *aktar* binds the degree variable left by movement of *tlet*.



If Sarah found five shells and Nabil found two, then  $\{d \mid \text{Sarah found } d\text{-shells}\} = \{1, 2, 3, 4, 5\}$  and  $\{d \mid \text{Nabil found } d\text{-shells}\} = \{1, 2\}$ . The first is a superset of the second, so the comparative claim is true. Further, the symmetric difference between the two sets (the union, which is  $\{1, 2, 3, 4, 5\}$ , minus the intersection, which is  $\{1, 2\}$ ) is  $\{3, 4, 5\}$ . The function  $\mu$ , which effectively counts the things in this set, applied to  $\{3, 4, 5\}$  yields  $\{1, 2, 3\}$ . The maximal element in  $\{1, 2, 3\}$  is 3. So the sentence in (40) is correctly predicted to be true in the situation just described.

This analysis therefore derives the attested interpretation for numeral differential constructions exemplified by (10)/(40). Again, the crucial ingredient in this analysis is one that seems to be necessary for the composition of garden-variety (phrasal) comparatives and superlatives, namely insertion of a quantifier between another term and the associated abstraction index. I claim that this is possible both as a result of movement ('internal merge'), as in the phrasal comparative in (31) and the superlative in (32c), and as a result of base generation ('external merge'), as in my analysis of numeral differential constructions. In the latter case, re-association of a displaced numeral with the comparative seen in sentences like (40) is expected, by virtue of the composition in (45).

The analysis therefore does not invoke novel semantic tools, but draws on those previously proposed to account for phenomena in which quantificational and descriptive material split apart at LF. Kennedy's analysis of numeral raising that I adopt here bears a resemblance to earlier analyses of sentences like (46a) (Kroch's (1998) example (12b), p. 26), which may be understood to be asking for what number  $n$  the editor decided to publish  $n$ -many books this year (Cinque 1990, Cresti 1995, Rullmann 1995, Kroch 1998). Here, the interrogative force of *how many* is external to VP but existential quantification over *books* is within the scope of *decide*. Similarly, Sauerland (2004) proposes a theory of the interpretation of traces that treats them as copies of the descriptive but not the quantificational content of the antecedent, so that the VP that is recovered as the content of the gap  $\Delta$  in (46b) (Sauerland's example (65), p. 87) contains the restriction *towns* but not the partitive quantifier *two of the*. The phenomenon I analyse here also bears a resemblance to 'event-related' readings of sentences like (46c). On this reading, (46c) (Krifka's (1990) example (1a), p. 487) holds when four thousand events of a ship passing through the lock took place last year, even if some ships passed through repeatedly, so that less than four thousand ships passed through total. Krifka postulates a null operator that applies to the nominal

*4000 ships* and converts it into a quantifier over event descriptions. The net effect is that the numeral *4000* counts events and *ships* is interpreted existentially within the VP.

- (46) a. How many books did the editor decide to publish this year?  
b. Erik visited two of the towns Polly did  $\Delta$ . ( $\Delta$ =visit towns)  
c. 4000 ships passed through the lock last year.

Like my proposal, these analyses treat discontinuities in the integration of the descriptive content of VP (the verb and its objects) on the one hand, and the integration of information concerning quantification and reference on the other. I have claimed that numeral differential constructions are an instance of this general phenomenon, but that they represent a situation in which the composed descriptive content of VP may be modified by additional descriptive material (the comparative phrase) before the displaced numeral is re-integrated. This is possible by virtue of the fact that the comparative phrase is type-logically a modifier, as [Kennedy & McNally \(2005\)](#) claim, and may intervene between a moved term and its abstraction index, as [Heim \(1999\)](#), [Bhatt & Takahashi \(2007\)](#), and others claim.

#### 4 A few more observations

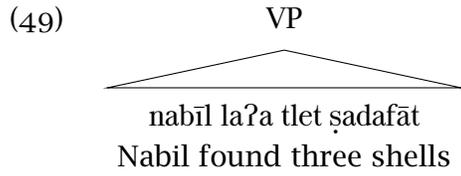
In this section, I demonstrate that the analysis fleshed out above extends to the ‘negative’ comparative *aʔall* ‘less’ in Arabic and discuss counterparts of *many*, *few* and *a few* in the role of the numeral in numeral differential constructions. Beginning with *less than* comparatives, example (47) describes the same situation as (40).

- (47) nabīl laʔa tlet ʕadafāt aʔall min sāra.  
 Nabil found three shells fewer than Sarah  
 ‘Nabil found three fewer shells than Sarah.’

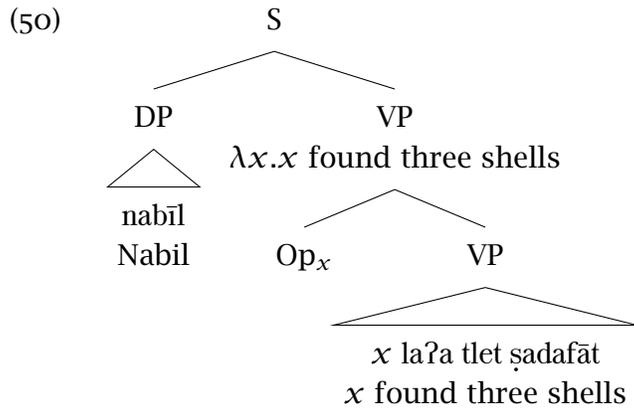
The term *aʔall* is morphologically composed of the comparative morpheme — the template *aCCaC* and the negative quantity adjective *ʔalīl* ‘little/few’. I attribute the definition in (48a) to *ʔalīl*, a variation on the analysis in Heim 2006 for English *little*. It combines with a degree relation *R* and builds a degree relation over the negation of *R*. I define *ktīr* ‘many/much’ as its positive counterpart in (48b), based on Solt 2015. I incorporate these terms into the comparative by virtue of the definition for *aCCaC* in (48c), which is the same as that in (38a) except that it combines first with a marker of ‘polarity’ — either *ktīr* or *ʔalīl* — in addition to its other arguments. The negative comparative quantifier phrase *aʔall* is defined in (48d) as the combination of *aCCaC* with *ʔalīl*, while *aʔall min sāra* ‘less than Sarah’, as it appears in (47) and the trees below, has the definition in (48e).

- (48) a.  $[[ʔalīl]] = \lambda R_{\langle d, \langle e, t \rangle \rangle} \lambda d \lambda x. \neg R(x, d)$   
 b.  $[[ktīr]] = \lambda R_{\langle d, \langle e, t \rangle \rangle} \lambda d \lambda x. R(x, d)$   
 c.  $[[aCCaC]] = \lambda \mathcal{P}_{\langle d, \langle e, t \rangle \rangle, \langle d, \langle e, t \rangle \rangle} \lambda y \lambda R_{\langle d, \langle e, t \rangle \rangle} \lambda d' \lambda x. \{d \mid \mathcal{P}(R)(x, d)\} \supset \{d \mid \mathcal{P}(R)(y, d)\} \& d' \in \mu(\{d \mid \mathcal{P}(R)(x, d)\} \Delta \{d \mid \mathcal{P}(R)(y, d)\})$   
 d.  $[[aʔall]] = \lambda y \lambda R_{\langle d, \langle e, t \rangle \rangle} \lambda d' \lambda x. \{d \mid \neg R(x, d)\} \supset \{d \mid \neg R(y, d)\} \& d' \in \mu(\{d \mid \neg R(x, d)\} \Delta \{d \mid \neg R(y, d)\})$   
 e.  $[[aʔall \text{ min } sāra]] = \lambda R_{\langle d, \langle e, t \rangle \rangle} \lambda d' \lambda x. \{d \mid \neg R(x, d)\} \supset \{d \mid \neg R(\text{Sarah}, d)\} \& d' \in \mu(\{d \mid \neg R(x, d)\} \Delta \{d \mid \neg R(\text{Sarah}, d)\})$

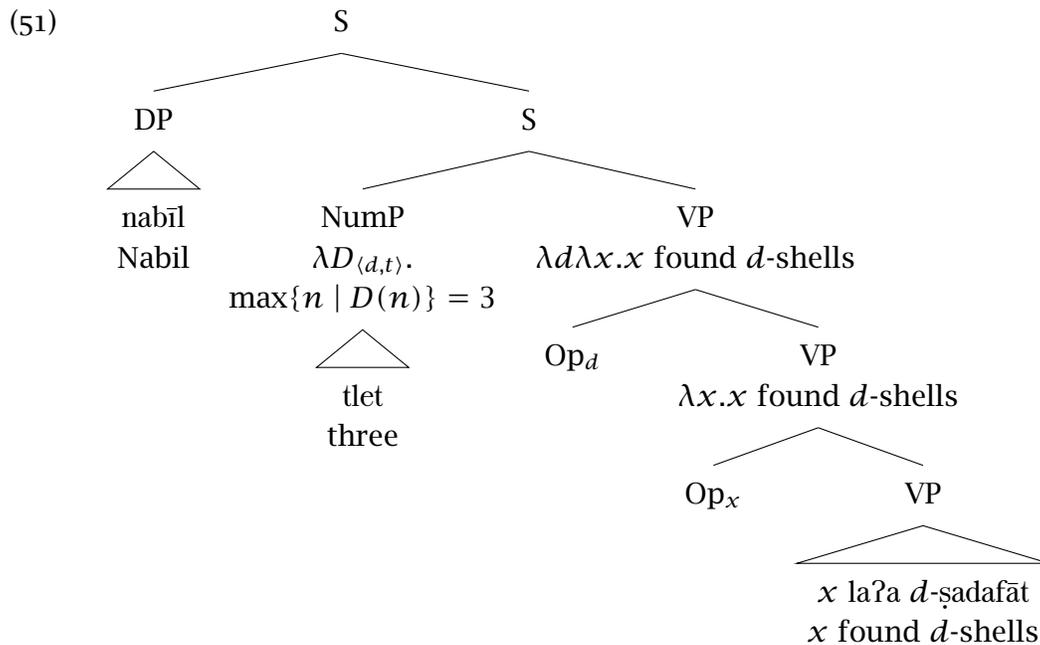
The derivation of (47) begins as before with the VP in (49).



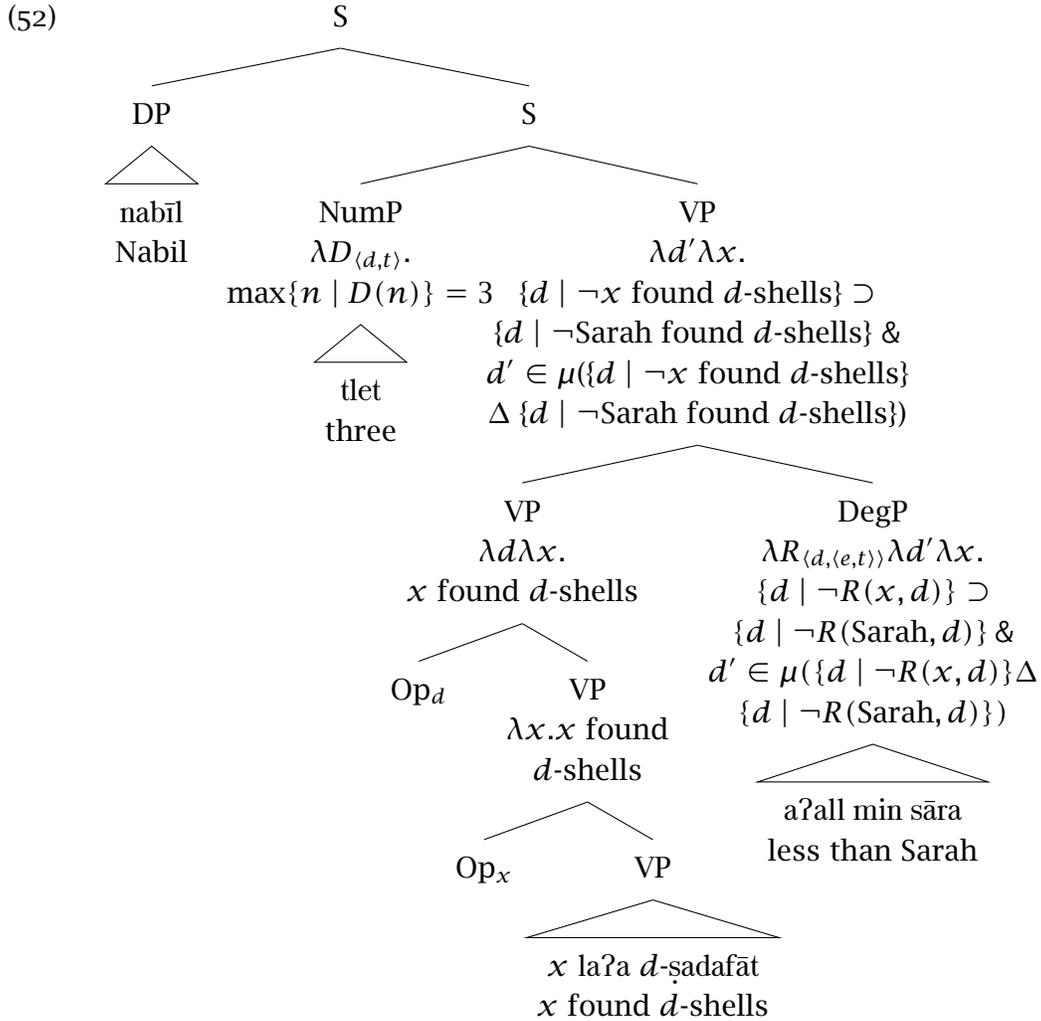
In the first step, the subject *nabīl* moves out of VP, triggering insertion of an abstraction index.



Then, the numeral *tlet* is interpolated between the moved subject and its abstraction index.

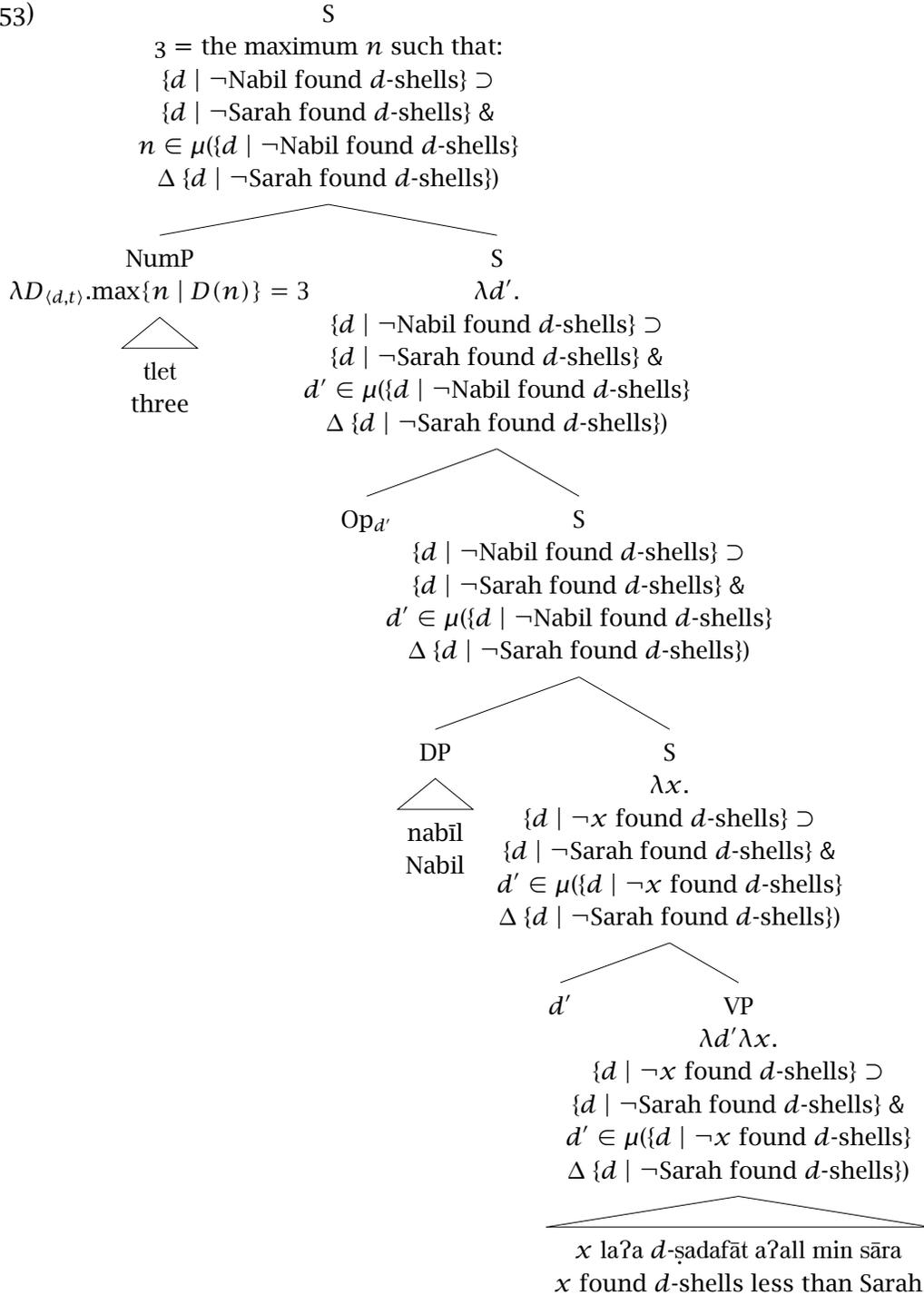


At this point we have derived a degree relation to which *aʔall min s̄ara* ‘less than Sarah’ can attach, again under the constituent we have just moved, as illustrated in (52).



As before, at this point we can type lower *tlet* ‘three’ to an individual degree or syntactically raise it to a position above the subject leaving an individual-denoting trace, as illustrated in (53), to create a structure that can be fully composed.

(53)



Suppose, as before, Nabil found two shells while Sarah found five. So  $\{d \mid \neg \text{Nabil found } d\text{-shells}\} = \{3, \dots, \infty\}$  and  $\{d \mid \neg \text{Sarah found } d\text{-shells}\} = \{6, \dots, \infty\}$ . Nabil's set is a superset of Sarah's set so the comparative claim is true (that Nabil found fewer shells than Sarah did, or to be exact, that Nabil is greater than Sarah in terms of how many shells he didn't find). The symmetric difference between the two sets (which again is the union  $\{3, \dots, \infty\}$  minus the intersection  $\{6, \dots, \infty\}$ ) is  $\{3, 4, 5\}$ , just as in the 'positive' counterpart in (45). The function  $\mu$  applied to this set returns  $\{1, 2, 3\}$ , the maximal element in which is 3. So the comparative claim and the differential claim are both true in this situation, as desired.

This analysis attributes a different type of denotation to *kt̄ir* 'much/many' and *?al̄il* 'little/few' than to the numerals like *tlet* 'three'. The former are degree relation modifiers (they map a degree relation to a degree relation) and the latter are degree quantifiers (they map a degree predicate to a truth value). This raises the question of how *kt̄ir* and *?al̄il* behave as differential-specifiers. At issue here are the Arabic equivalents of sentences like (54) in English. To this end, I expand briefly on the distribution of *kt̄ir* and *?al̄il*.

(54) Sarah found many/few more shells than Nabil.

The terms *kt̄ir* and *?al̄il* may occur as sentence predicates, as (55) shows (here in their plural form *kt̄ār* and *?l̄āl* respectively) in addition to their use as a base for the comparative.

(55) rif?āt-i kt̄ār / ?l̄āl.  
 friends-my many<sub>PL</sub> / few<sub>PL</sub>  
 'My friends are many/few.'

The term *kt̄ir* may occur as an adjective before or after a noun; in the pre-nominal position it does not display agreement with the noun, and in the post-nominal position agreement is optional but preferred. The term *kt̄ir* is special in this respect; all other adjectives follow the noun in Arabic.

(56) a. ?and-i kt̄ir rif?āt.  
 at-me many friends  
 'I have many friends.'  
 b. ?and-i rif?āt kt̄ār.  
 at-me friends many<sub>PL</sub>  
 'I have many friends.'

Its negative counterpart *?alīl*, on the other hand, may never precede a noun and only reluctantly follows it. The much preferred manner of expressing the proposition ‘I have few friends’ is as in (57c), where *?alīl* is separated out into negation and the positive quantity adjective *ktīr*.

- (57) a. \*ʕand-i ?alīl rif?āt.  
           at-me few friends  
           (‘I have few friends.’)  
       b. ?ʕand-i rif?āt ?lāl.  
           at-me friends few<sub>PL</sub>  
           ‘I have few friends.’  
       c. ma ʕand-i rif?āt ktār.  
           not at-me friends many<sub>PL</sub>  
           ‘I don’t have many friends.’

The term *ktīr* occurs naturally as an adverb but not *?alīl*. Again, *ma ... ktīr* ‘not ...much’ is preferred.

- (58) a. daras-t ktīr / ??alīl.  
           studied-1SG much / little  
           ‘I studied much/little.’  
       b. ma daras-t ktīr.  
           not studied-1SG much  
           ‘I didn’t study much.’

The notion ‘a few/a little’ is expressed by *fweyyit* in Syrian Arabic, etymologically the diminutive form of *fi* ‘thing’. It occurs prenominally, as in (59a) (parallel to *ktīr* in (56a)), as an adverb, as in (59b) (the *-it* suffix drops predictably when *fweyyit* does not directly precede a noun), but not predicatively, as (59c) shows (parallel to English ‘a few’ in the translation), nor as a post-nominal adjective, as (59d) shows.

- (59) a. ʕand-i fweyyit rif?āt.  
           at-me a few friends  
           ‘I have a few friends.’  
       b. daras-t fweyy.  
           studied-1SG a little  
           ‘I studied a little.’  
       c. \*rif?āt-i fweyy.  
           friends-my a few  
           (\*‘My friends are a few.’)

- d. \*ʕand-i rifʔāt fweyy.  
 at-me friends a few  
 ('I have a few friends.')

The term *fweyyit* makes an existential claim. Native speakers report that if I have no friends at all, I cannot say (59a) even facetiously. In this respect, *fweyyit* corresponds to *a few* and not *few*, a correspondence that is supported by the impossibility of its occurrence in predicate position (59c), just like English *a few*. In principle, Arabic has a counterpart to *few*, namely *ʔalīl*, used productively as a predicate and as a base for the comparative (and the superlative, not discussed here), but for reasons that remain unclear, not as an adjective.

To return to differentials, noun-modifying *fweyyit* can be used readily to designate a differential, and patterns like the numerals in this respect, though unlike the numerals, it is compatible with a collective noun. (60) describes the difference between the number of shells Sarah and Nabil found as amounting to 'a few'.

- (60) sāra laʔi-t fweyyit ʕadaf aktar / aʔall min nabīl.  
 Sarah found-3FS a few shells more / less than Nabil.  
 'Sarah found a few shells more/fewer than Nabil.'

I propose in light of this that *fweyyit* is semantically the same kind of thing as the numerals are — a degree quantifier that binds a degree variable — and displays the same scope possibilities. It combines with a degree property and asserts that the maximum value the degree property holds of is greater than 0 (because it makes an existential claim) but less than a contextually given value *c*. This definition can be plugged into the trees above to generate denotations for (60) with either *aktar* or *aʔall*.

- (61)  $\llbracket fweyyit \rrbracket^c = \lambda D_{\langle d,t \rangle}. 0 < \max\{n \mid D(n)\} < c$

The judgments concerning *ktīr* as a differential are somewhat less robust than those for *fweyyit*. Examples such as those in (62) are judged acceptable by all speakers, though not necessarily on both possible interpretations shown below.

- (62) a. *sāra laʔi-t ktīr ṣadaf aktar min nabil.*  
 Sarah found-3FS many shells more than Nabil.  
 (i) ‘Sarah found many more shells than Nabil.’  
 (ii) ‘Sarah found many shells — more than Nabil.’
- b. *sāra ʔtamd-it ʔala ktīr marāʔiʔ aktar min nabil.*  
 Sarah cited-3FS on many references more than Nabil  
 (i) ‘Sarah cited many more references than Nabil.’  
 (ii) ‘Sarah cited many references — more than Nabil.’
- c. *sāra ʔand-a ktīr ōrāʔ ʔadde aktar min nabil.*  
 Sarah at-her many cards card game more than Nabil  
 (i) ‘Sarah has many more cards than Nabil.’  
 (ii) ‘Sarah has many cards — more than Nabil.’

The two possible interpretations of the examples above are teased apart if we replace *aktar* ‘more’ with *aʔall* ‘less’. In this case the judgments are mixed. While some speakers accept the sentences in (63) others reject them, while pointing out that they can be salvaged by inserting *bass* ‘but’ before *aʔall*, so that e.g., (63a) reads ‘Sarah found many shells, but fewer than Nabil’. This last point suggests that those who reject the examples in (63) only accept the examples in (62) on a conjunctive reading of *ktīr* ‘many’ and *aktar* ‘more’, so that e.g., (62a) corresponds to ‘shells that are both many and more than the number of shells Nabil found’. In (63), this reading is awkward unless facilitated by *bass* ‘but’ in Arabic as in English (the (ii)-sentences below are awkward in English). In neither case does *ktīr* function as a differential specifier.

- (63) a. *sāra laʔi-t ktīr ṣadaf aʔall min nabil.*  
 Sarah found-3FS many shells more than Nabil.  
 (i) ‘Sarah found many fewer shells than Nabil.’  
 (ii) ‘Sarah found many shells — fewer than Nabil.’
- b. *sāra ʔtamd-it ʔala ktīr marāʔiʔ aʔall min nabil.*  
 Sarah cited-3FS on many references more than Nabil  
 (i) ‘Sarah cited many fewer references than Nabil.’  
 (ii) ‘Sarah cited many references — fewer than Nabil.’
- c. *sāra ʔand-a ktīr ōrāʔ ʔadde aʔall min nabil.*  
 Sarah at-her many cards card game more than Nabil  
 (i) ‘Sarah has many fewer cards Nabil.’  
 (ii) ‘Sarah has many cards — fewer than Nabil.’

I conclude that for some Syrian Arabic speakers, the term *kt̄ir* is ambiguous between the reading in (48b) and another reading analogous to *fweyyit*, where *kt̄ir* functions for all practical purposes like a numeral and has the same scopal options as a numeral. While *fweyyit* says of a degree predicate that the maximal value it holds of is less than a certain contextually fixed value, *kt̄ir*, on this interpretation, says it is greater than a certain contextually fixed value, as defined in (64). Like *fweyyit*, *kt̄ir* as defined in (64) may be plugged into the trees in Section 3 to derive its use as a differential specifier in constructions like (62) and (63).

$$(64) \quad \llbracket kt̄ir \rrbracket^c = \lambda D_{\langle d,t \rangle} . \max\{n \mid D(n)\} > c$$

For other Syrian Arabic speakers, the interpretation in (64) is not available for *kt̄ir*. For these speakers, *kt̄ir* may only be interpreted as defined in (48b), and on this interpretation, *kt̄ir* is scopally intransigent. It does not pattern like a numeral and does not participate in the derivational steps described in Section 3 that derive numeral differential constructions. These speakers do not allow *kt̄ir* in (62) and (63) to be interpreted as a differential specifier.

In summary, *kt̄ir* is potentially ambiguous between a degree quantifier that patterns like a numeral, may have wide scope and accordingly may occur in numeral differential constructions (in the role of the numeral, though it does not specify a specific quantity), and a degree relation modifier. This latter use is scopally restricted and so does not participate in numeral differential constructions. Some Syrian Arabic speakers admit only this latter use, and do not allow *kt̄ir* to be used in the role of a numeral. All speakers admit *fweyyit* ‘a few’ in this role. English *much/many* and *little/few* seem to be systematically ambiguous between these two uses.

## 5 Cross-linguistic implications

The discussion of French in Section 2 mentioned some aspects of Homer and Bhatt’s analysis of the French pattern that are difficult to reconcile with the Arabic pattern. But Homer and Bhatt show convincingly that the numeral and noun are combined to the exclusion of the comparative phrase in French, and function as an object of the verb, just as I have claimed for Arabic. This raises the question of whether the analysis of Arabic above might be extended to French. Further, a reviewer points out that English displays a selectional dependency between numerals and nouns that is reminiscent of the selectional relations shown to hold in Arabic, which supports treating Numeral+NP as

a constituent in numeral differential constructions. Specifically, the number feature of the noun depends on the numeral, being plural except when the numeral is *one*, as (65) shows. This is the case regardless of whether the comparative quantity adjective *more* precedes or follows the noun. Recall, too, as mentioned in Section 1, that extraposition of the comparative clause in English, seen in (66a) cannot take the numeral functioning as differential with it, as (66b) shows. The numeral is ‘locked’ in construct with the following noun. It appears that Bresnan’s analysis, which makes the numeral an argument of comparative *more* in the base structure, is based more on semantic perspicuity than on any empirical facts motivating that constituency.

- (65) a. Sarah found one <more> shell <more> than Nabil.  
 b. Sarah found two <more> shells <more> than Nabil.
- (66) a. Mary swam five laps more than Joan swam.  
 b. \*Mary swam five more than Joan swam.

But the analysis presented here has an ingredient that is difficult to reconcile with the syntax of comparative constructions in English and French. It is that in Arabic, the entire DegP *aktar min ...* ‘more than ...’ is base generated as a VP adjunct, not as an adjunct of the plural NP that functions as its scalar associate. That VP functions as a degree relation by virtue of movement of the numeral, not movement of the DegP. In Arabic, DegP is never within the plural DP that provides the degree variable it binds in numeral differential constructions. Homer and Bhatt analyse comparative DegPs (e.g., the phrase *de plus que Jean* lit. ‘of more than Jean’ in (19b)) as adjuncts of NP in their analysis of French. A facet of the English counterpart points to this same conclusion. Wh-movement of the object in the examples in (65) obligatorily pied pipes the comparative morpheme *more* and optionally the standard phrase. This seems to call for an analysis in which the comparative phrase is within the DP undergoing wh-movement, though the standard phrase may undergo extraposition.

- (67) a. How many more shells did Sarah find than Nabil?  
 b. How many more shells than Nabil did Sarah find?

The analysis defended here predicts that sentences like (67b) should be impossible in Arabic, and I argue below that this prediction is borne out. It is, as expected, possible for the string *kam şadafe* ‘how many shells’ to undergo wh-movement, stranding the degree quantifier *aktar min nabīl* ‘more

than Nabil’, as (68a) shows.<sup>7</sup> The judgments for the counterpart of (67b) in Arabic, shown in (68b) are both mixed and inconsistent across examples in the same syntactic format.

- (68) a. *sāra kam ṣadafe laʔi-t aktar min nabīl?*  
 Sarah how.many shell found-3FS more than Nabil  
 ‘How many more shells did Sarah find than Nabil?’  
 b. *%sāra kam ṣadafe aktar min nabīl laʔi-t?*  
 Sarah how.many shell more than Nabil found-3FS  
 ‘How many more shells than Nabil did Sarah find?’

This ambivalence about the status of (68b) is reflective of native speakers’ judgments about preposing the degree quantifier in declaratives. Example (69a) shows a degree quantifier preceding a gradable adjective, in (69b) it precedes a VP containing a plural scalar associate. Neither of these are consistently judged acceptable in Syrian Arabic, but nor are they consistently rejected.

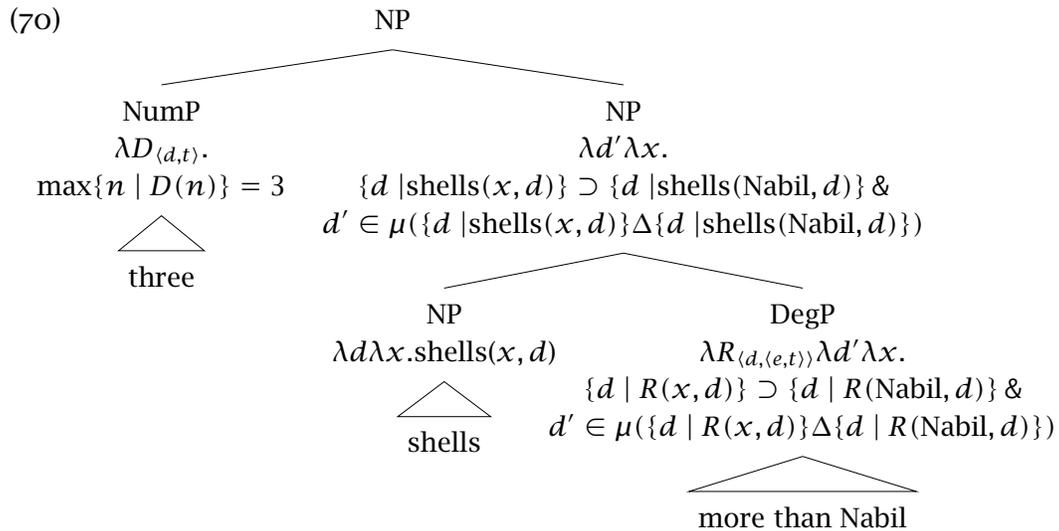
- (69) a. *%sāra aktar minn-i ḥilwe.*  
 Sarah more than-me pretty-FS  
 ‘Sarah is prettier than me.’  
 b. *%sāra aktar minn-i laʔi-t ṣadaf.*  
 Sarah more than-me found-3FS shells  
 ‘Sarah found more shells than me.’

This pattern presents an explanation for the judgments on (68b) in Arabic. The degree quantifier *aktar min nabīl* ‘more than Nabil’ is not actually part of the noun phrase *kam ṣadafe* ‘how many shells’ there. It is preposed independently of the fronted wh-phrase, and its marginality in that position reflects the general marginality of fronting a degree quantifier across VP in Syrian Arabic.

<sup>7</sup> A reviewer raises the question of how sentences like (68a) are interpreted, since the analysis I have proposed here requires the numeral (here in the form of the wh-word *kam* ‘how many’) to undergo quantifier raising independently of its restriction. In general, degree questions can be interpreted with the restriction in situ, even when the restriction is pied piped to the left clause edge in the surface structure; see the discussion surrounding (46a) above. I assume then that *kam* ‘how many’ in (68a) first undergoes raising to VP, deriving a degree relation to which the comparative phrase may apply, exactly on analogy to numerals, and from there it undergoes wh-movement to the left clause edge. Both steps pied pipe the restriction *ṣadafe* ‘shell’, but this restriction undergoes reconstruction at LF.

On one hand, these observations corroborate the analysis of Arabic proposed here. On the other, they would seem to preempt extending the analysis to the English sentence in (67b), where there can be no doubt that the degree phrase *more...than Nabil* is part of the wh-DP; the comparative morpheme *more* is sandwiched between parts of that DP and there is no general possibility of fronting a degree quantifier around VP in English.

In principle, DegP and NumP as defined here could combine directly with a plural NP, as illustrated in (70). Here, the numeral *three* correctly identifies the size of the differential, but the interpretation does not match the attested interpretation of *three more shells than Nabil* in another respect. It asserts that Nabil is a quantity of shells! It is crucial for the attested interpretation that DegP be outside the NP at the point where *R* is identified. But if we move DegP to a higher position, it will leave a trace denoting a degree variable, which then will saturate the degree argument of the noun *shells*. Then there is no degree predicate left for *three* to apply to. Even if we move *three* to a higher position, it will leave behind a degree denoting trace, which will not be able to be integrated into the NP structure.



This illustrates why it is crucial that the DegP is not base generated within the plural DP, but rather higher in the tree. Since it is merged high, it does not itself leave a trace of movement, rather it ‘picks up’ the trace left by movement of the numeral. The numeral then is free to bind the differential argument of the DegP. While this works elegantly for Arabic, it appears to bode badly for the possibility of extending this analysis to English.

As mentioned briefly in footnote 6, Bhatt & Pancheva (2004) argue that standard phrases in English are base generated (specifically ‘late merged’) in the scope position of *-er*, not in its base position within the noun phrase. They remark that examples like (71a) (their (72a), p. 35) pose a problem for that analysis, one that is similar to the problem described above. The apparent occurrence of *than Bill* between the two objects of the verb (*more presents* and *to Mary*) appears to contradict the claim that the lowest position in the clause that *than Bill* may occur in is the derived position of *-er* at the level of VP. They claim therefore that *than Bill* is in fact at the right VP edge but the phrase *to Mary* has been postposed further still. But this analysis of (71a) is difficult to reconcile with the constituent question facts in (71b) (parallel to (67b)), where the standard phrase seems to have been pied piped with wh-movement of the plural NP associate.

- (71) a. John will give more presents than Bill to Mary.  
 b. How many more presents than Bill will John give to Mary?

There is no evidence that quantity comparative *more than...* is ever interpreted locally to its scalar associate in English. The only evidence that puts comparatives within the maximal projection of the scalar associate is morphosyntactic: in English, *more* appears internal to the plural NP that functions as the scalar associate. But this morphosyntactic fact is not reflected in either the interpretation nor in binding configurations, as Bhatt & Pancheva (2004) show in detail. The facts in (67b) and (71b) are not easily reconciled with the analysis of Arabic presented here, but neither are they easily reconciled with the interpretational facts that motivate Bhatt and Pancheva’s late merger analysis of English. Arabic appears to reflect the LF scope of the comparative DegP in its surface word order, and the present analysis presents a mechanism through which a numeral adjacent to the plural scalar associate for the comparative may function as a differential specifier of the comparative at LF. In light of this, a mechanism that maps the English surface syntax to the Arabic LF would be desirable, but it is unclear at present how that is possible (see the discussion surrounding (70) above). Since Bresnan’s (1973) analysis does not predict the pattern in (65) and (66) and Homer & Bhatt’s (2020) analysis raises some unanswered questions of its own, as described in Section 2, I consider the question of whether and how French, English and Arabic might receive a unified treatment to still be open.

## 6 Conclusion

I have presented an analysis of sentences of the form *Sarah found three shells more than Nabil* in Syrian Arabic, in which the numeral *three* forms a syntactic constituent with the object noun but yet is interpreted as a specification of the differential of the comparative. In Syrian Arabic there is particularly compelling evidence for a tight selectional relationship between the numeral and noun, undermining an analysis in which the numeral forms a constituent with the comparative phrase in the base structure, which is then postposed in the surface structure, giving rise to the illusion that the numeral and noun form a constituent. Syrian Arabic displays a robust morphological selectional relationship between the numeral and noun even in such constructions, suggesting that the numeral functions in the syntax as a modifier of the noun. But I have shown that the interpretation in which the numeral nonetheless binds the differential degree argument of the comparative in the logical form can be derived using tools that are already common currency in semantic analysis. One is the premise that DegP movement need not extend the tree, which is a component of standard movement theories of the phrasal comparative and the superlative. Another is the notion that numerals are degree quantifiers that can have scope independently of the noun they modify in the surface structure. Consequently, the surprising interpretation of sentences of the kind treated here is in fact predicted by current assumptions in semantic theory.

## References

- Bhatt, Rajesh & Vincent Homer. 2019. Differentials crosslinguistically. In Daniel Altshuler & Jessica Rett (eds.), *The semantics of plurals, focus, degrees, and times: Essays in honor of Roger Schwarzschild*, 217–238. Cham, Switzerland: Springer Nature Switzerland. [https://doi.org/10.1007/978-3-030-04438-1\\_11](https://doi.org/10.1007/978-3-030-04438-1_11).
- Bhatt, Rajesh & Roumyana Pancheva. 2004. Late merger of degree clauses. *Linguistic Inquiry* 35(1). 1–45. <https://doi.org/10.1162/002438904322793338>.
- Bhatt, Rajesh & Shoichi Takahashi. 2007. Direct comparisons: Resurrecting the direct analysis of phrasal comparatives. *Semantics and Linguistic Theory (SALT)* 17. 19–36. <https://doi.org/10.3765/salt.v17i0.2958>.

- Al-Bitar, Ahmad. 2019. *The superlative in English and Arabic*. Tübingen: Universität Tübingen MA thesis.
- Bresnan, Joan. 1973. Syntax of the comparative clause construction in English. *Linguistic Inquiry* 4(3). 275-343. <http://www.jstor.org/stable/4177775>.
- Bruening, Benjamin. 2001. QR obeys superiority: Frozen scope and ACD. *Linguistic Inquiry* 32(2). 233-273. <https://doi.org/10.1162/00243890152001762>.
- Chomsky, Noam. 1993. A minimalist program for linguistic theory. In Kenneth Hale & Samuel Jay Keyser (eds.), *The view from Building 20: Essays in linguistics in honor of Sylvain Bromberger*, 1-52. Cambridge, MA: MIT Press.
- Chomsky, Noam. 1995. *The minimalist program*. Cambridge, MA: MIT Press. 420.
- Chung, Sandra & William Ladusaw. 2004. *Restriction and saturation*. Cambridge, MA: MIT Press. <https://doi.org/10.7551/mitpress/5927.001.0001>.
- Cinque, Guglielmo. 1990. *Types of A'-dependencies*. Cambridge, MA: MIT Press. 223.
- Cresswell, Max. 1976. The semantics of degree. In Barbara Partee (ed.), *Montague grammar*, 261-292. New York: Academic Press. <https://doi.org/10.1016/B978-0-12-545850-4.50015-7>.
- Cresti, Diana. 1995. Extraction and reconstruction. *Natural Language Semantics* 3(1). 79-122. <https://doi.org/10.1007/BF01252885>.
- Fassi Fehri, Abdelkader. 2018. *Constructing feminine to mean: Gender, number, numeral, and quantifier extensions in Arabic*. London: Lexington Books.
- Greenberg, Joseph. 1974. Numeral classifiers and substantival number: Problems in the genesis of a linguistic type. 17-37.
- Hackl, Martin. 2000. *Comparative quantifiers*. Cambridge, MA: Massachusetts Institute of Technology dissertation.
- Hackl, Martin. 2009. On the grammar and processing of proportional quantifiers: *Most* versus *more than half*. *Natural Language Semantics* 17(1). 63-98. <https://doi.org/10.1007/s11050-008-9039-x>.
- Hallman, Peter. 2016. Superlatives in Syrian Arabic. *Natural Language and Linguistic Theory* 34(1). 1281-1328. <https://doi.org/10.1007/s11049-016-9332-1>.
- Heim, Irene. 1985. Notes on comparatives and related matters. Ms., University of Texas, Austin. <https://semanticsarchive.net/Archive/zcoZjYoM/>.
- Heim, Irene. 1999. Notes on superlatives. Ms., University of Texas, Austin. <https://semanticsarchive.net/Archive/Th1MTlhZ/Superlative.pdf>.

- Heim, Irene. 2006. Little. *Semantics and Linguistic Theory (SALT)* 16. 35–58. <https://doi.org/10.3765/salt.v16i0.2941>.
- Hellan, Lars. 1981. *Towards an integrated theory of comparatives*. Tübingen: Gunter Narr.
- Homer, Vincent & Rajesh Bhatt. 2020. Measuring cardinalities: Evidence from differential comparatives in French. In Peter Hallman (ed.), *Interactions of degree and quantification*, 271–303. Leiden: Brill. [https://doi.org/10.1163/9789004431515\\_009](https://doi.org/10.1163/9789004431515_009).
- Jespersen, Otto. 1949. *A modern English grammar on historical principles, part II*. København: Munksgaard.
- Kayne, Richard. 2005. A note on the syntax of quantity in English. In *Movement and silence*, 176–214. Oxford: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780195179163.003.0008>.
- Kennedy, Chris. 2013. A scalar semantics for scalar readings of number words. In Ivano Caponigro & Carlo Cecchetto (eds.), *From grammar to meaning: The spontaneous logicity of language*, 172–200. Cambridge: Cambridge University Press. <https://doi.org/10.1017/CBO9781139519328.010>.
- Kennedy, Chris. 2015. A “de-Fregean” semantics (and neo-Gricean pragmatics) for modified and unmodified numerals. *Semantics and Pragmatics* 8(10). 1–44. <https://doi.org/10.3765/sp.8.10>.
- Kennedy, Chris & Jason Stanley. 2009. On *average*. *Mind* 118(471). 583–646. <https://doi.org/10.1093/mind/fzp094>.
- Kennedy, Christopher & Louise McNally. 2005. The syntax and semantics of multiple degree modification in English. *The 12th International Conference on Head-Driven Phrase Structure Grammar*. 178–191. <https://doi.org/10.21248/hpsg.2005.10>.
- Krifka, Manfred. 1990. Four thousand ships passed through the lock: Object-induced measure functions on events. *Linguistics and Philosophy* 13(5). 487–520. <https://doi.org/10.1007/BF00627291>.
- Kroch, Anthony. 1998. Amount quantification, referentiality, and long *wh*-movement. *University of Pennsylvania Working Papers in Linguistics* 5(2). 21–36.
- Li, Xiao. 2015. Degreeless comparatives: The semantics of differential verbal comparatives in Mandarin Chinese. *Journal of Semantics* 32(1). 1–38. <https://doi.org/10.1093/jos/fft013>.
- Ojeda, Almerindo. 1992. The semantics of number in Arabic. *Semantics and Linguistics Theory (SALT)* 2. 303–325. <https://doi.org/10.3765/salt.v2i0.3040>.

- Partee, Barbara. 1987. Noun phrase interpretation and type-shifting principles. In Jeroen Groenendijk, Dick de Jongh & Martin Stokhof (eds.), *Studies in discourse representation theory and the theory of generalized quantifiers*, 115–143. Dordrecht: Foris Publications. <https://doi.org/10.1515/9783112420027-006>.
- Rett, Jessica. 2006. How *many* maximizes in the Balkan sprachbund. *Semantics and Linguistics Theory (SALT)* 16. 190–207. <https://doi.org/10.3765/salt.v16i0.2939>.
- Richards, Norvin. 1997. *What moves where when in which language?* Cambridge, MA: Massachusetts Institute of Technology dissertation.
- Rullmann, Hotze. 1995. *Maximality in the semantics of wh-constructions*. Amherst, MA: University of Massachusetts at Amherst dissertation.
- Sauerland, Uli. 2004. The interpretation of traces. *Natural Language Semantics* 12(1). 63–127. <https://doi.org/10.1023/B:NALS.0000011201.91994.4f>.
- Sharvit, Yael & Penka Stateva. 2002. Superlative expressions, context, and focus. *Linguistics and Philosophy* 25(4). 453–504. <https://doi.org/10.1023/A:1020875809794>.
- Solt, Stephanie. 2015. Q-adjectives and the semantics of quantity. *Journal of Semantics* 32(2). 221–273. <https://doi.org/10.1093/jos/ffto18>.
- von Stechow, Arnim. 1984. Comparing semantic theories of comparison. *Journal of Semantics* 3(1-2). 1–77. <https://doi.org/10.1093/jos/3.1-2.1>.

Peter Hallman  
Austrian Research Institute for Artificial  
Intelligence  
Freyung 6/6  
1010 Vienna, Austria  
[peter.hallman@ofai.at](mailto:peter.hallman@ofai.at)