Complex Numeral Expressions: A Plea for Grafts°

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Abstract. Grafting is a syntactic device developed and defended by van Riemsdijk (2000 and subsequent work) by which two independent input trees are connected via external remerger of internal elements, thus sharing a constituent. Grafting clearly violates standard assumptions about phrase structure. Still, several structures found in natural language are best analyzed in terms of grafting. The present paper discusses one such construction: complex numerals. It shows that the characteristic multidominance of grafting explains the word order, case assignment, plural, paucal, and singular distribution associated with complex numeral combinations better than a coordination approach and is more compatible with more number (or counting) systems found in the world's languages.

1. Introduction: What Is Grafting?

In a series of contributions, van Riemsdijk (2000, 2005, 2006, 2010, among others) has developed a theory of syntactic grafting. In this framework, the innovative and simultaneously controversial point for phrase structure is that under certain conditions a daughter node may be dominated by two mother nodes. Consequently, these grafting trees go beyond traditional phrase markers that arise through regular phrase structure rules. Thus, it does not come as a surprise that grafting faces a similar level of criticism and scepticism as other related or comparable syntactic systems generating "multidimensional" trees. Many researchers apparently refuse grafting on principled grounds, but it seems that some critics might be convinced by the number of constructions that fare well under a grafting analysis. Van Riemsdijk has already expanded the class of multidimensional constructions to include a series of more or less unrelated configurations that go beyond the perhaps already classic right-node-raising structures (Ross 1967 and subsequent work on across-the-board reduction)—for example, several types of free relatives, Horn and Lakoff amalgams, the *far-from* construction in English (Kajita 1977), and the *sowas-von* construction in German (see Meinunger 2006), among many others.

The present paper addresses complex cardinal numerals: yet another construction in natural language that seems to be best described in terms of grafting. Previous treatments cannot, or can only very rarely, account for the rather quirky behavior of certain complex numerals in interaction with nouns quantified by them. Thus, this paper aims to contribute to the empirical side of the grafting issue by discussing a

construction that, on the one hand, fails to be properly captured by classic syntactic rewrite rules and, on the other, fits elegantly into van Riemsdijk's grafting machinery. It will also indicate the necessity of constraining and restricting grafting.

Before applying grafting to complex numerals, I want to first give a very short sketch of what grafting is. Example (1) shows a prominent example: the *far-from* construction, which was intensively discussed for the first time by Kajita (1977).

(1) a. a far-from-simple matter
     b. (This matter is) far from simple.

(2) This town is not far from Vienna.

Within von Riemsdijk's grafting approach, the assigned tree (or trees) captures the intuition that in some sense *simple* is an adjectival modifier of *matter*: after all, semantically it is a *matter* that is *simple* or not—and not *far*. On the other hand it seems that *far from* is not a regular constituent in the sense of an adverbial degree modifier like *very*, *hardly*, *almost*, or the like. Under this quite normal perspective, it seems that *from*—undoubtedly being a preposition—requires a complement, which is the word or constituent that follows it, in the present case: *simple*. This can be better understood if it is compared to its occurrence in a sentence like (2). In either example, *from* acts like a preposition that requires a complement. These considerations get us into a bracketing paradox. A graft structure can resolve such an ambiguous situation. The relevant tree then grows from two different directions.

(3)
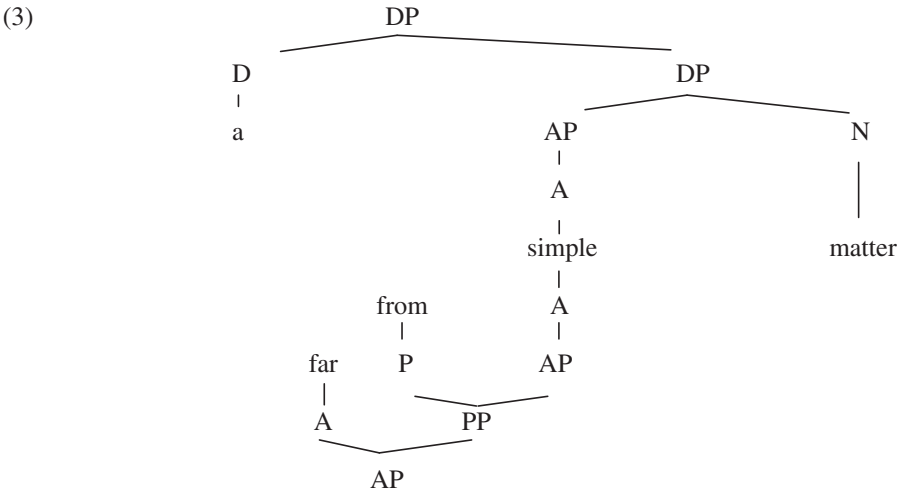
Understandably, such an approach is very delicate, and hence the status of the tree in (3) is highly controversial. The structure in (3) violates standard (i.e., classic)

assumptions about phrase markers, such as that (i) branches, which link nodes, cannot cross, or (ii) a daughter node may not be dominated by more than one mother node.

Grosu in a series of papers and talks (2007, 2010) reconsiders each of van Riemsdijk's constructions and concludes that all of them not only can but even should be given an analysis different from grafting. His arguments are worth considering. Grosu offers alternatives that are in some sense convincing. After all, his approach supports a grammar without multidimensional trees, which is in accord with a traditional and more restrictive theory of phrase structure. However, many of Grosu's alternative proposals make use of more elaborate structures that contain more empty categories or silent, unpronounced structures.[1] In any event, it seems that the attractiveness of an approach in general, and of grafting in particular, grows with the number and breadth of linguistic phenomena that it covers. Further potential constructions to be approached with a grafting analysis are parentheticals or apokoinus (e.g., Kluck 2011 and Meinunger 2011, respectively). It is in such structures where traditional treatments face difficulties. The present article aims to present one more of these constructions: "words" or collocations like *seventy-three* (73) or *21 books*.

It is argued here that many composed (i.e., complex) numerals are grafts in syntax, which means that for the combination of such a numeral with a quantified NP, only a subpart of the complex expression is syntactically active—namely, the smaller or smallest unit. "Syntactically active" here means that only the smallest unit (last digit) has grammatical influence on the projection line. This implies that the decimal or higher potencies are as if they were "faded out."

2. Evidence from Several Languages

2.1. The Case of Russian

The first examples come from Russian. In this language, in structural-case positions, the behavior of the cardinal *odin* 'one' can be explained in two ways. The first possibility is that it does not assign case, in which case morphological case is licensed from outside to the whole noun phrase.[2] The other option is to assume that *one* assigns either nominative or accusative case according to the following constituent within the clause.

(4) a. Ja delayu odin šag.   b. Ja vižu odnu   čašku.
    I make one step.NOM/ACC   I see one.ACC.F cup.ACC.F
    'I take one step.'   'I can see/am seeing one cup.'

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[1] Quite a few linguists reject empty categories altogether, but many do accept them. However, the majority of those researchers who do assume empty elements are very careful. It seems that postulating empty categories or silent structures is a delicate enterprise, and for many grammarians an analysis that does without empty elements is superior to one that postulates them. Similar difficulties apply to the assumption of genuine incomplete structures. Grosu entertains such an approach to capture Horn amalgams. This is an option, but it seems hard to give conclusive evidence for such a stance.

[2] Here the forms for *one* are real cardinals, not indefinite articles. Like most Slavic languages, Russian has no simple definite or indefinite determiners.

So far, things are not unusual. However *dva/dve* 'two.M/F/N', *tri* 'three', and *četyrje* 'four' do assign case (namely genitive) and remarkably singular. Sometimes this case–number combination in this very function is considered to be paucal.[3]

(5) a. Ja delayu dva šaga.   b. Ja vižu dve čaški.[4]
     I   make   two step.GEN   I   see   two cup.GEN

P'at' 'five', *šest'* 'six', *s'em'* 'seven', and other numbers up to 20 assign genitive plural. The same case–number form is found on nouns after quantifiers like *mnogo*, *skol'ko*, and *malo* 'many, how much/how many, few' if the nouns that combine with the numeral are countable.

(6) a. Ja delayu šest' šagaov.   b. Ja vižu dev'at' čašek.
     I   make   six   step.GEN.PL   I   see   nine   cup.GEN.PL

The crucial observation is that as the cardinal value increases, things begin again: 21 appears with either nominative or accusative singular, as in (7). The numbers 22, 23, and 24 assign genitive singular (paucal), as in (8); and 25, 26, and so on up to 30 assign genitive plural, as in (9).

(7) a. Ja delayu dvacat' odin šag.
   b. Ja vižu   dvacat' odnu čašku.

(8) a. Ja delayu dvacat' dva šaga.
   b. Ja vižu   dvacat' dve čaški.

(9) a. Ja delayu dvacat' sem' šagov.
     I   make   twenty seven step.GEN.PL
   b. Ja vižu dvacat' sem' čašek.
     I   see   twenty seven cup.GEN.PL

Things repeat with 30, 40, 50, and so on. Thus, 41 appears with the singular, although it is clearly a case of pretty high plurality, as in (10), similarly to a number such as 182, which represents a mismatch between paucal marking on the one hand and a clear case of semantic plural with high cardinality on the other, as in (11).

(10) sorok odin stol
     forty one table.NOM/ACC

[3] Things become more complicated if adjectives are involved. These show up with genitive plural marking in normative grammar, at least for the masculine forms. I refer the reader to any standard Russian grammar text. The details are not important here, however.

[4] The genitive singular *čaški* is accidentally syncretic with the nominative or accusative plural.

(11) sto   vos'em'des'at'   dve   čaški
     hundred eighty   two.F cup.GEN.SG

   So far we have seen that, for case assignment inside the complex noun phrase or number XP, only the small unit counts. It is the last digit within the larger cardinal numeral that affects the morphosyntactic form of the upcoming noun or adjective+noun combination. The higher potency positions do not count. It is as if they were faded out. A graft approach can account for this behavior easily and elegantly; see (14) and (15). We are thus faced with a bracketing paradox: in (10), morphosyntactically the unit (numeral) *odin*—without the tens unit (40)—goes together with the quantified noun. Semantically, however, it is part of the word(-like structure) *sorok odin* '41'.[5]

   Further evidence comes from the interaction of cardinally quantified subjects and verbal agreement. Here, however, speakers' intuitions are somewhat less clear cut, but solid enough. Again it is the influence of the small digit rather than the clear semantic plurality of the complex number that triggers singular agreement on the verb. Consider the respective answers to the "how-many" question shown in the next set of examples.

(12) [Q: Skol'ko   studentov   prišlo?]
         how-many students.GEN.PL came.SG.N
         'How many students came?'
     A: Dvacat' odin student   prišel/*prišlo/*prišli.
        twenty   one   student.SG came.SG.M/SG.N/PL
        'Twenty-one students came.'

(13) [Q: Skol'ko studentov prišlo?]
     A: Dvacat' tri   studenta   / dvacat' sem'   studentov
        twenty three student.SG.GEN twenty seven student.PL.GEN
    *prišel/prišlo/prišli.
    came.SG.M/SG.N/PL

As one can see in (12), if the complex cardinal ends in *odin* (as is the case for 21, 31, 41, etc.), not only does the counted entity's NP show up in the singular, but the verb does as well. With cardinals higher than one, either plural or neuter singular agreement (despite the masculinity of the noun *student*) is triggered. Thus at least for

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[5] In addition to the grafting approach, two alternatives are conceivable. The first could be a sort of derivational variant of the rather representational grafting analysis. In approaches to bracketing paradoxes, theoreticians like Kiparsky (1982) or Pesetsky (1985) make use of level-ordering, thus serialization of rules and principles. This would be one, albeit not too different, way of approaching these structures.
   A second option was suggested as an alternative by one of the reviewers—namely, restricted and selective feature activity. Thus, an uninterpretable number feature is associated with *odin* (singular), which percolates up to the complex phrase and coexists with the interpretable feature (presumably the cardinality) of 41. The uninterpretable feature triggers singular morphology but is invisible to semantics. This effect on the morphology is presumably accompanied by the feature's deletion (checking off).

these cases it seems that only the small monomorphemic digit is syntactically active. A graft captures this situation very straightforwardly:

(14)

NumP

∅   Num′

Num   NP

~~dvacat'~~ dva   šag-a

twenty   two   step-GEN

numeral word

The complex numeral is generated—or structured—independently of the rest of the linguistic environment; only the small digit, which acts as a quasi-quantifier or determiner, links the high number with the rest of the clause, much like a hinge. The structurally analyzed sentence in (15) shows this in more detail.

(15)

TP

NumP   VP

Num   N(P) V^0

dvacat' odin   student   prišel
twenty one   student   came.SG

numeral word

2.2. Evidence from German

I will return to Russian later, but the next construction to be discussed, which is similar to the Russian case just presented, comes from German. This language uses the relatively widespread so-called *Voranstellung der Einer*—the preposing of the small units (Menninger 1969; "turns of speech" or "reverse position of the units"). This device is not so uncommon for double-digit numbers in many languages or number systems. To illustrate: 23 (*dreiundzwanzig*), for example, is literally "three-and-twenty," thus the small digit comes first. German exploits this device for all

two-digit numbers from 13 to 99, with exceptionless formation regularity from 21 upward. Twenty-one itself, according to the pattern, is "one-and-twenty," thus the *ein* '*one*' is left-peripheral. After bigger numbers (from three digits), however, the small unit finds itself right-peripheral: 201: *zweihunderteins* or *zweihundertundeins*; 306: *dreihundertsechs* or *dreihundertundsechs*; 1001: *eintausendundeins* or *eintausend-eins*. If adjacent to the quantifiable NP, *ein* behaves as if it were bracketed off, going together and inflecting in case with the noun (phrase), which appears in the singular, although the semantics of the whole is clearly that of a plurality.

(16) ein   Haus
      one   house
      'one house'

(17) einunddreißig   Häuser
      one-and-thirty   house.PL
      '31 houses'

(18) *einunddreißig   Haus
       one-and-thirty   house.SG

(19) dreihundertundein   Haus
      three-hundred-and-one   house.SG
      '301 houses'

(20) *dreihundertundein   Häuser[6]
       three-hundred-and-one   house.PL

Thus, in German, 301 has a singular noun phrase after it. One also sees this nicely with the oriental Scheherazade fairy tales. In English, Scheherazade is the storyteller of "One Thousand and One Nights": *night* in the plural. In German and Dutch, one calls the fairytale collection: "Märchen aus 1001 (tausendundeiner) Nacht"—with singular case marking on the noun *Nacht* but also and foremost on the number or the seeming indefinite article *einer* (in Dutch, it is "De Vertellingen (or Sprookjes) van Duizend-en-één-nacht," also singular). And it is again exactly this behavior that can and perhaps even must be captured with grafts.

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[6] There exists, however, another option: *dreihunderteins*, which is the number when counting: …298, 299, 300, 301, 302…. With this form, the plural is possible: ?*dreihunderteins Häuser* (301 houses).

(21)
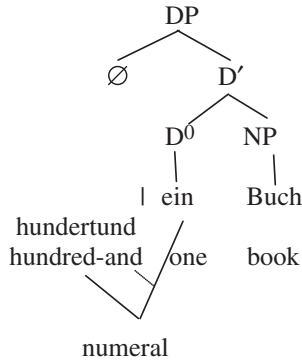
A grafting approach can handle the construction straightforwardly.

One of the reviewers suggests a reasonable alternative, which would be compatible with a bidimensional and hence more conservative analysis. Many of the cases like (10), (11), (19), or (21) could be viewed as cases of (erroneous) proximity concord or local agreement, much like the famous sentences in (22) and (23) from Bock & Miller 1991. Even closer to the numerals discussed here would be Morgan's (1984) examples in (24) and (27), where the grammatical influence is triggered locally rather than globally—respecting structural dependencies.

(22) The key to the ornate Victorian cabinets was/*were lost.

(23) The keys to the ornate Victorian cabinet *was/were lost.

(24) More than one student has/*have passed the exam.

Capturing these data in a bidimensional approach implies (according to the reviewer) viewing morphological agreement as a postsyntactic PF process. Pfau (2003) questions such an approach for these data. He argues that such a stance is in the spirit of classic minimalism, yet based on specific empirical grounds and theoretic extrapolations he adopts the late insertion model from Distributed Morphology, which in turn generates its own difficulties. In light of this uncertainty, it seems consistent to pursue the graft approach, which handles the data quite elegantly. This applies all the more as the proximity data in (22) and (23) are generally considered to be shaky and remind one of so-called grammatical illusions, whereas the Russian data in section 2.1 are crystal clear.[7]

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[7] The same reviewer proposes checking (19) as to which agreement such an NP will trigger if it appears in subject position. This suggestion is very much justified because it would strengthen the argument as much as the Russian examples (12) or (15). Unfortunately, the judgments are not as solid. There seems to be a strong preference for singular agreement on the verb—when the subject is singular as well, of course— but this is not mandatory. So, in defending a very controversial approach, I will at least stick to uncontroversial data.

Furthermore, the proximity hypothesis seems to be disproven by the following data. In non-subject-initial verb-second structures where the numeral appears right after the finite verb and begins somewhat pleonastically, but perfectly possibly, with *ein* ('one', as in 142 "*einhundertzweiundvierzig*," 1013, 124, etc.), the verb still can never be in the singular, as would be expected under the proximity-concord approach.

(25) Letztes Jahr *wurde/wurden **ein**hundertzwanzig Lehrer entlassen.
       last   year was/were   one hundred twenty teacher fired
       'Last year 120 teachers were fired.'

(26) Gestern   wurde ein Lehrer entlassen.
                                    (*Lehrer* is syncretic for singular and plural)
       yesterday was   one teacher fired

This is similar to the other crucial set of Morgan's examples, where the agreement is anti-local (cf. (24) vs. (27)).

(27) More students than one have/*has passed the exam.

Furthermore, another set of related data seems to refute the proximity hypothesis. This is the case where there is no adjacency at all—on the contrary. There is a construction in which, if it is analyzed as a graft, the *callus* (i.e., the shared element) is separated from the agreement trigger by intervening material. The pertinent structure is the sort of irreversible binominal discussed by Müller (1997). There are cases where the second element of the coordinated material agrees with the DP-initial material, such as determiners, numerals, and adjectives, in number and case. At the same time, the adjacent elements show incompatible morphological features, which suggests that they behave as if they are invisible for the regular syntactic environment:[8]

(28) von 1000 durchgeweinten [Tag/*Tagen   und Nächten]
       of 1000 wept-through   day.DAT.SG/day.DAT.PL and nights.DAT.PL)
       'of 1000 wept-through days and nights'

This case is similar to the discontinous grafts of the Celtic numeral constructions to be discussed in the next section.

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[8] Example (28) is taken (via Müller) from Goethe, who also provided (i):

(i) mit allem/*aller   mobilen [Hab   und Gut]
     with all.DAT.N/DAT.F mobile   having.F and property.N
     'with all mobile belongings'

Müller develops an analysis that is quite different from the proposal here, mainly because he is interested in a different issue (i.e., the linear order of the two coordinated elements), but what is remarkable is his detailed argument that these binominal structures are not compositional. This stance is completely congruent with the position advocated in the present article; see section 5.
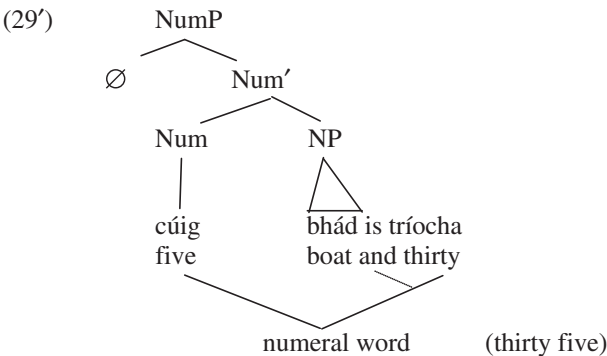
2.3. Most Compelling Evidence from Celtic

In some languages, especially in traditional Celtic, complex numerals with quantized nominals split in the following way: the small, which means the decisive, unit is set off together with the NP to be quantified, and only then do the higher potencies follow to the right. This results in a discontinuous numeral, as in (29) and (30) (see also Duffield 1995).[9]

(29) cúig bhád is tríoca   Modern Irish
     five boat and thirty
     '35 boats'

(30) seachd fir   deug   Scottish Gaelic
     seven man ten
     '17 men'

In these examples, just the small unit—a monomorphemic number or quantifier—links syntactically with the noun; the rest comes in an uncanonical way afterward. A graft seems to be the best analysis for such a structure.

(29′)   NumP
         ∅   Num′
             Num   NP
             |
            cúig   bhád is tríocha
            five   boat and thirty

            numeral word   (thirty five)

For more, even more complicated examples, see section 3.1. Duffield (1995) mentions that a similar behavior of "teen straddling" is attested in the Aztec-Mayan language Nahuatl. This language has in addition to a regular variant (see (31a)) the Celtic-like discontinuous pattern (see (31b)), just without the preposing of the small unit.[10]

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[9] Thanks for the advice to Andrew Carnie and an anonymous reviewer.

[10] That complex numeral quantification may result in discontinuous numbers is also described by von Mengden (2009) for Old English. His examples, however, all involve three- or four-digit numbers. These do not reverse in the front, thus it is not the small unit that combines with the noun to be counted but a larger base, as in (i). The phenomenon of splitting, however, remains, much as in the relevant Nahuatl example:

(i) þreo hund   muneca and twa and fiftig
    three hundred monks and two and fifty
    '352 monks'

(31) a. niquitta màtlactli omeyi cuahuitl.
　　　 I-see　　 ten　　　 three　　 tree
　　 b. niquitta màtlactli cuahuitl omeyi.
　　　 I-see　　 ten　　　 tree　　　 three
　　 Both: 'I see 13 trees.'

3. Complex Numerals in the System of Ionin & Matushansky (2006)

3.1. A Tempting Syntactic Proposal, yet with Specific Problems

Under certain conditions, the data presented in the preceding section can also be dealt with in the framework of Ionin & Matushansky (2006), who offer a comprehensive analysis of complex numbers. Although they are more concerned with the semantics, they give a concrete syntactic analysis. Ionin & Matushansky propose an intuitive and, at first glance, reasonable structure: they analyze a number such as 26 (twenty-six) as a regular coordinative structure, as in (32), with coordination projecting according to the ordinary X' frame for conjunction.

(32)

ConjP
NP Conj′
Conj^0(&) NP
twenty NP six NP
~~books~~ books
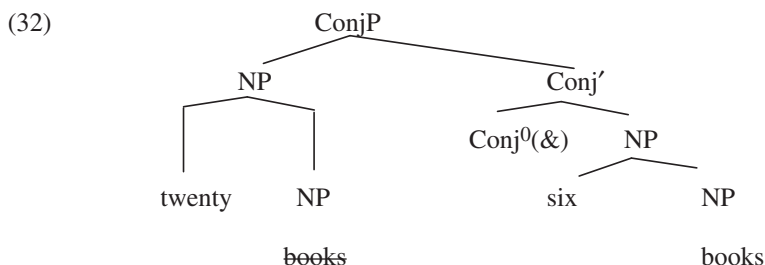
Such an approach is not inelegant, and it can capture some of the phenomena I have presented so far. The analysis, however, suffers from many severe problems. All center around the issue of why and how the quantified NPs—which means the entities that are assigned the relevant cardinality—are spelled out only once. For all relevant examples, there is only one phonetic realization of the quantized things. Normally, all conjunction reductions have a full version that is grammatical. All instances of gapping or other versions of ellipsis allow a fully fledged version without deletion. These alternative longer options may sound a bit unnatural or redundant in normal spoken communication, but they are always possible. Not so with complex numbers:

(33) */#In my whole life, I have seen 80 movies and 7 movies.

Also, in cases where the counted entities appear as subjects, pragmatic constraints would yield different readings (Grice's maxim of quantity).

(34) Hier haben sich gestern 26 Studenten getroffen.
     here have REFL yesterday 26 students   met
     'Yesterday 26 students met here.'

(35) (#)Hier haben sich gestern 20 Studenten und 6 Studenten getroffen.
      'Yesterday 20 students and 6 students met here.'

In (35), which is marked, the predominant reading is that two groups met, one consisting of 20 students, the other of six. Example (34) does not favor such a reading at all, although it would not exclude it. Nevertheless, let us tacitly assume that we do have ellipsis in all these examples. After all, (33)–(35) could well be argued to be pragmatic in nature and hence beyond regular syntax. Still, one has to explain how it comes about, that is, how *twenty-six books* is derived from *twenty books and six books*.

What Ionin & Matushansky suggest is not surprising: they name either right-node raising (RNR) or phonological deletion.[11] Both approaches fail to capture cases that involve numbers ending in one (21, 31, 41, etc.). The crucial point is that RNR as well as the decisive variant of deletion are bound to (morpho)phonological identity. This is evident for RNR: the moved element can be reconstructed into its two (or more) associated base positions resulting in a licit structure only without any morphophonological modification; otherwise an ungrammatical base-structure would have to be assumed. As for phonological deletion, things are less evident, but empirical observation makes the majority of researchers agree that phonological deletion also hinges on string identity. The following examples hence refute both approaches. *Einundzwanzig (21) Bücher* would require ungrammatical base structures as in (36).

(36) a. [[ein Bücher$_i$ und zwanzig Bücher$_i$] __$_i$]   RNR
     b. [ein ~~Bücher~~ und zwanzig Bücher]   backward deletion

Thus an essential part would have to appear as **ein Bücher* (≈ 'one books'), which is impossible. RNR and deletion become even less convincing with pluralia tantum.

(37) [[twenty ~~pants/trousers and~~ one pant(s)/trouser(s)] __]

(38) [ein ~~Leut(e)~~ und zwanzig Leute]
     one "person" and twenty people

The assumption of a unit *ein Leut(e)* is hard to argue for, similar the English case *pant(s)* in the second conjunct of (37). This piece of counterevidence is purely structural.

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[11] Interestingly, these are often the devices that are alluded to when it comes to giving an analysis for structures that are argued to be grafts (by van Riemsdijk).

A comparable argument for a refusal of Ionin & Matushansky's approach again comes from Modern Irish.[12] The relevant data are presented and discussed by Duffield (1995): the numeral constructions in (39) show modification involving teen numbers; those in (40) modification involving numbers higher than 20.

(39) a. dhá rud   bheaga (base form: *beag* 'little')
       two thing.SG little.PL
       'two little things'
    b. dhá rud   déag bheaga (*dhá rud bheaga déag)
       two thing.SG ten   little.PL
       'twelve little things'
    c. na trí   charr déag bheaga (*na trí charr bheaga déag)
       the three car.SG ten   little.PL
       'the thirteen small cars'
    d. na hocht gcarr déag bheaga (*na hocht gcarr bheaga déag)
       the eight car.SG ten   little.PL
       'the eighteen small cars'

(40) a. dhá rud   bheaga is   fiche   (*dhá rud is fiche bheaga)
       two thing.SG little.PL and twenty
       'twenty-two little things'
    b. cúig theach   mhóra is   tríocha (*cúig theach is tríocha mhóra)
       five house.SG big.PL and thirty
       'thirty-five big houses'
    c. seacht gcapall bhána   is   seasca (*seacht gcapall is seasca bhána)
       seven horse.SG white.PL and sixty
       'sixty-seven white horses'

Observe that there is an important difference between teens and other multiples of ten (20–90) vis-à-vis attributive adjectives: whereas higher tens in (39) appear to the right of attributive adjectives, the ten of "teens" in (40) must appear immediately postnominally, to the left of such adjectives. Thus, in such examples, the postnominal numeral *déag* 'ten' obligatorily precedes any modifying adjectives. It seems that the pattern in (40) may possibly be derived via forward deletion or some similar ellipsis device. However, the "teen" cases cannot be derived by either RNR or backward deletion.

Example (41) is not a licit input structure for these operations.

(41) #trí charr bheaga & déag charr bheaga (no overt coordinative conjunction like *is*)

To derive the correct string, *na trí charr déag bheaga*, one would have to both (i) selectively drop the right-peripheral adjective in the first conjunct and (ii) delete the quantized nominal part in the second conjunct, in a gapping-like manner. Such a deletion device is unknown and would hence be unexpected. Equally unexpected would be RNR—that is, unbounded rightward movement of a bare adjectival.

(42) trí charr ~~bheaga~~ déag ~~charr~~ bheaga

A graft approach can cover both cases—the ones in (39) and those in (40)—straightforwardly.

The Irish data provide more evidence for a graft analysis. In both sets of examples, the postnominal numeral elements (i.e., the tens) are unaffected by initial consonant mutation. Modern Irish orthography reflects these alternations directly: the spirantization of /b/ is indicated by the following character <h>. This phonological process, which—in the case of lenition (palatalization)—is a spreading effect, affects all postnominal adjectival modifiers. Crucially, the numeral element *déag* is unaffected in this construction. However, in other contexts, *déag* can be lenited, as in *a dhéag leabhar* 'his ten books'. Here *a* '3SG.MASC.POSS' triggers lenition on *déag*, when it appears prenominally. This suggests that *déag* is transparent in the specific context of a complex numeral. In other words, it appears on a separate tier, as the grafting approach implies.

3.2. Semantic and Pragmatic Problems

There are, however, also semantic and pragmatic difficulties. At first glance, the idea that coordination, as proposed by Ionin & Matushansky, and addition, also in the mathematical sense, are related or even equal seems intuitive and tempting. However, it faces severe problems. Conjunction within complex cardinals or their alleged syntactic coordination must not be mixed up with set union or the mathematical operation of addition computing the cardinality. Pragmatically it might be implicated that from a linguistic form like *twenty books and six books* one is urged to presume two sets, one of the cardinality 20 and the other one distinct from the first and of the cardinality 6, thus creating |26| through set union. But this is not mandatory. The mere conjunction puts two independent sets next to each other. It might well be that elements of the first set are also elements of the second on principled or mathematical grounds for that matter (the reasoning here is somewhat inspired by—although clearly different from—Krifka's distinction between object-related or event-related counting; see Krifka 1990).

The coordination approach also becomes less convincing in cases where the numeral is a part of a larger word as in *twenty-five-year-old woman*, *fünfundzwanzigjährige Frau*, *vierunddreißigfacher Vater* (father of 34 children), *22-bändige Ausgabe* (edition in 22 volumes), *25-fold increase*, and so on.

3.3. More Number Systems That Are Incompatible with the Coordination Approach

The following facts can be seen as empirical arguments against Ionin & Matushansky's coordination-equals-set-union approach for complex numerals (and

counting): subtractive number systems and/or "overcounting." Nowadays—almost around the world—the canonical case is characterized by very fixed and standardized number systems, which are highly conventional and are based on addition and multiplication. But this has not always been so. In subtractive systems, things are comparable to how time is specified in colloquial German or in English: *2:56* (= *two fifty-six* or *56 past 2*) or equally *4 to three* (both denote the same time: 2:56). In past times, the subtractive version was often used for regular cardinals in addition to the additive variant. So next to Latin *decem (et) octo* (literally: ten (and) eight = 18), one finds *duo-de-viginti* (two-of/from/off-twenty). There is also *duo-de-sexaginta* (two-of/from/off-sixty = 58), and in Ancient Greek *dyoin déontes hexékonta* (the same: two- of/from/off sixty = 58), as well as 19 from former Hindi *ek-una-vimsati* or Anglo-Saxon *anes wona twentig*: both "one less twenty." According to Menninger (1969), this way of counting used to be quite common and widespread; it was found, for example, in Ainu and Finno-Ugric, thus not only in Indo-European languages.[13] This type of coordination or conjunction can by no means be conceived of as addition or set union. Thus the cardinality does not come from coordination or adding two numbers.

This is also the case for the following device, which is even more complex, called overcounting. To quote Menninger (1969:76), overcounting is "a remarkable manner of counting, which once prevailed in two areas of the world, the Germanic north of Europe and ancient Mexico. . ... This method of counting expresses 24, for example, not in the usual manner of either "4 and 20" or "4 and 2 tens", but as "4 from the 3rd ten". . .."[14]

(43) fiora dagar ens   fiorþa hundraþs   Old Norse
      four days in-the fourth great-hundred (= 120)
      '364 days'

(44) 2   menn ens   ellifta tigar
      two men and/in-the 11th   ten
      '102 men'

So it seems that the internal structure of complex numbers cannot be broken down into regular coordination structures and we must resort to a structure that somehow differentiates between the relevant parts. A grafting approach can deal with all this.

Of course, grafting is not systematic, but given the right conditions it is available. It allows speakers to just take the parts they want or need. With complex numerals, this means that, sometimes, it is the whole complex that is compositionally active, but also very often that it is just a part, namely the unit place: the small right-hand

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[13] For Menninger, subtraction is considered basic and natural and is attributed to many "primitive cultures"; perhaps in very early Indo-European, 7, 8, and 9 were also created through subtraction from 10. (Subtraction is also a common device in written number systems, e.g., the Roman numbers.)

[14] Menninger gives further examples from the Mayas and the Aztecs as well as from a third group, the Ainu in East Asia. It is also interesting to observe that overcounting seems to mainly occur with the Gaelic-like splitting.

position of a complex, or sometimes in the discontinuous cases the left-hand, but small digit number. Under these circumstances, one takes this syntactically active piece and assigns it the status of a determiner, or an adjective, or a numeral, or quantifier. The rest does not count in the relevant dimension; it is as if it were faded out, but it comes in by way of a graft. The graft ensures the right semantics.

4. Returning to Russian: Case Endings for the Callus Only

The grafting approach, which captures the intuition that a large part of the complex numeral is invisible (faded out) for syntax, seems to also be confirmed by yet another observation about Russian numerals. Isačenko (1962:536) discusses this phenomenon in the variant of his Russian grammar, which was written in German.[15] In normative grammar, when a very large and complex cardinal numeral carries a lexical case such as dative or instrumental, for example, each and every numeral part has to inflect, which means that each and every number shows case morphology, as in (45). Substandard, colloquial large, complex Russian numerals exhibit a construction that has not received much theoretic treatment. Isačenko gives examples that show that it is only the right-hand position of the complex cardinal that inflects, as in (46). Again, the higher numbers are as if they were not present for case assignment.

(45) s   tysjačami   stami   pjat'judesjat'ju dvumja
      with thousand.INS hundred.INS five.INS-ten.INS two.INS
      sportsmenami   Normative Russian
      sportsmen.INS
      'with 1152 sportsmen'

(46) s   tysjača   sto   pjat'desjat' dvumja
      with thousand   hundred   five-ten   two.INS
      sportsmenami   Inflection only on 'two'
      sportsmen.INS

A graft can easily be drawn around this. I take this option as yet one more indicator of the existence of grafts. I can see no other way to capture this so easily. Thus the conclusion is that grafts seem to be real and active and a part of linguistic and syntactic structure.

5. Outlook

Once grafting is assumed, the generative machinery seems to be too powerful. This point is also one of the main arguments against generally adopting grafting (see

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[15] The German version is Isačenko's own revision of the original Russian version, which appeared in 1954 in Bratislava. There are several more or less important differences. The original Russian version lacks the relevant remarks about numerals.

Grosu 2010). Van Riemsdijk is aware of this and has been looking for restrictive moments from the beginning. In van Riemsdijk 2010, it is θ-theory that constrains and restricts grafting as reinstantiation of merger. The traditional and timeless θ-Criterion forbids XPs (NPs, PPs, or clauses) to bear more than one θ-role. This can be illustrated with Horn amalgams as in (47).

(47) John is going to—I {think, regret to say} it's *Chicago*—on Saturday.

The callus *Chicago*, which is structurally (i) the object of the preposition *to* and (ii) the predicative inside the "embedded" copular clause, only expresses one argumental relationship: goal of the predicate *go*. In this light, one can speculate that graft structures arise where there is a mismatch between phrase-structural (non-)adjacency constraints and semantic modification. Higginbotham (1985) already discusses relevant θ-assignment configurations and restrictions. Some of his considerations also concern cases that are in some sense parallel to the *far-from* construction presented in the first section. These cases comprise quantized noun phrases of the sort in (48).

(48) I bought two kilos of apples/a box of chocolates.

Here the judgment is that the measure phrase modifies and quantifies the true object, but a simple-minded syntactic phrase marker would imply the opposite. At any rate, semantically only one θ-role is involved. The treatment of numerals would be compatible with such a "mismatch view," given that numbers or subparts of numbers do not infiltrate new arguments and/or θ-roles. However, certain considerations cast doubt on this view. First, not all linguists assume that verbs of naming do not involve a θ-role for the nomination DP (e.g., Matushansky 2006, which discusses, but then refutes, the idea that the nomination DP may bear the role of a theme). Second, the status of the θ-Criterion, or even of θ-theory itself, is not clear within the Minimalist Program. And third, for certain amalgams such as contact clauses and apokoinus—presented and discussed by Lambrecht (1988) and Lambrecht & Ross-Hagebaum (2006) or Meinunger (2011)—it is clear that the shared constituent bears two different θ-roles. Given that these constructions are very likely to be grafts, a different approach that does without θ-roles seems expedient.

The complex numeral construal suggests another, far-reaching interpretation. My understanding is such that grafting brings in elements that are not part of core grammar.[16] I will understand core grammar exactly as Chomsky characterized it in the introductory chapter to *Lectures on government and binding*: it (= core grammar) comprises the classic modules, that is, the principles, such as X′-theory, θ-theory, binding, bounding, Case, and so on, plus "the parameters of [Universal Grammar] fixed in one of the permitted ways" (Chomsky 1982:7). Core grammar is thus the most characteristic part in the generation of linguistic structures. Minimalism

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[16] Note that this is in direct conflict with van Riemsdijk's placement of grafting within grammar theory: "Grafts are by no means the marginal and exotic creatures ..." (van Riemsdijk 2006: 42). Future research will decide on this issue.

basically keeps this architecture of computational system plus lexicon as the two essential ingredients for creating complex linguistic structures in a compositional way. Grafts are proposed here to be part of the periphery, which is conceived of as the complement to core grammar, not bound to compositionality. Postal (2004) challenges the Chomskyan (minimalist) model of grammar = lexicon + computational system, offering data like (49) to argue that "a numeration is not restricted to the lexicon but can be totally wild" (see also Jackendoff & Culicover 2005:90).

(49) a. The Martian said, "*Klaatu barrada nikto*."
     b. A cow doesn't go "*foog*," it goes "*moo*."
     c. The @ sign was invented in 1541.
     d. [teenspeak:] An then I was all, like, [*gesture of annoyance*]
     e. In forming the passive of (7), *-en* hops over *forget*.
     f. *Je t'aime* means *I love you.*

This argument may or may not be convincing, but these data show that our sentences are full of things from "outside"—which Chomsky would call "peripheral." This is the position taken here to locate grafting. There exist complex—but absolutely regular—linguistic signs, associated with a structured phonetic matrix, which are not the output of core grammar.[17] One such case is complex numerals such as those discussed here. Other instantiations would be complex names: *his Royal Highness Prince Daniel*, *Alexander the Great*, *Professor Doktor h.c. mult. Manfred Bierwisch*, and so forth. These expressions are multimorphemic, and the discrete parts enter into closer and looser relationships, but they do not combine in X′-manner or project according to any regular version of phrase structure, be it classic rewrite rules or bare phrase structure. This becomes comprehensible when we consider that the way complex names as well as complex numbers are formed can be prescribed by a law,[18] or that several combinatory modes can coexist (as in Latin or Ancient Greek). This is also obvious with (spelled-out) formulaic expressions like H_2O, H_2CO_3, 4^{-8} (in German, e.g., *vier hoch minus acht* with the phonological phrasing *[(four high) (minus eight)]*, *c#m* (c-sharp minor), and so on. Further candidates that have been discussed in the literature are phrasal compounds (Lieber 1992), such as *this [gesture for someone with big ears] attitude*, *a [slept-funny-on-my-neck-and-then-ate-too-much] headache*, *around-the-world trip,* or metalinguistic talk, as in (49e), and translations (equations) in multilingual contexts and societies, as in (49f). What seems important is that the parasitic string finds a suitable point to attach. Usually an edge of the pivot ("parasite") acts as if it were the regular sister the so-called callus; the rest is accessory matter and perhaps invisible to the main tree.

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[17] In such cases, the semantic contribution does not come in compositionally: quotes, phrasal compounds, certain technical terminology (cant, lingo).

[18] Norway abolished the Germanic preposing of the smaller unit in favor of the English-like bigger-smaller order in 1951.

A sample case in point is the Saxon (i.e., prenominal) genitive in Standard German. In German, the genitive in the prenominal position behaves differently from that in the postnominal position. Crucially, the German genitive is different from the similar construction in English. Whereas in English the 's has been argued to occupy the D^0 position (Abney 1987) and/or to act as a phrasal affix (enclitic) to the pronominal noun phrase (Anderson 2008:1), as in (50), the German "genitive-*s*" cannot attach to a phrase but is pretty much restricted to bare, mostly monomorphemic names and name-like expressions (Haider 1992), as in (51), all starred, versus the grammatical options in (52).

(50) The man in the hall's taste in wallpaper is appealing.

(51) a. *der Müllers aus der Theatergruppe Kinder
      b. *der Müllers aus der Theatergruppes Kinder
      c. *der Müller aus der Theatergruppes Kinder
          the Müller('s) from the theatre group('s) children

It is only always the "last" element—of a (complex) name—that carries the genitive -*s* (see, e.g., Zifonun 2001).

(52) a.   Angelas Besuch
            Angela's visit
      b.   Angela(*s) Merkel*(s) Besuch
      c.   Walther von der Vogelweides Dichtkunst
            Walther von der Vogelweide's poetry
      d.   *Walthers von der Vogelweide Dichtkunst
      e.   ??die Dichtkunst Walther von der Vogelweides
      f.   (?)die Dichtkunst Walthers von der Vogelweide

Von der Vogelweide is not conceived of as a PP modification (as is *aus der Theatergruppe* in (50)) but as part of a name; and as such the subpart *Vogelweide* (or just the family name *Merkel* in (51b)) is "(ab)used" as the pivoted graft-hinge. The rest of the name is not visible to the syntactic environment of the given noun phrase. It does not arise in a regular structure-building *(i.e., compositional) way.* A well-known case where compositionality reaches its limits is classic bracketing paradoxes. These paradoxes surface in situations in which morphophonological structure and semantic structure are not isomorphic. The work on and detection of bracketing paradoxes is closely associated with level-ordering theories such as Pesetsky's (1985) or Spencer's (1988) approaches to morphological phenomena. These theories propose morphological structure building on the basis of level-ordering, which is sometimes in conflict with the semantic structure. Grafting could then be seen as a syntactic (and representational) approach to non-isomorphicity that tries to account for larger-than-word units. The semantics of the subtrees is calculated separately (staggered), and later the results are merged and matched. A similar machinery to capture and iron out the syntactic mismatches still needs to be elaborated. It will certainly have to take

the morphological approaches as a role model. Grafts thus act as lock-ins for complex linguistic material that has not been generated in the canonical phrase structure mode.

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