A morphosyntactic account of verbal number in Mupun

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In this paper, I argue that *verbal number* is *Agree* with either a DP (resulting in participant number reading) or an Adverbial Phrase (giving rise to an event number interpretation). Several facts support this claim: mismatches between the number features on the verb and on its argument, the role of the external argument for verbal number dinstinctions, the ambiguity between the two functions (participant plurality/event plurality) and the morphological productivity of the category. The analysis considers data from two Chadic languages, Mupun and Mwaghavul, and is couched in Minimalist Syntax and Distributed Morphology.

1. Introduction

Verbal number (Corbett 2000:243-264) is a grammatical category that quantifies the effects of an action, rather than enumerating entities as nominal number does. Verbal number can refer either to participant plurality, to event plurality or to both (see Mattiola (2017) for a recent overview on this phenomenon). When it expresses event number, it largely overlaps with various functions of aspect, such as iteration, distributivity, intensification.

Many previous analyses account for verbal number as a semantic characteristic of certain verbs, which are born with a plural number feature, in the same ways as the English verb *to massacre* means multiple killing events of multiple people. However, some examples of mismatches between the number on the verb and the number on its internal argument suggest a different analysis of this phenomenon. I aim to provide a morphosyntactic account of verbal number in the West-Chadic languages Mupun and Mwaghavul, couched in Minimalist Syntax and Distributed Morphology. This analysis can explain problematic issues for previous approaches and gives a unified picture of the two functions of verbal number, namely participant number and event number.

This paper is structured as follows. Section 2 presents the data from Mupun. In section 3, I highlight the problems of previous analyses. In section 4, I introduce the theoretical framework that I will use. Section 5 contains the main proposal of the paper, with the necessary assumptions

and the claims that I make. In section 6, I go through the derivation of some of the data presented in section 2. Then, in ection 7, I extend the proposal to another Chadic language, Mwaghavul. The last section contains the summary of the paper.

2.   *Verbal number in Mupun*

Mupun is an Afro-Asiatic, West Chadic language from Nigeria. Traditional analyses (Frajzyngier 1993) claim that verbal agreement is not available for this language: the verb agrees neither with the subject nor with the object. Moreover, the verb does not inflect for tense or aspect: this information is encoded instead by markers that appear at the beginning of the sentence. In contrast, verbal number is a productive category in Mupun. Although the set of verbs with number distinctions is not large, 'the formation of plural stem is the only morphological change that may affect the verb stem' (Frajzyngier 1993:54).

(1)   a.   infix -*a*-:
              pīin 'crack' - *piān* 'crack (many things)'
              pūt 'go out' - *púát* '(many people) go out'
        b.   infix -*r*-:
              tēp 'break' - *trèp*, *tráp* 'break (many things)'
              gáp 'cut a piece' - *gráp* 'cut pieces'
              séet 'buy/sell' - *srép* 'buy/sell (many things)'
        c.   suffix -*é*:
              tù 'kill' - *tùé* 'kill (many people)'
              sù 'run away' - *sùé* '(many people) run away'
        d.   suffix -*ep*:
              mùut 'die' - *mùrép* '(many people) die'
              pét 'call' - *prép* 'call (many people)'
              séet 'buy/sell' - *srép* 'buy/sell (many things)'
        e.   suffix -*wat*:
              siāŋ 'abort' - *sìwnát* '(many people) abort'
        f.   infix -*k*- or suffix -*k*:
              yà 'catch' - *yak* 'catch (many things)'
              lóom 'be lost' - *lihàm* '(many people) be lost'
        g.   suppletion:
              dēn 'put' - *lé* 'put (many things)'
              tá 'fall down' - *dóŋ* '(many people) fall down'

As (1) shows, several verbal roots exhibit alternations between a singular and a plural allomorph. The meaning of the plural form indicates that the action is performed either multiple times or on multiple objects. This pluractionality can be realized through different morphological devices: infixation (1-a), (1-b), (1-f), suffixation (1-c), (1-d), (1-e), (1-f) or suppletion (1-g).

Here are some examples of the pattern (Frajzyngier 1993:59-62). Example (2) involves the suppletive root $\sqrt{\text{BEAT}}$: *cīt* beat.SG ∼ *nás* beat.PL.

(2) a. *Wu **nas** mo.*
3M.SG hit.PST.PL 3PL
'He hit them.'

  b. **Wu **cit** mo.*
3M.SG hit.PST.SG 3PL
'He hit them.'

  c. *Wu **cit** wur.*
3M.SG hit.PST.SG 3M.SG
'He hit him.'

  d. *Wu **nas** wur.*
3M.SG hit.PST.PL 3M.SG
'He hit him many times.'

As (2-a) and (2-b) show, a plural object requires a plural verb, in the same way as a singular object asks for a singular verb (2-b). However, a plural verb can also cooccur with a singular object, giving rise to a plural event reading (2-d). The opposite pattern (plural object and singular verb) is not grammatical under any reading (2-b).

In examples (3)-(4), verbal number is realized by the suffixes -*e* (3-b) and -*k* (4-b). (3-a)-(3-b) show that the pattern is not sensitive to the person feature of the subject, which is 1st person. In examples (4-a)-(4-b), we can see that verbal number is also independent of the number feature on the subject, here plural: it is the number on the object that determines the number on the verb.

(3) a. *N-**tu** joos.*
1SG-kill.PST.SG rat.SG
'I killed a rat.'

  b. *N-**tu-e** joos.*
1SG-kill.PST-PL rat.SG
'I killed rats.'

(4) a. *Mo **ya** joos.*
3PL catch.PST.SG rat.SG
'They caught a rat.'

  b. *Mo **ya-k** joos mo.*
3PL catch.PST.PL rat.SG PL
'They caught a rat.'

Note that the plural morpheme on the noun (*mo*) is optional (3-b)-(4-b). The marker of plurality *mo*, derived from the 3rd person pronoun (Frajzyngier 1993:46-47), either can be attached to nouns when they are the last constituent of the phrase, or can occur at the end of the noun phrase, or can be dropped. When nouns do not inflect for number, then number on the verb is the only morphological sign of the plurality of the argument (3-b). Thus, the optionality of the plural marker in the nominal domain increases the ambiguity between the two functions of verbal number.

Unaccusative verbs exhibit verbal number differences too. In this case, it is the surface subject (underlyingly the internal argument), which governs the number value on the verb (5).

(5)   a.   *Wu   **taa**   yil.*
             3M.SG fall.PST.SG down
             'He fell down.'

        b.   *Mo **doŋ**   yil.*
             3PL fall.PST.PL down
             'They fell down.'

Unergative verbs may show verbal number too. Here, the number on the verb depends on the number of the external argument (6).

(6)   a.   *Wu   **su**   seet.*
             3M.SG run.PST.SG away
             'He ran away.'

        b.   *Mo **su-e**   seet.*
             3PL run.PST-PL away
             'They ran away.'

As is the case for transitive verbs, I predict mismatches between a plural verb and a singular argument to be possible with a plural event reading, as in (2-d). Therefore, I expect an example such as *wu **su-e** seet* '3M.SG run.PST.PL away' to be grammatical with the pluriactional meaning 'he ran away many times'. Unfortunately, the grammar of Mupun (Frajzyngier 1993) does not provide enough data.[1]

The example in (7) shows that for some verbs, such as *to cut*, the plural form pluralize the action rather than the objects ('cut a piece'/'cut into pieces'). (7-c) is an instance of a plural verb without an overt argument; moreover, it shows that verbal number is preserved in non-finite clauses.

(7)   a.   *Wu   **gap**   pak lua   lusim.*
             3M.SG cut.PST.SG some meat.SG leopard.SG
             'He cut a piece of leopard meat.'

        b.   *Wu   **grap**   pak lua   lusim.*
             3M.SG cut.PST.PL some meat.SG leopard.SG
             'He cut leopard meat into pieces.'

        c.   *Da a   sat mo **grap**.*
             go 2M.SG tell 3PL cut.PL
             'Go and tell them to cut it into pieces.'

In (8), the habitual prefix *kə̀* requires the use of the plural form.

(8)   a.   **Wu   kə̀-**cit**   war.*
             3M.SG HABIT-beat.SG 3F.SG
             'He beats her continuously.'

        b.   *Wu   kə-**nas**   war.*
             3M.SG HABIT-beat.PL 3F.SG
             'He beats her continuously.'

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[1]This remark should be repeated for every prediction I make. All data at disposal that are relevant are reported here.

We can now turn to the empirical generalizations. A plural feature on one argument requires a plural feature on the verb (2-a)-(2-b): * V_{sg} DP_{pl}. This seems to suggest that both the verb and its argument should always carry the same number feature. However, the example (2-d) shows that a singular object can be merged with a plural verb too: V_{pl} DP_{sg}. In this case, the verb does not express the plurality of the participants, but rather the plurality of events. The same plural form can be used for this two different functions. The constituent that governs verbal number is the internal argument of transitive verbs, whereas for intransitive verbs two cases must be distinguished. As far as unaccusative verbs are concerned (5), it is still the number of the internal argument that patterns with the one on the verb. For unergatives (6), the external argument, which is the sole DP to be merged with the verb, determines the number feature on the verb.[2]

Let me highlight this latter point. The role of the external argument in verbal number distinction for unergative roots is not expected under traditional accounts of verbal number (Durie 1986), (Mithun 1988). In particular, it has been claimed that the distinction between verbal number and ϕ agreement (of a verb with its arguments) lies in the property called *ergativity* (Corbett 2000): only the internal argument can determine verbal number, whereas agreement can express various grammatical relations. The example in (6) shows that this distinction is not always true. Other languages exhibit cases of verbal number depending on the external argument, as for example Hopi (Kalectaca 1978) (9).

(9)   a.   *Pam wari.*
             3SG run.SG
             'S/he ran.'
       b.   *Puma yuutu.*
             3PL   run.PL
             'They run.'

3.   Problems for previous analyses

All previous accounts treat verbal number as a selectional phenomenon. Durie (1986) considers the number specification on the verb and its arguments as matter of *selection*, Mithun (1988) talks about *semantic co-occurrence*, Tuite (1998) considers it as a phenomenon of *feature coincidence*. All these accounts have problems in explaining the following issues: (i) number mismatches, (ii) meaning mismatches, (iii) non suppletive cases, (iv) unergative verbs showing verbal number.

Let me repeat example (2).

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[2] Note that I am assuming that the root $\sqrt{\text{RUN}}$ (among other roots: $\sqrt{\text{GO OUT}}$, $\sqrt{\text{ABORT}}$...) in Mupun is unergative. This is an argument for analyzing verbal number as Agree, as we will see in section 3. I cannot test for the status of these intransitive verbs at the moment, but even if they turn out not to be unergative, there are still other reasons to think of verbal number as agreement (cf. section 3).

(10) a. *Wu   **nas**   mo.*
          3M.SG hit.PST.PL 3PL
          'He hit them.'

   b. **Wu   cit**   mo.*
          3M.SG hit.PST.SG 3PL
          'He hit them.'

   c. *Wu   **cit**   wur.*
          3M.SG hit.PST.SG 3M.SG
          'He hit him.'

   d. *Wu   **nas**   wur.*
          3M.SG hit.PST.PL 3M.SG
          'He hit him many times.'

By adopting a selectional account, there are two possibilities to explain these data. Under the first option, the same number value is always expected both on the verb and on the object, but this is not what (10-d) shows. Under the second possibility, two different meanings (punctual/iterative) must be assigned to the two allomorphs *cit* ∼ *nas*, but this seems not to be the case (10-a)-(10-d), since *nas* does not always mean 'to hit many times'. Thus, selectional approaches can neither explain why (10-b) is ruled out and (10-d) is grammatical, nor why the same form *nas* is used once with the function of participant number (10-a), once as event number (10-d).

Moreover, verbal number is often expressed through morphology and not only through suppletion. The selectional approach has nothing to say about verbal number encoded by morphemes. If it could seem reasonable to store the meaning of suppletive allomorphs in the lexicon, this strategy is not ideal for the various pluractional morphemes in (1). In addition, in some languages verbal number is so productive (or obligatory, for example in the Chadic language Goemai (Hellwig 2017)) that it would be better to consider it being part of the grammar rather than stored in the lexicon, as the selectional account claims instead. Lastly, unergative verbs pose a problem as well, since verbal number is always expected to be conditioned only by the internal argument, i.e. the one that is locally selected by the verb.

4.   *Theoretical background*

The analysis I am proposing is couched in the frameworks of *Minimalist Syntax* (Chomsky 1993, Radford 1997, Adger 2003) and *Distributed Morphology* (DM) (Halle & Marantz 1993, Harley & Noyer 1999). DM adopts a modular architecture of grammar and implements this division of labor between its components as follows. Syntax is a separate module that manipulates abstract morpho-syntactic features through two operations: *Merge* and *Agree*. The output of syntax is cyclically sent to Spell-out. At this point, morphology can operate on the chunks of syntactic structure before Vocabulary Insertion happens. After morphological operations have applied, the phonological exponent of a vocabulary item is inserted into a syntactic terminal node according to the Subset Principle (Halle 1999).

As far as agreement is concerned, I adopt the **interaction model of Agree** proposed by Deal (2015). In this system, Agree consists of two parts:

- *Interaction*: the probe P interacts with feature F by copying F;

- *Satisfaction*: the probe P is satisfied by G if copying G makes P stop probing.

Therefore, the probe P is specified as follows: INT-[F], SAT[G]. The probe P copies the feature F from every potential goal that it encounters while probing, until it finds the feature G, which represents its satisfaction condition and has the power to stop the Agree operation. After Agree is carried out, the probe P will have copied the feature G and eventually one or multiple instances of the feature F. This model is based on the *feature-geometry* approach to ϕ features (Béjar & Rezac 2009; Harley & Ritter 2002; McGinnis 2005; Preminger 2014; Kalin 2017). According to this proposal, feature values are organized in a structure that encodes implicational relations between them. The structure of the feature set allows for probes to look for a specific feature. Coming back to Agree, goals are *snippets of the feature geometry*, i.e. specific chunks of hierarchically organized features. Probes are placeholders for these feature structures and are *relativized* for that specific part of feature geometry that they are looking for. They are also *omnivorous*: they can agree with multiple goals and skip targets which do not bear the right featural specification. The valuation of a probe consists in copying an appropriate sub-part of the feature geometry from the goal onto the probe. Under this view, Agree is subject to cyclic expansion (Béjar & Rezac 2009) until its satisfaction condition is met or its domain is exhausted. Agree may fail if the probe it is not satisfied into its search domain (Preminger 2014).

5. Proposal
5.1. The probe

I propose that verbal number is the morpho-syntactic result of an Agree relation between *v* and either a DP or a covert AdvP. I claim that the probe *v* has the following structure (11).

(11)   *Feature specification of Mupun v*
        INT-[#], SAT[ϕ]

This probe is satisfied when it encounters a full ϕ projection (i.e. a DP); then it stops probing.[3] However, it interacts with every # feature that it encounters during the valuation. As long as the probe finds a # feature, it will copy it, without any regards for its source. I treat singular as the absence of number (Puškar 2018; Nevins 2011). A singular DP is unmarked for number and does not bear a # feature. Therefore, it cannot be a suitable goal for a probe that looks for a # feature and it is skipped by Agree. I place the probe on *v*, rather than on T, because verbal number is preserved in non-finite clauses (cf. (7-c)).

   The probe that I am proposing relies on the interaction model of Agree (cf. section 4), which considers both interaction and satisfaction features. At this point, the reader may wonder: why should the probe be articulated into two different conditions of interaction and satisfaction? How would Agree work with a simple probe that looks for a certain feature, such as *v* looking for #? The main challenge to such an analysis is the following. The data shows us that cyclic upwards

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[3]Note that another possible satisfaction feature is the categorical feature D: INT-[#], SAT[D]. This could be an option in the case of DPs that do not carry ϕ features (for example, under the assumption that 3rd person is underspecified for person feature). Such a probe has been proposed by Deal (2017) for Swahili and Chichewa, where *v* does not agree with the subject when the object does not contain [ϕ].

expansion happens for unergative verbs (6-b), whereas in transitive verbs this is excluded (4-a). The INT/SAT model gives exactly this result: it allows Agree to stop when a specific condition is met, namely the presence of an internal argument, which is independent on the features that the probe is looking for, namely number.[4] I repeat example (4), since the pattern $Subj_{pl}$ V_{sg} Obj_{sg} (and, presumably, *$Subj_{pl}$ V_{pl} Obj_{sg}) constitutes the main argument for the INT-SAT model.

(12)   a.   *Mo **ya**   joos.*
              3PL catch.PST.SG rat.SG
              'They caught a rat.'
        b.   *Mo **ya-k**   joos   mo.*
              3PL catch.PST.PL rat.SG PL
              'They caught a rat.'

As far as Multiple Agreement is concerned, it may seem a superfluous mechanism for the data in question. The reasons for adopting it are both theoretical and empirical. Firstly, even though it does not make a difference for the Mupun data, the possibility of Multiple Agreement is intrinsically present in the INT-SAT model. Secondly, the closely related language Mwaghavul, whose data are presented in section 7, shows evidence for adopting Multiple Agree. In particular, Mwaghavul has triplet of pluriactional verbs whose morphological features can be distinguished through different specification on the probe ([pl]/[pl, pl]).

5.2.   *The adverb*

Coming now to the second point of the proposal, I claim that AdvP may bear a # feature that refers to event number, whereas in the nominal domain the # feature refers to participant number. Adverbials can be a goal for Agree, although the probe is not satisfied by the snippet of feature geometry that they can bear (namely, only #). Thus, the difference between adverbs and nominals is the absence of ϕ features in the AdvP, whereas both can contain a # feature. Interestingly, this difference is mirrored by the outcome of Agree. A DP has a full ϕ features geometry, therefore it can satisfy the probe.[5] An AdvP has a small subset of ϕ features, namely only the # feature, lacking the whole ϕ features structure. Therefore, an AdvP can interact with the probe, which copies its # feature, but cannot satisfy it, since it does not carry a snippet of features that it is complex enough to include the satisfaction features ϕ.

    Adverbs can be either underspecified for number, as is often the case (cf. temporal, local adverbial phrases), or can be marked as plural, especially when they have nominal source. Mupun presents some hints of plural number on adverbials. For example, reduplication is used both to inflect adjectives as plural and to derive adverbs from adjectives (Frajzyngier 1993:75):

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[4]There are of course possible alternative analyses. For example, we could use a simple probe for # on *v*. However, this idea requires two joint assumptions: (i) *singular* is a value for # feature and (ii) there are two number values for nominal (singular and plural) and only one for adverbials (just plural). This last assumption is needed because a singular DP is a suitable goal for Agree, whereas a singular AdvP is not. However, it seems to me that a homogeneous treatment of number is a desiderata. Another possible analysis could consider the subjects of unergative verbs to be generated lower down in the structure. I have not taken this option into account, since other languages may have verbal number with unergative verbs. Moreover, the lack of data for Mupun makes this assumption impossible to test at the moment.

[5]Note that I am assuming that 3rd person is specified for person features (Nevins 2007). Alternatively, it is possible to use [D] as a satisfaction feature, as I have already mentioned.

kén 'fast' [Adj] $\sim$ *kénkén* 'fast' [AdvP]. In particular, the reduplicated forms of nouns, verbs or adjectives in sentence final position have the function of manner adverbials.

AdvP is merged as an adjunct to VP when the intended meaning to be expressed is *(x times)(VP)*. This AdvP is generally covert, similar to a silent operator. However, it can be overt too. For instance, here we have an example with an overt manner adverbial, low in the structure, derived from the verb *sù* 'run' (Frajzyngier 1993:274): the verb is plural even though both the subject and the object are singular (13).

(13)   a.   *Wu*   ***grəp***   *suep kaa* *fin*   ***səsu***.
              3M.SG cut.PST.PL hair head 3POSS.M.SG running
              'He cut his hair in a hurry.'

5.3.   The Agreement

Recall that in Mupun the verb does not agree with the ϕ features present on either the subject or the object. The only Agree operation available is verbal number, which is different from verb-object Agree. Firstly, it can depend on the number on the subject, as is the case with unergative verbs. Secondly, the number on the object can be different from the number on the verb: when the DP$_{obj}$ is singular, the verb can still be plural.

Verbal number is independent from other types of agreement as well, which may involve features on T. When a language presents different agreement possibilities, then T is generally responsible for verb-subject Agree, *v* for verbal number and/or for verb-object Agree. An example can be seen in Huichol (Comrie 1982) (14).

(14)   a.   *Wan Maria ma-ti*   *me-neci-mieci.*
              Juan Maria and-SUBJ 3PL.SUBJ-1SG.OBJ-kill.SG
              'Juan and Maria are killing me.'
      b.   *Nee Wan Maria maa-me ne-wa-quiini.*
              1SG Juan Maria and.OBJ 1SG.SUBJ-3PL.OBJ-kill.PL
              'I am killing Juan and Maria.'

In Huichol, the verbal root $\sqrt{\text{KILL}}$ has two allomorphs, which are distinct for number. The singular form *mieci* is inserted when the object is singular, as the object marker for 1SG.OBJ *neci* shows in (14-a). Moreover, the verb agrees with the subject, as the morpheme *me* for 3PL.SUBJ indicates. In example (14-b), the internal argument is plural, therefore the verbal root that is used is the plural *quiini*. In addition, the agreement markers indicates that the object is plural and the subject singular. Example (14) shows that verbal number and agreement of the verb with its arguments can be syntactically and morphologically distinct operations.

5.4.   The semantics

My proposal leads to the unification of the two functions of verbal number (event number and participant number). Under this account, the two meanings are not due to two different semantic interpretations of *v*. Instead, the different goals for the probe *v* are responsible for these two interpretations.

Another consequence of my claim is that number can be an underspecified feature. In fact, *v* looks for a # feature that refers to *many x*, *x* being either an event or a participant. There is only one type of # features, namely the ones that are part of the complete ϕ features set. However, they are independent from other features (π, γ) and can show up in isolation as a smaller snippet of features, which can be hosted by different constituents. # features are not tied to the nominal domain, but may be hosted by other categories and simply indicate that the constituent they scope over has the semantic property *[+many]*. When the syntactic structure is sent to Spell-out, the position of the adverbial higher than the VP allows the # feature to scope over the entire VP in the LF module. In contrast, the # in the DP domain scopes over the noun and it is interpreted inside the DP.[6]

6.   Analysis
#### 6.1.   Transitive verbs
6.1.1.   Plural verb + plural argument

I now propose the derivation of some of the data presented in section 2. The first analysis illustrates why a transitive verb must be plural if its internal argument is plural (15).

(15)   a.   *Wu   **nas**   mo.*
              3M.SG hit.PST.PL 3PL
              'He hit them.'
         b.   **Wu   **cit**   mo.*
              3M.SG hit.PST.SG 3PL
              'He hit them.'

Firstly (step 1), the syntactic structure is built. When the probe *v* is merged, it starts probing downwards inside its domain. After each cycle of derivation, upwards Agree is possible if the probe has not yet found its satisfaction feature.

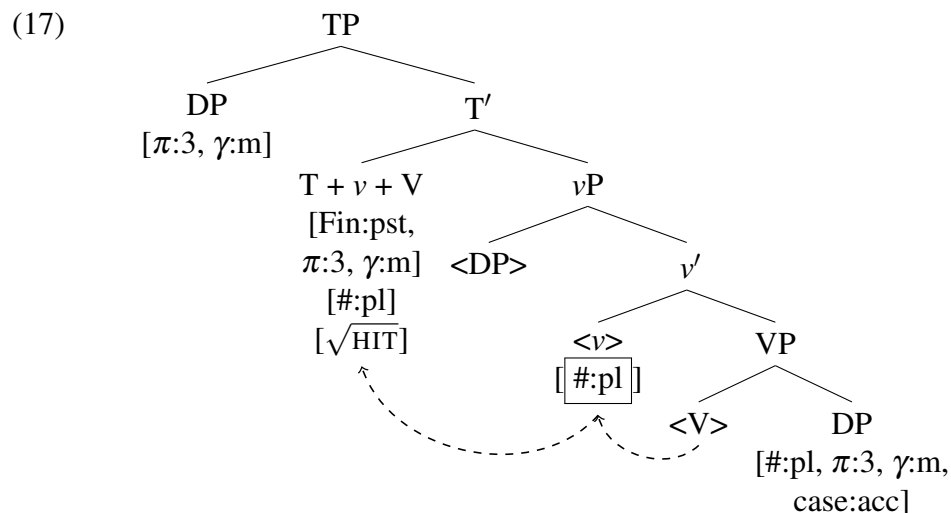Step 1: (a) building the structure, (b) probing

(16)
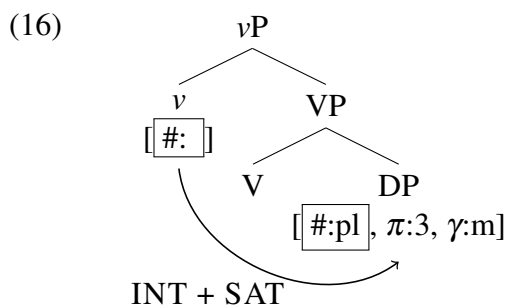
The probe *v* looks for a snippet of ϕ features that contains number, person and gender (ϕ satisfaction features). It is also a placeholder for number features: it collects all instances of # while looking for the other ϕ features (# interaction feature). *v* finds the internal DP as a potential goal, since it contains both # and other ϕ features. Therefore, *v* interacts with # on the

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[6]This discussion aims at giving just an idea about the interpretation at LF after the syntactic derivation. The semantic implementation is beyond the scope of this paper and needs further research.

DP by copying it (step 2a). Moreover, it is satisfied by the ϕ features on the DP: π and γ cause Agree to stop. As a result, the probe has copied the value for # from the DP, as it can be seen in (17).

Step 2: (a) copying features, (b) moving heads

(17)

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                        TP
              ┌──────────┴──────────┐
             DP                     T′
         [π:3, γ:m]          ┌──────┴──────┐
                          T + v + V          vP
                          [Fin:pst,      ┌────┴────┐
                          π:3, γ:m]   <DP>         v′
                            [#:pl]           ┌─────┴─────┐
                           [√HIT]          <v>          VP
                                          [ #:pl ]    ┌───┴───┐
                                                    <V>      DP
                                                       [#:pl, π:3, γ:m,
                                                          case:acc]
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After Agree has stopped, head movement creates the complex head T + v + V (step 2b). When this is spelled out (step 3), the lexical entry to be inserted is the one that matches the highest number of features in the terminal node, according to the Subset Principle. Thus, if the probe hosts a # feature and the lexicon contains a lexical entry that is specified for that snippet of features, this vocabulary item will be inserted.
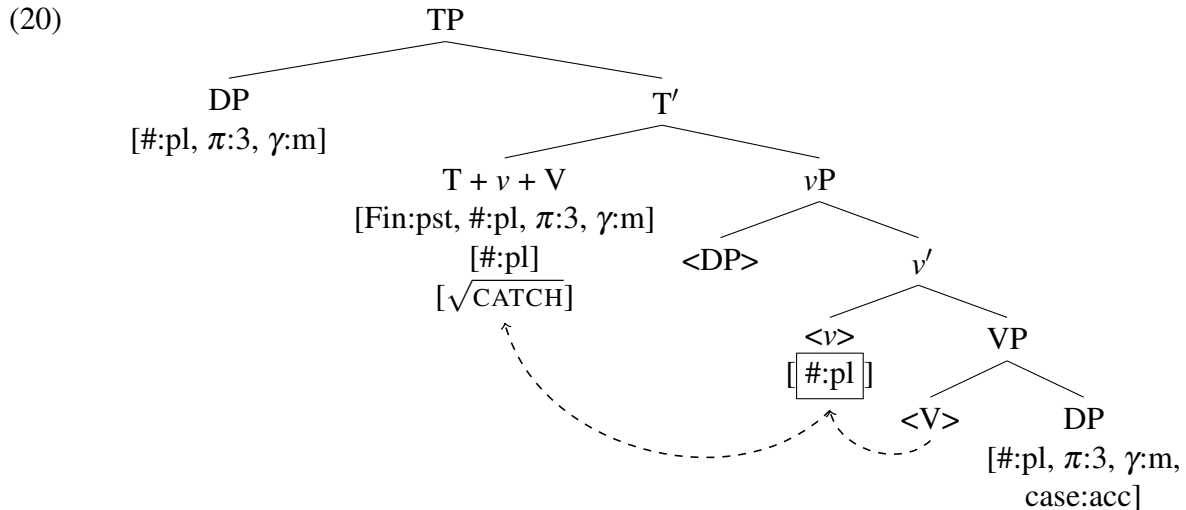
Step 3: Vocabulary Insertion

(18) a. $\sqrt{\text{HIT}} \leftrightarrow$ /nas/ / v[pl] _
      b. $\sqrt{\text{HIT}} \leftrightarrow$ /cit/
      c. $v \leftrightarrow \emptyset$
      d. $T \leftrightarrow \emptyset$
      e. [3, m] $\leftrightarrow$ /wu/
      f. [3, m, pl] $\leftrightarrow$ /mo/

I assume the lexical entries in (18). In this case (17), the exponent /nas/ (18-a) is inserted because it realizes a subset of the features in the terminal node (in particular, it realizes both the lexical meaning $\sqrt{\text{HIT}}$ and the plural on v) and it is more specific that the other allomorph /cit/ (18-b). A derivation with V_{sg} and DP_{pl} (15-b) is ruled out because the feature on v becomes specified for the value [pl] through the Agree relation with the DP. Consequently, the more specific allomorph that is compatible with the context has to be inserted (hence, (18-a) /nas/).

In the case of suppletive roots, there is a single lexical entry for the bundle of features on the complex head T + v + V. In contrast, in case of infixation or suffixation (1), a separate morpheme spells out the v head. In the following example, v is spelled out by the suffix /k/.

(19) *Mo **yak*** *joos mo.*
3PL catch.PST.SG rat.SG PL
'They caught rats.'

Step 1 and 2 are the same as for example (15), giving rise to the following structure.

(20)

Step 3: Vocabulary Insertion

(21) a. $\sqrt{\text{CATCH}} \leftrightarrow$ /ya/
      b. $v[\text{pl}] \leftrightarrow$ /k/ / $\sqrt{\text{CATCH}}$
      c. [3, m, pl] $\leftrightarrow$ /mo/
      d. $\sqrt{\text{RAT}} \leftrightarrow$ /joos/
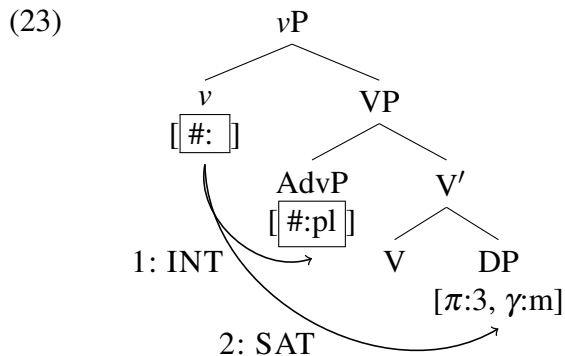   e. [pl, D] $\leftrightarrow$ /mo/

The syntactic structure is the same as for the previous example. According to the lexical entries in (21), the Mupun root $\sqrt{\text{CATCH}}$ is not specified with a # feature, but it is compatible with the exponent of *v* /k/ that realizes the value [pl]. Therefore, the complex head T + *v* + V is spelled out by two exponents: /ya/ for V and /k/ for *v*. The morphology and the phonology make the difference, both language-internally and cross-linguistically.

6.1.2. *Plural verb + singular argument*

I now propose the derivation for a transitive verb with a singular argument. This morphosyntactic structure is grammatical only with a pluractional interpretation. Thus, if a plural verb is merged with a singular object, the meaning of the verb must contain a plural event interpretation, as in (22).
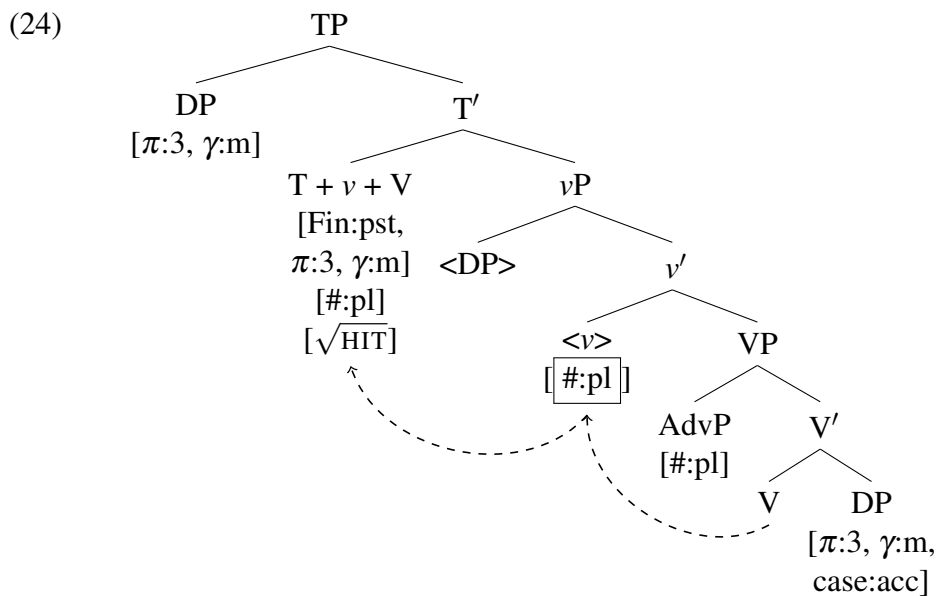
(22) *wu **nas** wur.*
3M.SG hit.PST.PL 3M.SG
'He hit him many times.'

Step 1: (a) building the structure, (b) probing

(23)

```
                        vP
                   ┌────┴────┐
                   v         VP
                 [#: ]    ┌───┴───┐
                        AdvP      V′
                       [#:pl]   ┌──┴──┐
            1: INT               V    DP
                                     [π:3, γ:m]
                 2: SAT
```

In this syntactic structure, an AdvP is merged as an adjunct to the verb to achieve the intended pluractional meaning. The probe *v* interacts with # on the AdvP, but it is not satisfied by it, since it does not contain the whole φ projection. The valuation goes further until the probe is satisfied by the DP. Agree stops and the probe has copied the value for # from the AdvP. If the DP is also plural, *v* copies the # feature twice.

Step 2: (a) copying features, (b) moving heads

(24)

```
                          TP
                   ┌───────┴───────┐
                  DP               T′
               [π:3, γ:m]    ┌──────┴──────┐
                         T + v + V         vP
                        [Fin:pst,      ┌────┴────┐
                        π:3, γ:m]  <DP>         v′
                         [#:pl]            ┌─────┴─────┐
                        [√HIT]            <v>          VP
                                        [#:pl]     ┌────┴────┐
                                                 AdvP        V′
                                                [#:pl]    ┌───┴───┐
                                                          V       DP
                                                              [π:3, γ:m,
                                                               case:acc]
```

Step 3: Vocabulary Insertion
In addition to the vocabulary items in (18), I add the following vocabulary items.

(25) a. [Adv, pl] ↔ ∅
      b. [3, m, acc] ↔ /wur/

The feature on *v* gets specified for the value [pl] through the Agree relation with the AdvP. Consequently, the more specific allomorph that is compatible with the context has to be inserted (hence, (18-a) /nas/). This result is independent from the number on the DP in the structure.

Every time an AdvP[pl] is adjoined to the VP, the probe will copy the # feature that the AdvP carries. Then, the available lexical entry specified for [pl] will be inserted, regardless of the presence or absence of a # on the internal DP. If the AdvP[pl] is not merged with the VP, the plural event reading is not available and *v* only interacts with the # feature of the internal DP. Consequently, the verb is spelled out as singular if the DP is singular, as plural if the DP is plural (but without a plural event interpretation).

Note that an adverb that is unmarked for a # feature would have been skipped by this Agree operation: the only intervener between *v* and the internal DP can be a constituent that bears a # feature. This is an argument for Relativized Minimality (Rizzi 1990): a constituent is an intervener for X and Y if it is located between X and Y and if it matches the value of the morphosyntactic features of X.

6.1.3. *Plural verb + plural event + plural argument*

We can now look at the combination of a plural transitive verb with a plural internal argument, with plural event interpretation.

(26) *Wu* **nas** *mo.*
3M.SG hit.PST.PL 3PL
'He hit them many times.'

Step 1: (a) building the structure, (b) probing
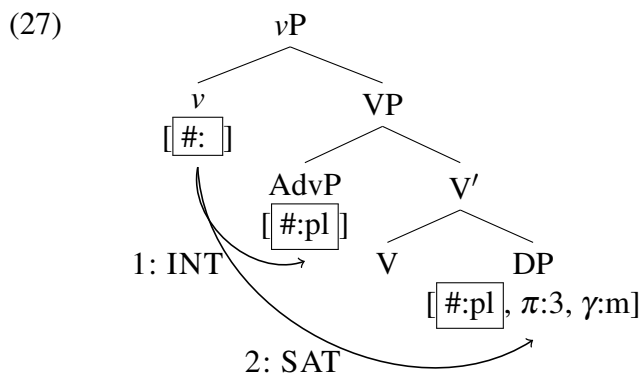
(27)

vP
├─ *v* [#:]
│   1: INT
│   2: SAT
└─ VP
    ├─ AdvP [#:pl]
    └─ V′
        ├─ V
        └─ DP [#:pl, π:3, γ:m]

The probe *v* interacts with # on the AdvP, but it is not satisfied by it, since it does not contain the ϕ projection. The valuation goes further until the probe is satisfied by the # feature on the DP. Agree stops and the probe has copied the value for # from the AdvP and from the DP: *v* contains the # feature twice. This is a case of Multiple Agreement. However, this is not visible on the surface, since Mupun does not have lexical entries that are specified as *v*[pl, pl], as the lexical entries in (18) show.[7]

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[7]As I have already mentioned, Mwaghavul provides evidence for adopting Multiple Agreement in general.

Step 2: (a) copying features, (b) moving heads

(28)
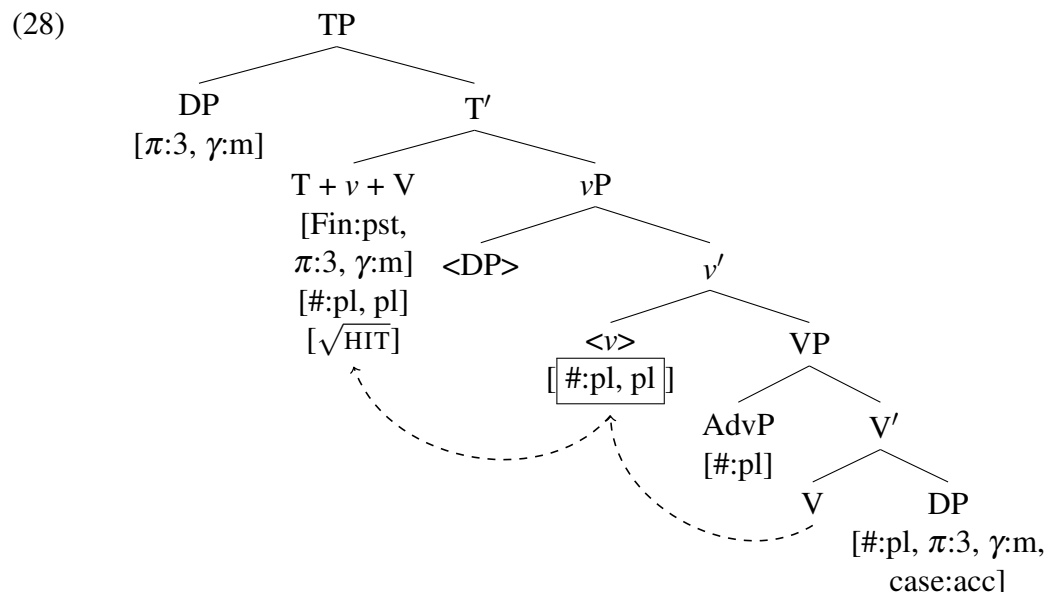
Step 3: Vocabulary Insertion

Given the lexical entries in (18) and (25), the allomorph /nas/ is selected, since it realizes the highest number of features in the terminal node that contains the complex head T + *v* + V.

Mupun seems not to have a dedicate linguistic item to express plural participant number in the same time as plural event number (as the meaning in (26)). In fact, I did not find such a case in the grammar (for an example, cf. Mwaghavul examples (40-c), (41-c) in the next section). Therefore, the strings (15-a) and (26) *wu nas mo* '3M.SG hit.PST.PL 3PL' are ambiguous on the surface because Mupun does not have lexical entries that are enough specific to distinguish between these two structures. Nevertheless, the cumulative reading of (26) is realized at LF, where the plural features are computed both on the DP and on the AdvP. Even though the adverb is a covert constituent, it is present in the syntactic structure and it is interpreted at LF. Since the AdvP is spelled out by a null exponent, I expect the sentence in (15-a) and (26) to be disambiguated by the context. Instead, if an overt AdvP[pl] is merged with the VP, then the # features are visible both on the AdvP and on the DP and, consequently, the meaning of the sentence expresses unambiguously both plural participant number and plural event number. In other words, there is nothing special about *v* that permits to distinguish between the two interpretations in (15-a) and (26), but it is the distribution of the features in the structure that gives rise to one meaning or to the other one ([pl] on AdvP: plural event, [pl] on DP: plural participant, [pl] on AdvP and [pl] on DP: plural event and plural participant).

More generally, under this account the morphological realization of Agree (at PF) is independent from its semantic interpretation (at LF). In fact, the semantics does not give a direct interpretation of the # features on the probe, but rather it considers the # features on either the AdvP or the DP or both. In this respect, Agree behaves as a postsyntactic operation, since its result is considered just at PF at the time of Vocabulary Insertion and not at LF.

6.2.   Intransitive verbs
6.2.1.   Unaccusative verbs

Unaccusative verbs pattern exactly as transitive verbs. The surface subject is generated as the internal argument and it determines the value of # on the verb. A plural subject must be merged with a plural verb, as in example (29).

(29)   *Mo do   yil.*
   3PL fall.PST.PL down
       'They fell down.'

In contrast, a singular subject can be merged either with a singular verb or with a plural verb with plural event reading. Note that the sentence *wu doŋ yil* '3SG fall.PST.PL down' is not attested, but I expect it to be grammatical and to mean 'he fell down many times', in the same way as in example (22).

Step 1: (a) building the structure, (b) probing

(30)
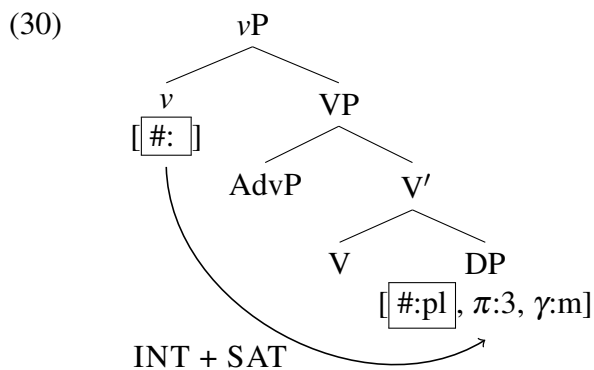
The probe *v* interacts with # on the DP and it is satisfied by the ϕ features of the DP. Agree stops and the probe has copied the value for # from the DP.

Step 2: (a) valuing features, (b) moving heads
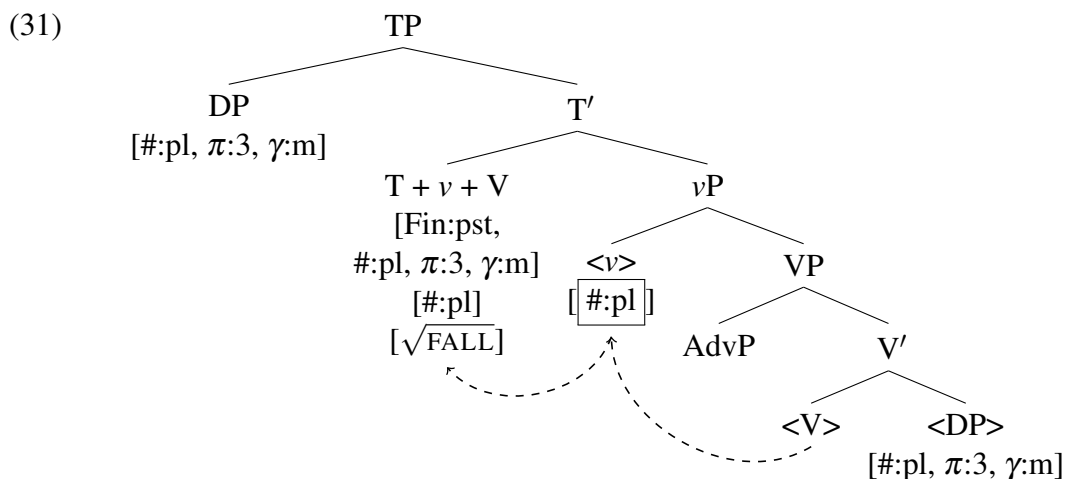
(31)

Step 3: Vocabulary Insertion

For this analysis, I assume the following lexical entries, in addition to the previous ones.

(32)   a. $\sqrt{\text{FALL}} \leftrightarrow$ /doŋ/ / v[pl] _
       b. $\sqrt{\text{FALL}} \leftrightarrow$ /taa/
   c.   [AdvP, $\sqrt{\text{DOWN}}$] $\leftrightarrow$ /yil/

The allomorph /doŋ/ is inserted, since it matches the highest amount of morpho-syntactic features in the terminal node. The *Elsewhere* form /taa/ is excluded by the Subset Principle.

6.2.2.   *Unergative verbs*

Unergative verbs merge only with an external argument introduced by v, which is the goal for verbal number agreement. The example in (33) shows that the number on the subject determines the # value on the verb.

(33)   *Mo sue   seet.*
       3PL run.PST.PL away
       'They ran away.'

Step 1: (a) building the structure, (b) probing

(34)

(35)
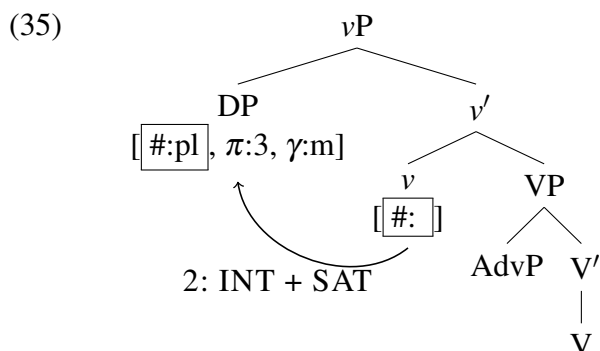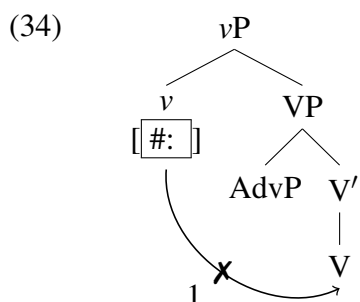
After the probe v has been merged in the structure, it starts its search for a goal downwards (34). However, it does not find any appropriate snippets of feature geometry, since there is no DP lower than v that could be a goal for Agree. Thus, the probe does not copy any feature after this first step of Agree. The derivation proceeds and now the external argument has been merged in Spec,vP (35). A new cycle of Agree can start through cyclic expansion (Béjar & Rezac 2009): the syntactic derivation has now enlarged the probing domain. Since the probe is not satisfied

yet, it can now look upwards and consider the external argument as a goal for Agree. *v* interacts with # on the external DP and it is satisfied by it. Agree stops and the probe has copied the value for # from the external argument.

Step 2: valuing features, moving heads

(36)
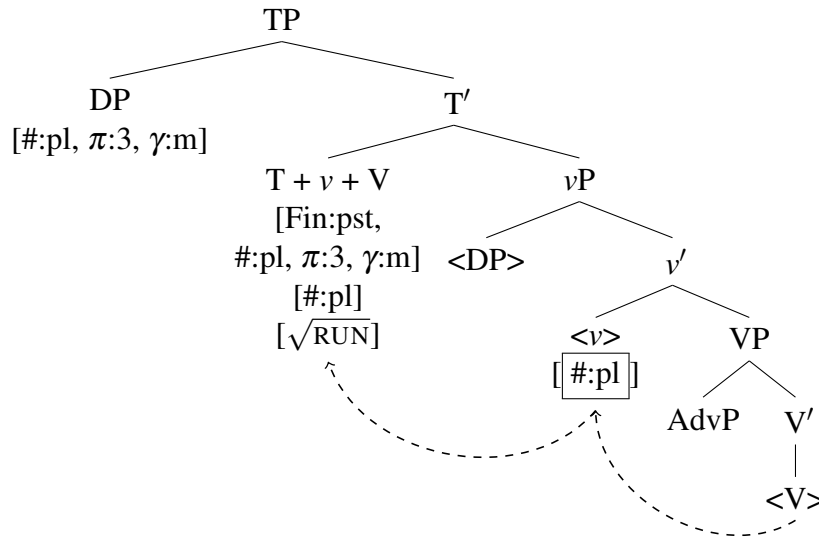
Step 3: Vocabulary Insertion
For this analysis, I assume the following lexical entries, in addition to the previous ones.

(37)   a. $\sqrt{\text{RUN}} \leftrightarrow$ /su/
       b.   *v*[pl] $\leftrightarrow$ /e/ / $\sqrt{\text{RUN}}$
       c.   [AdvP, $\sqrt{\text{AWAY}}$] $\leftrightarrow$ /seet/

Unergative verbs are different from other types of verbs because they do not introduce any internal argument. Therefore, downwards there is no matching goal. There could still be a constituent with the interaction feature #, such as a plural AdvP, but there is no constituent that bears the satisfaction feature. Since the probe is not satisfied yet, as soon as the derivation proceeds and new syntactic structure is built, cyclic expansion can apply. Now the probing domain is expanded to the new derivation and a new cycle of upwards Agree can start. The DP in the subject position is a proper goal, thus *v* copies its # feature and is satisfied by its *phi* features. As is the case for transitive verbs, I expect that if an AdvP[pl] is merged in the structure with an unergative verb, the number on the verb will then be [pl], independently on the number on the DP$_{\text{subj}}$ (for an example, cf. (6) and the unattested sentence *wu sue seet* '3SG run.PST.PL away'). In this case, the probe will copy the # feature from the AdvP during the first cycle of Agree. Then, it will look at the DP$_{\text{subj}}$, since it is not satisfied yet. If the DP$_{\text{subj}}$ does not bear a # feature, the probe will still contain it because of the previous interaction with the adverbial phrase. Unfortunately, I do not have data either supporting or rejecting this prediction.

6.2.3.   Summary

I have shown that the verbal number distinctions in Mupun can be derived through Agree. The probe on *v* keeps track of all the # features that it encounters while it is looking for a

whole ϕ projection. Then, if the lexical entries are sensitive to a # feature, the result of Agree will be expressed at the point of Vocabulary Insertion. The presence of a (covert) pluractional adverbial phrase in the structure gives the plural event reading. The possibility of # on different constituents (namely DP and AdvP) gives rise to ambiguity on the surface.

For transitive verbs, the verb will be plural either if the DP$_{obj}$ is plural and/or if there is a plural adverb, in the latter case with no difference depending on the number of the DP$_{obj}$. The DP$_{subj}$ is never reached by the probe. This result is achieved through the interaction-satisfaction model of Agree. In fact, a singular adverbial is skipped by the probe because it does not bear a #, whereas a singular DP is considered because of the whole ϕ projection.[8] The same scenario arises for unaccusative verbs, the only difference being that there is only one DP in the structure, namely the internal argument (transitive DP$_{obj}$ = intransitive DP$_{subj}$). In other words, there will always be an internal argument that, being a DP with ϕ features, will satisfy the probe.

In contrast, for unergative verbs, the derivation proceeds in cyclic steps. When v is merged in the structure, there is no DP downwards. Therefore, the probe cannot be satisfied. Later in the derivation, the external argument is merged. Now Agree can start a new cycle upwards and the probe is satisfied by the ϕ on the DP. Thus, the number on the verb is dependent on the number on the DP$_{subj}$. This pattern is problematic for theories that rely on the property of ergativity (i.e. only the internal argument can trigger verbal number).

7. Extending the proposal to other Chadic languages
7.1. Verbal number in Mwaghavul

Mwaghavul is a West Chadic language, spoken in Central Nigeria (Blench 2011). It is so close to Mupun, that the latter is sometimes considered as a variety of Mwaghavul.The system for verbal number in Mwaghavul is quite developed. A plural verb can refer both to event or to participant number. Additional nominal number markers can disambiguate the interpretation of the plural verb (as in (38-b)). Note that this is not normally the case in Mupun, where plural markers are generally dropped (cf. (3)).

In the example (38-b) (Blench 2011:63), the plural verb *pyan* instantiates a case of participant number, as the plural marker *mo* on the noun indicates.[9]

(38) a. *Wán kin* **piin** *tughul àm   ni.*
          1SG have break.SG pot.SG water.SG 3SG
          'I have broken the pot of water.'
      b. *Doghon jépmo teer   **pyan**   tughul fina   ni **mo**.*
          yesterday child.PL during.the.night break.PL pot.SG POSS.1SG 3PL PL
          'Children broke my pots last night.'

Example (39-b) (Blench 2011:62) illustrates a case of plural event number. Multiple people (plural events) are acting on a single object; thus, the verb is plural and the translation implies pluriactionality.

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[8] Note that there is no morphological reflex of this Agree, since the lexical entries of the Mupun verbs are only sensitive to the # feature.

[9] All Mwaghavul examples come from Blench (2011), where either only the glosses are provided, or only the translations. I tried to complete the examples in the appropriate way.

(39) a. *Shàràrlek fìna   wuri **at**   an.*
          enemy.SG poss.1SG 3SG beat.PST.SG 1SG
          'My enemy bit me.'

      b. *Nfùtmo   teer   **irap**   an.*
          mosquito.PL during.the.night beat.PST.PL 1SG
          'Mosquitos bit me many times during the night.'

Moreover, allomorphs for verbal number may be organized in triplets of roots, with two plural forms linked to a singular one, as the following table shows.

lexical meaning	singular	I plural	II plural
'to drink plenty of water'	*shwaa*	*mis*	*myas*
'to throw away'	*vwèt*	*fwo*	*car*
'to break, to snap'	*tep*	*tirep*	*roghop*
'to beat'	*nu*	*niram*	*siram*

Table 1: Verbal number distinctions in Mwaghavul (Blench 2011:61).

In the case of triplets, a verb in the singular form is used to refer to a single event. If the action involves either multiple events or multiple participants, the first plural form is used. When the event concerns multiple event and multiple participants, the second plural form is selected (Blench 2011:63-64).

    (40) shows the alternations of the root $\sqrt{\text{THROW}}$: *vwèt* ∼ *fwo* ∼ *car*. The first pluriactional (40-b) is used with a plural object, whereas the second one (40-c) is used for plurality of objects and events.

(40) a. *Wurí tàà   **vwèt**   kwàghàzàk fìri.*
          3SG.M on.the.way throw.PST.SG shoe.SG   poss.3SG.M
          'He discarded his shoe on the way'

      b. *Wùrá tàà   **fwo**   léé   fìra   a   ár mwaan.*
          3SG.F on.the.way throw.PST.IPL cloth.PL poss.3SG.F on road go
          'She discarded her clothes on the way going on the road.'

      c. *Mo nkaa **car**   shak.*
          3PL at   discard.IIPL reciprocal
          'They are throwing things at one another.'

A similar pattern can be observed in example (41). Here, the first plural allomorph (41-b) is used with a pluriactional interpretation (meaning intensity); the second one (41-c) is used with plural objects and plural events.

(41) a. *Jépmo ki **tep**   kam-dàghàr   fìna   mi.*
          child.PL have break.PST.SG walking-stick.SG poss.1SG 3SG
          'The children have broken in two my walking-stick'

      b. *Wátmo doghon **tirep**   pò   lù   fna   mi.*
          thief.PL yesterday break.PST.IPL door.SG house.SG poss.1SG 3SG
          'Yesterday, thieves broke down the door of my house.'

c. *Mo teer* **roghop** *shwáá* *an* *nwát.*
3PL during.the.night break.PST.IIPL maize.PL poss.1SG steal
'They broke off and stole many of my maize-cobs during the night.'

7.2. Analysis
7.2.1. The proposal

In the interaction model of Agree that I am using, all the probes are omnivourous, since they can interact with multiple goals. I claim that Mwaghavul has the same probe as Mupun, the only difference being in the morpho-phonology that contains a different inventory of lexical entries. The probe *v* can be valued again even if it has already copied the interaction feature.

This is a case of Multiple Agree, i.e. Agreement between one probe and multiple goals. Cases of Multiple Agree are found in many languages (Bjorkman & Zeijlstra 2014), for instance in Japanese (Hiraiwa 2001:76) (42).

(42) *Ohn-**ga*** *yosouijouni* *nihonjin-**ga*** *eigo-**ga*** *hidoku* *kanji-ta.*
John-NOM than.expected the.Japanese-NOM English-NOM bad.INF think.PST
'It seemed to John that the Japaneses are worse at speaking English than he had expected.'

7.2.2. The derivation

Mwaghavul can express at the same time plural participant number and plural event number. When a verbal root has only a plural form, both functions are simultaneously realized through the plural verb plus a plural marker on the DP (38-b). When two plural forms are available (40)-(41), the first one expresses one function, the second one both. The following is the derivation for (41-c).
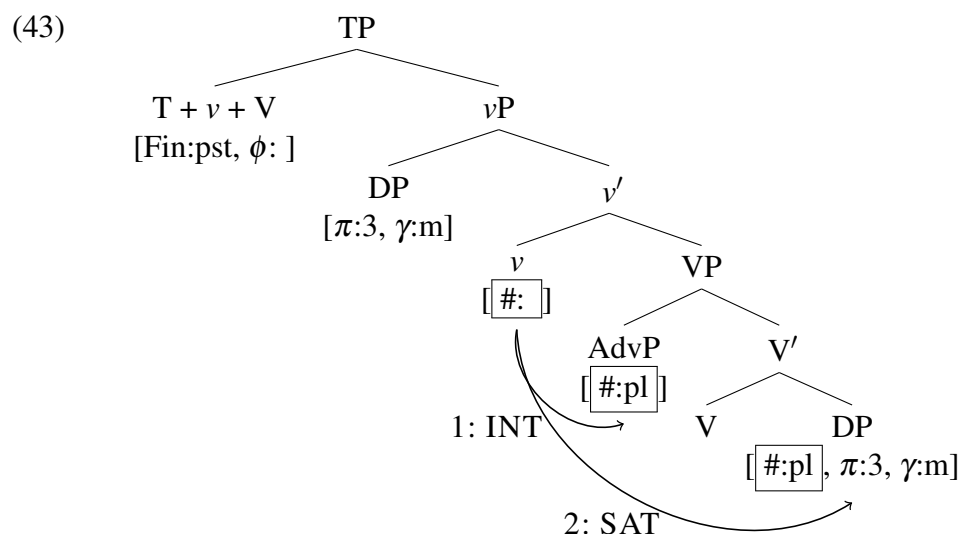
(43)

The probe *v* interacts with # on the AdvP, but it is not satisfied by it, since it does not contain the whole ϕ projection. The valuation goes further until the probe is satisfied by the DP. Agree

stops and the probe has copied the value for # both from the AdvP and from the DP: *v* contains two # features. The vocabulary items list includes a lexical entry (/car/) (44-b) that is specified for *v*[pl, pl]. Since this realizes a proper subset of the morphosyntactic features in the syntactic structure and it is more specific than its competitors, the allomorph /car/ can be inserted.

The relevant lexical entries for example (41-c) are as follows.

(44) a. $\sqrt{\text{DRINK}} \leftrightarrow$ /fwo/ / *v*[pl] _
      b. $\sqrt{\text{DRINK}} \leftrightarrow$ /car/ / *v*[pl, pl] _
      c. $\sqrt{\text{DRINK}} \leftrightarrow$ /vwèt/
      d.   *v* $\leftrightarrow \emptyset$

We saw that in Mupun the morphological realization of Multiple Agree is not visible on the surface, since there are no lexical entries that distinguish between *v*[pl] and *v*[pl, pl]. In contrast, the lexical inventory of Mwaghavul contains phonological exponents that are specified for different morpho-syntactic features on the probe. The two allomorphs /car/ and /vwèt/ realize the root $\sqrt{\text{DRINK}}$ in the context of *v*[pl] and *v*[pl, pl], respectively. Therefore, the outcome of Multiple Agree is made visible at Vocabulary Insertion.

8.   *Concluding remarks*

I have proposed a morphosyntactic account of verbal number in Mupun (and in other Chadic languages, such as Mwaghavul). To the best of my knowledge, there is no other syntactic approach to verbal number to date. This analysis allows to derive the patterns that are attested in Mupun and to rule out the ungrammatical sentences. It can also naturally account for problematic issues for previous approaches: (i) the realization of verbal number through morphology, (ii) the difference between event number and participant number, (iii) the external argument of unergative verbs as a goal for verbal number. The feature on *v* is the same for both participant number and event number; the difference between these two functions is due to the syntactic structure. The # feature is independent from other ϕ features and underspecified: *many x*, *x* being either a participant or an event.

I make some predictions that are left as a testing ground for the theory. Firstly, I expect that plural adverbial phrases influence the number on intransitive verbs, in the same way as it happens for transitive verbs. This fact follows directly from my analysis, but it has still to be confirmed by data. I expect these cases to be grammatical with the plural event reading. Secondly, adverbials that are underspecified for number or that have a singular meaning (such as 'once') should be skipped by Agree, since they do not carry the relevant feature. In these cases, the number on the DP would determine the number on the verb. Thirdly, if the indirect object of a ditransitive verb is higher in the structure than the direct object, then I expect the indirect object to be the goal for the probe. In other words, a sentence such as 'he gave the books to his mum' should have the plural verb, whereas 'he gave the book to the children' should have the singular verb. The same picture is expected with other DPs that are introduced by voice morphology (causative, applicative etc.). Depending on its position in the structure, if a DP intervenes between *v* and the internal argument, it should be a suitable goal for Agree and should determine the number on the verb. Further research aims at clarifying all these points.

Acknowledgments

Abbreviations

F	feminine
HABIT	habitual
INF	infinite
M	masculine
NOM	nominative
OBJ	object
PL	plural
POSS	possessive
PST	past
SG	singular
SUBJ	subject

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