

# Agreement

Greg Kobele

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- We must decide what morphological features are, and how they are structured. There doesn't seem to be any *a priori* correct way of doing this, and so I will simply treat a morphological feature as consisting of a pair of a feature name (like **person**) and a feature value (like **3**).<sup>1</sup>
- A morphological feature bundle is simply a set of morphological features. This allows for *inconsistent* feature bundles (a bundle is inconsistent if it contains two different values for the same feature name), but does not allow for a feature bundle to have 'multiple instances' of the same feature (qua name-value pair).
- As a simple case study in building a specification of how morphological information should be transmitted across syntactic dependencies, let us consider English subject-verb agreement.
  - In our current analysis, subjects (which tend to be DPs) have the syntactic features **d -k**, and it is the inflection in the clause where the subject checks its **-k** feature which covaries with the subject; this is the finite T head, which has syntactic features **=v +k t**.
  - We can assume (with many others) that DPs have fully specified (morphological)  $\phi$ -features (person and number), but an unspecified (morphological) case feature. That the case of the subject DP is nominative is, in our analysis, a virtue of the fact that it checks its **-k** feature against the **+k** feature of finite T. Similarly, finite T should have unspecified (morphological)  $\phi$ -features,

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<sup>1</sup>To make this fully general, we can encode names as numbers (and so we might encode **person** as the number 17), and we can treat values as numbers as well. We treat the value 0 as special; a pair  $\langle n, 0 \rangle$  will be taken to indicate that feature  $n$  is *unspecified* as to its value.

which become identical with those of the subject in virtue of the fact that the syntactic dependency between  $+k$  and  $-k$  features has been established.

- We can view this syntactic dependency as a sort of *communication channel*, and allow both expressions on either side of the channel to pass and receive (finite) messages to and from each other. DP must end up passing information about its person and number features, and receiving information about its case feature. T must pass information about the case specification DP should have, and receive information about its person and number feature values.<sup>2</sup> We might write this information on the features themselves by superscripting the information passed, and subscripting the information received.

- \* Thus the  $-k$  feature of a DP should look instead like the following:

$$-k_{\text{case}}^{\text{per,num}}$$

The superscripts are intended to mean that the information passed out along the channel established by  $-k$  are the *values* of the head's morphological **per** and **num** features. The subscript is intended to mean that the information received along the channel is to be set as the *value* of the head's morphological **case** feature.

- \* The the  $+k$  feature on finite T should look like the following:

$$+k_{\text{per,num}}^{\text{NOM}}$$

The superscript is intended to mean that the information passed along the channel established by  $+k$  is the *value* **nom** – this need not be the value of any morphological feature of the head T. The subscripts are intended to mean that the information received along the channel should be set as the values of the head's morphological **per** and **num** features respectively.

- This setup allows both for more information to be passed along a channel than a receiver expects (or wants) to receive, and for less information than is desired. What should happen in either of these situations?

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<sup>2</sup>Note that it is very strange to think that T has a (morphological) case feature; no morphologist looking at English verbal inflection would posit such a thing.

**Too much** In this case, we might well allow that the receiver be able to simply discard the irrelevant information.

**Too little** Here, it is not obvious how to ‘fix’ this. Some options:

1. the syntactic features on the receiver do not delete.
2. the other desired but unobtained values are set to some predetermined default.
3. the derivation crashes.

It is not clear that we will ever have cause to worry about this latter case in the grammars for English that we are developing; at least in the simple fragments we have been considering, it is easy to coordinate both sides of the channels so as to provide *at least* as much information as is desired.<sup>3</sup> Note that we already provide *too much*, as objects check their case against a feature (AgrO, or little-v) which does not need any morphological  $\phi$ -features.

- We must countenance (so it seems) morphological information being passed along during **merge** as well as **move** (or **agree**). Consider the determiners *every* and *all*, which select for singular and plural NPs respectively. We might think of the noun *boy* as having an under-specified **num** feature, which becomes specified as **sg** once merged with *every*, and as **pl** once merged with *all*. Thus, the lexical entry for *every* in English should look like the following:

$$\left\langle \left[ \begin{array}{l} \text{num:SG} \\ \text{per : } \mathbf{3} \\ \text{case: } - \end{array} \right], \text{EVERY, =n}^{\text{num}} \text{ d } -\text{k}_{\text{case}}^{\text{per,num}} \right\rangle$$

- We might reasonably inquire why on earth *every* should have morphological features, especially as no morphologist in looking at the forms of *every* would see fit to postulate a non-trivial paradigm. The answer is that this is forced upon us by our theoretical decision to treat *every* as the head of a DP, and the empirical fact that DPs we analyze as headed by *every* trigger 3rd person singular agreement on verbs. Note that demonstratives (*this*,/these/,/that/,/those/) do have non-trivial paradigms, and

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<sup>3</sup>Although the first option, which is assumed in much of the current literature, would allow us to give *to* a syntactic case feature (+k) which is *defective*, in the sense that it would not trigger the deletion of the case feature (-k) on the DP which moves to its specifier, in effect allowing us to put the stipulation that the +k on *to* is different from the +k on, say, **Past** in the morphological feature bundle, instead of the syntactic one.

that they are often assigned to the same category as quantifiers like *every* and *all*.

- Were we to instead adopt a more traditional analysis of NP, whereby D is a dependent of N and not the other way around (I.e. N selects for D), we could avoid assigning any morphological features to *every*, if we could find some way to force the morphological number features of the head noun to be singular, when merged with *every*. Note that a pluralia tantum such as *scissors* is morphologically plural, despite being semantically singular, and cannot combine with *every* (\**every scissors*). Clearly, we do not want *scissors* to overwrite its inherently specified morphological number value. Instead, we want *scissors* to be able to test its number value against some information it obtains on the channel. We can do this in one of two ways.

1. Stipulating that an attempt to set a morphological feature value to a different value than it currently has (when specified) fails. Thus if you have a `num` feature value of `pl`, and you attempt to set it to some value  $x$  you receive along a channel, it will fail unless  $x = \text{PL}$ . If we adopt this approach, we must find compatible analyses of phenomena which have been described in terms of multiple case assignment.
2. Treating updating of features as a *unification* problem.<sup>4</sup> This involves re-interpreting notation like  $\text{-k}_{\text{case}}^{\text{per,num}}$  as an instruction to establish equations `self.per = x`, `self.num = y`, and `self.case = z`, where `self.w` is the value of your own  $w$  feature, and  $x$ ,  $y$ , and  $z$  are the respective values of the head at the other end of the channel. At the end of the derivation, it is determined whether these equations can be satisfied, and if so, what values must be assigned to unknown morphological features.<sup>5</sup>

- With this technology at hand, we can revisit the question of whether and how words should be constructed in the syntax. For example, we have seen how we can deal with the Auxiliary system of English

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<sup>4</sup>Unification is a hard problem when it is unconstrained (second order unification is undecidable), but we are using a very restricted (atomic) version, which is efficiently computable.

<sup>5</sup>An *implementation* of the grammar in a parsing algorithm could of course unify in an incremental way.

by decomposing inflected verbs into verb roots together with various (derivational) affixes. Now, however, we have another possibility available to us, namely, that an auxiliary (such as *have*) selects directly for a verb, but requires that it have the morphological feature of **+perfective**. Note that this is *different* from having a lexical item of the form  $\langle \text{KNOWN}, =\mathbf{c} \mathbf{V}_{perf} \rangle$ , as  $\mathbf{V}_{perf}$  is a syntactic category symbol, and has nothing to do with morphological features. We thus need another lexical for the participial form, another for the gerundivial, etc. This unpalatable situation was what motivated the affix hopping approach in the first place. Now we are able to say that the *single* lexical item for the verb *know* has the lexical entry below:

$$\langle [ \text{form:} - ], \text{KNOW}, =\mathbf{c} \mathbf{V}_{\text{form}} \rangle$$

Here, the **form** feature may take values among **verb pres-part**, and **past-part**. The progressive *be* and perfective *have* forms might have the following lexical entries:<sup>6</sup>

$$\langle [ \text{form:} - ], \text{PROG}, =\mathbf{v}^{\text{PRES-PART}} \mathbf{v}_{\text{form}} \rangle \quad \langle [ \text{form:} - ], \text{PERF}, =\mathbf{v}^{\text{PAST-PART}} \mathbf{v}_{\text{form}} \rangle$$

However, this does not yet enforce the rigid (?) word order which obtains when they are both present (*have* < *be*). To do this, we have two options.

1. Find some principled semantic reason which forces  $\llbracket \textit{have} \rrbracket$  to occur outside of  $\llbracket \textit{be} \rrbracket$ .
2. Encode this in the selection features.

This last strategy is a familiar one, and, adopting it, we are led to the following revised pair of lexical entries:

$$\langle [ \text{form:} - ], \text{PROG}, =\mathbf{v}^{\text{PRES-PART}} \text{prog}_{\text{form}} \rangle \quad \langle [ \text{form:} - ], \text{PERF}, =\text{prog}^{\text{PAST-PART}} \text{perf}_{\text{form}} \rangle$$

But of course, then we need an option to *not* have either (or both) of these auxiliaries:

$$\langle [], \text{XPROG}, =\mathbf{v}^{\alpha} \text{prog}_{\alpha} \rangle \quad \langle [], \text{XPERF}, =\text{prog}^{\alpha} \text{perf}_{\alpha} \rangle$$

Here the lexical item XPROG and XPERF simply ‘pass on’ the **form** feature of their complement (which makes most sense in a unification perspective on feature bundles).

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<sup>6</sup>One might wonder why the *have* item has a morphological **form** feature at all, as *have* is always the highest (non-T) auxiliary. This is due to the fact that what we might call a PerfP can occur in a present participial form (*having eaten, I left*).

- One might at this point question why we have  $\phi$ -features on finite T, and not on the actual verb, where they show up. Note that the generalization in English is that only items with the form feature value **verb** may express  $\phi$ -features. Furthermore, only those items with the **verb** feature value which are in a clause with a past or a present T head evince  $\phi$ -features. Given this dependence on tense, it makes sense to keep  $\phi$ -features on the T head.
- How do we decide between our current approach, which treats derivational affixes (such as the participial endings) as separate heads, and the one discussed just above, which denies them any syntactic reality, and relagates them to the morphological component?
  - As we are focussing on syntax, and not on the finer details of morphology, we must look at syntactic arguments. It is not clear what these might be, although it may be the case that the syntactic head approach, *together with our current analysis*, allows for the verbal elements to be pronounced in more different head positions due to head movement (or mirroring, or DM spellout rules, etc) than does the morphological approach. Whether this is a real substantive difference (or whether the analyses in the one style can be rewritten in the other) remains to be worked out.