*I amn't

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In most standard dialects of English, there is a gap in the paradigm of the verb BE where we should expect to find **amn't*. But how do we know that this gap exists, since learners have no positive evidence that **amn't* is ungrammatical? It is even more puzzling since there is no gap when the subject is inverted (*Aren't I...?*). Familiar explanation for this gap fail; in particular, it cannot be the result of conservative acquisition strategies. The explanation offered here is based crucially on a combination of multiple default inheritance and function-based morphology, as embodied in word grammar. The gap is due to a `Nixon diamond' conflict between two competing values for the same morphological function required by the categories `negative' and `first-person'. The inverted form is supplied by stipulation because of the functional pressure to supply a `casual' form. The paper also considers various dialect alternatives to the Standard English pattern. The success of this explanation that language must use default inheritance, multiple non-orthogonal inheritance, and morphological functions.*

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1. The problem and an outline of the solution . Why does the paradigm for the English verb BE (in some though not all dialects) have the curious gap where we expect *amn't* after *I* as in (1d)?

(1) a She's not your friend.
b She isn't your friend.
c I'm not your friend.
d *I amn't your friend.

In contrast there is no gap in the inverted paradigm, although (in most dialects) **amn't* is still excluded.

(2) a Isn't she your friend?
b Aren't/*amn't I your friend?

There is no uncertainty about the data, though there are interesting regional variations which we shall discuss below: native speakers of most dialects of English agree that **amn't* is quite impossible. The problem has been well known in linguistics since at least 1970 (Langendoen 1970, Hudson 1977; Dixon 1982, Gazdar et al 1982, 1985:64, Sells 1985:93, Hudson 1990:215, Bresnan forthcoming b), but no solution has been offered which goes beyond mere stipulation of the gap[i].

The problem has to do with learning rather than formalisation (though as we shall see below the two are connected). Any feature-based theory can define the gap in terms of a unique cluster of features such as [BE, PRES, -INV, 1SG] and then rule this cluster out in some way or other. That part is easy; what is much harder is to explain how native speakers know that the gap exists and why we don't simply plug it with the obvious form, **amn't*. After all, a paradigm without a gap is presumably simpler than one with a gap, so we might expect learners to take the very easy step of simplifying this paradigm (as they might simplify irregular forms of some less common words). In fact the puzzle is even deeper: since learners have no positive evidence for the gap they need never be aware of it, so their experience to all intents and purposes presents them with a paradigm that has no gap - and yet we all know that the gap is real. Any reasonable theory of language acquisition or of language change predicts that a gap such as this should vanish within a generation; and yet it persists and (so far as I know) there is no evidence of any tendency to fill the gap in the dialects where it exists.

In a search for an explanation, a number of rather obvious candidates present themselves, but all fail on a moment's reflection.

- Because the sequence /mn/ makes **amn't* hard to pronounce. This cannot be the explanation, partly because **amn't* is used in some dialects, and partly because the normal reaction to a pronunciation problem is to fix the pronunciation, and not to eliminate the word. If the pronunciation is indeed problematic, there are many ways to change it, e.g. by inserting [e] between the nasals, or by eliminating one of them as in the normal pronunciation of some dialects, *am't*.
- Because some negatives are irregular, namely *don't, won't, shan't* and *can't*, so there is no clear model for the creation of **amn't*. This cannot be the explanation because there are enough regular cases to outweigh these (in fact, 17 regular to just four irregular), and in any case the irregularity does not affect the suffix *-n't*, which is absolutely regular: every single synthetic negative form, without exception, ends in *-n't* (or its reduced phonological equivalent /n/).

There are two other plausible explanations, conservative language acquisition and usage-based acquisition, which deserve more attention. In section 2 I shall review these two avenues, but they will both turn out not to lead to a solution.

What is needed, then, is an analysis of the relevant parts of English which will explain the remarkable stability of this gap. There must be something about the grammar of English that causes the gap, so that speakers don't need any evidence for it and don't try to fill it. On the other hand, this explanation must not be too good, because (as we shall see) there are some dialects in which the gap has indeed been filled.

In a nutshell, the explanation that I shall offer explains the gap as the result of an unresolved conflict of multiple default inheritance. The word concerned needs to be an example of the negative of the present tense of BE, which (by default) is *aren't*; but it also needs to be an example of the first-person of the present tense of BE, which is *am*. It cannot have both of these forms at once, so the conflict must be resolved; but we cannot resolve it in the normal way, by giving priority to the more specific alternative, because neither pattern is more specific than the other. Therefore the conflict remains unresolved, we don't know how to pronounce (or write) the word, and we can't use it.

The rest of the paper will develop this explanation, which clearly cannot stand on its own. It stands or falls with the theoretical assumptions about the mechanics of inheritance and of morphology, and with the particular analysis of English morphology that I shall outline, so all these things have to be justified. Conversely, to the extent that the explanation works it counts as evidence for these assumptions. The proposed solution will be outlined in Section 3, and formalised in terms of word grammar in Section 4. Finally Section 5 will draw some general theoretical conclusions.

2. Two alternative accounts

2.1 Conservative acquisition strategies. A plausible approach to explaining the gap is based on the idea of strict conservatism in learning which has been suggested by Pinker; if each form in a paradigm must be learned separately, then clearly our gap will be transmitted faithfully from generation to generation. In general, Pinker rejects strict conservatism in language acquisition on the grounds that children create non-adult complementation patterns such as *Can you nut these?* and *Don't giggle me* (Pinker 1989:19, 1984/1996:192). However he makes a special case for auxiliary verbs:

> The learning theory for auxiliaries basically consists of the claims that children analyze auxiliaries as complement-taking verbs, that they create verb paradigms with sentence modality and morphology as dimensions, and, crucially, that cells in such paradigms for auxiliaries may not be filled in by productive operations based on nonauxiliary paradigms (or on homonymous forms), only by direct positive evidence. (1984/1996:256)

If Pinker is right, it is easy to explain any gap in a child's auxiliary paradigm, including the one for **amn't*, so although Pinker himself does not discuss the *I amn't* problem, his theory is worth exploring. However, there are reasons to doubt that this is in fact the explanation.

Most obviously, it leaves us without an explanation for the stability of the gap. The gap will survive only if children never hear the relevant form, so every single model speaker must share the gap; one speaker who fills the gap would eventually `contaminate' the whole system. Nor does it explain how the gap originated. According to Warner (1993:208), the reduction of *not* to *n't* dates from the 17th century, so something must have prevented it from applying to *am*, giving the expected *amn't*. Strict conservative acquisition does not help here.

Furthermore, although Pinker's theory is expressed in absolute terms, he acknowledges a small number of counterexamples - auxiliary forms which are not based directly on adult forms[ii]. Consider one particular non-adult form which Pinker discusses, the

apparent auxiliary *better* as in *We('d) better go now*. Positive evidence for a non-adult classification would be any example where *better* was used like an auxiliary, but Pinker found no such examples in the very large data-base that he surveyed (1984/1996:273); however other people have found examples in which *better* is negated (Crystal 1987/1997:245) or inverted in negative tags[iii]:

(3) a You bettern't do that.
b We better go now, bettern't we?

This cannot be the result of conservative learning, so there seems to be some `leakage' even for auxiliaries. To some extent, therefore, children must be able to guess the contents of cells in auxiliary paradigms, though this generally has no effect on the adult language because the forms concerned will soon be replaced by the official adult ones. In contrast, in the absence of an alternative form a guessed filler for the **I amn't* cell should survive into adulthood, providing positive models for the next generation in a way that should quite quickly remove the gap altogether. But this does not seem to have happened.

These doubts about Pinker's approach extend to any attempt to explain the **amn't* gap in terms of conservative language acquisition. However conservative a child may be, it can only transmit a pre-existing gap, so we still need an explanation for the gap itself; and anyway there seem to be limits to conservatism even in the acquisition of auxiliaries so we should expect at least some children to plug the gap. Unlike all their other non-adult guesses, this one should persist into adulthood for lack of any positive evidence that it is wrong. The effect of this kind of leakage should be the usual S-shaped curve in the use of **amn't* until the gap no longer exists for anyone; and yet there is no evidence that this change is actually happening. It seems, then, that we need to look at the adult language for a structural explanation.

2.2 Usage-based acquisition strategies. Another possible explanation for the **amn't* gap is that children learn it by paying attention to the statistics of usage: they learn that **amn't* is never used, and behave accordingly. This explanation presupposes, of course, that it is possible to learn from 'negative evidence', contrary to standard assumptions; and we shall see below that this is indeed possible. However we shall also see that such learning only takes us half-way to an explanation of the **amn't* gap.

Usage-based learning is a theoretical tenet of Cognitive Grammar (Langacker 1987:380), where its effects are called 'entrenchment': "Entrenchment is a cognitive consequence of experience: the more frequently a given form or pattern is experienced (whether in production or comprehension), the more entrenched it becomes. The more entrenched a form is, the more likely it is to be activated in actual usage events." (Kemmer and Israel 1994:166) This is a controversial claim, since most theories of grammar make no provision at all for different 'degrees of entrenchment', but that is not in itself reason to discount it and indeed there are very good reasons to take it seriously as a claim about the way in which grammars are implemented mentally. One of the most firmly established findings of psycholinguistics is the 'frequency effect', whereby more frequently used words are easier to access than those that are used less frequently (Garman 1990:256, Reisberg 1997:51). Assuming that entrenchment correlates with frequency, this finding supports the claim that different words do indeed have different degrees of entrenchment.

A simple application of this idea to the **amn't* gap would be to say that the gap exists simply because nobody says **amn't*, so it has zero entrenchment in all our grammars. But this explanation is too simple because it runs into the problem of generalisation that we considered in Pinker's theory. There are plenty of inflected words that may never have been

uttered but which we can nevertheless imagine ourselves using, given the need; and the reason for this is that we can generate them by generalisation. Any theory of grammar ought to allow some kind of generalisation across negative auxiliaries such as *isn't* and *haven't* from which the possibility of **amn't* can be predicted; and then the possibility arises that the relevant degree of entrenchment is that of the general pattern. If **amn't* is generated by a generalisation based on relatively frequent words such as these, why should its degree of entrenchment be different from theirs? In short, if **amn't* is generated by a generalisation which can combine *am* with *n't* in a regular way, why should its entrenchment not be simply a function of the entrenchments of these two forms? The question, then, is how a child can learn that **amn't* has an irregular degree of entrenchment simply by never hearing it.

A possible answer comes from a very different area of study, quantitative sociolinguistics, where there is massive evidence for quantitative differences in usage which must be explained (ultimately) in terms of some kind of quantitative differentiation in cognition. In this work the focus is on forms that are in competition with each other, which allows each form to be assigned a probability relative to its rivals: ".. the relative frequency of use of competing or alternating forms in a given speech community seems to be part of the community's linguistic norms and so learned in the course of language acquisition." (Kroch 1989:137) It is easy to find examples of competing forms whose relative frequencies have been transmitted faithfully across many generations, the classic example being the choice between the velar and nasal pronunciations of the English *-ing* suffix which is found, with much the same statistical patterning, right across the English-speaking world (Labov 1989). The importance of focussing on such contrasting sets is that the occurrence of one form is evidence for the NON-OCCURRENCE of the other where it might have occurred. This is very different from simply counting forms that do occur. For example, one can count the occasions when post-vocalic /r/ does not occur by counting all the words where it could have occurred, and deducting those where it does occur.

When applied to our **amn't* gap, this approach yields a plausible model for how we might learn that, in spite of the generalisation that allows it, it actually does not occur. The crucial element in the argument is that negative verbs in English contrast systematically with another pattern, consisting of the reduced form of the same verb followed by full *not* (e.g. *isn't* versus *'s not*); following Bresnan (forthcoming b) we can call these alternatives 'synthetic' and 'analytic' respectively. By assumption the synthetic and analytic forms are exact synonyms, so the choice between them is determined solely by social (including stylistic) considerations. Unfortunately we have no data on the actual statistical balance between these, but for the sake of argument let us assume that there is a regular ratio of synthetic to analytic across all verbs. Now whatever this ratio may be, it sets up an expectation for the negative of *I am*, so the learner has a standard of comparison against which to measure experience; and when measured by this standard, **amn't* is noticeable for its absence. In short, every time we hear *I'm not* we are reminded that **I amn't* is not possible.

Let us suppose that this account is correct. Does it in fact explain why **amn't* is ungrammatical? Unfortunately not. Even if it explains how the gap is transmitted from generation to generation, it does not explain why the gap arose in the first place. Why should *am* have been treated differently from all the other auxiliary forms when our ancestors started to attach *-n't* to verbs? This is the fundamental challenge, and transmission is a secondary issue.

3. A solution

3.1 An outline. The basic idea behind the following solution is that it is due to competition between two competing forms (*aren't* and *am*) which neither can win. The notion of competition has recently become popular in linguistic theory, especially through Optimality Theory and the Minimalist Program[iv]. However, a much older and more familiar system for handling competition is DEFAULT INHERITANCE, which underlies most formal analyses dating back to Panini (and which has the great attraction of being widely accepted as a part of general cognition). The present section will develop an explanation for the **amn't* gap which is based on default inheritance, following an interesting observation by Andrews in a footnote (1990:519) which points out the consequence of allowing any form to block any other form whose features subsume it: `equally specified (distinct) forms would then block each other, so that neither could be used, unless some additional and marked stipulation disabled blocking'. The next section will present a more formal analysis based on a specific theory of default inheritance, word grammar.

Briefly, the proposed analysis involves a competition in which neither candidate wins. The competition is between the nodes in an inheritance network which combine to define **amn't*, namely, those for *aren't* and *am.* The reason why **amn't* does not exist is that it has to unify the forms *aren't* and *am*, which is (obviously) not possible. Thus the explanation has two parts:

- the claim that **amn't* has to combine the morphological properties of both *aren't* and *am*,
- the claim that these properties cannot be combined.

3.2 Multiple inheritance: some general principles. The background to the first claim is an uncontroversial set of ideas about classification and inheritance of properties. The classification of a category or word shows how it fits into a hierarchical system of more and less general categories which is commonly called a `semantic network' and whose links are labelled 'ISA' (Luger and Stubblefield 1993:35). Thus *are* `isa' BE which in turn isa[v] verb, and so on. Isa relationships can be treated as basic elements - an approach that we shall take later - but they can also be left implicit in the names of categories. This is the basis for feature classifications of the kind that most linguists use, so it will be helpful to use it in this section though we shall reject it in the next section. If A isa B, then A's feature description must subsume that of A, but not vice versa. For example, suppose the definition of BE in terms of features is simply <BE, verb>, this immediately shows that BE isa verb because <BE, verb> contains <verb> without being contained by it.

If A isa B, then it follows that A INHERITS the characteristics of B. This too is uncontroversial: after all, we only classify BE as a verb because it has the characteristics that we associate with verbs. Almost as uncontroversial is the further claim that inheritance is DEFAULT INHERITANCE, so characteristics are inherited only 'by default', in the absence of overriding characteristics. In short, if A isa B, then A may be assumed to inherit all of B's characteristics except those which conflict with characteristics that it is known to have.

The relevance of default inheritance is that it is a principle for handling competition in a complex system such as a grammar. In this respect it is very similar to other competition models such as OT, and like OT it guarantees a winner in every competition, namely the one characteristic which is not overridden. In itself, therefore, it cannot solve the problem of **amn't*. The solution lies in adding another idea, that of MULTIPLE INHERITANCE whereby one element in a system may inherit from two or more other elements which do not inherit from each other. This is known to be a source of problems for working AI systems because it can

lead to contradictions as in the famous 'NIXON DIAMOND', where Nixon inherits pacifism from `Quaker' and non-pacifism from `Republican'; the example is from the standard discussion in Touretzky (1986:11). Multiple inheritance works smoothly as long as it is `orthogonal' - i.e. as long as the characteristics inherited from different models are orthogonal (unrelated) to each other. For example, a verb may inherit from both a lexeme, such as <*WALK*>, and an inflectional category, such as <past>, so long as it inherits its stem from one model and its suffix from the other.

In short inheritance works smoothly provided that either of the following conditions is met:

- the inheritable characteristics are mutually compatible and simply unify with each other, or
- the inheritable characteristics conflict but the conflict can be resolved by default inheritance.

The one situation that cannot be tolerated is where characteristics conflict but default inheritance leaves the conflict unresolved.

3.3. Multiple inheritance in DATR. In grammar the principle of orthogonal multiple inheritance has been accepted de facto for centuries. More recently it has been used as one of the basic principles of the computer language DATR which has been built specifically for modelling language (Evans and Gazdar 1996), and which has been applied to morphology in Network Morphology (Corbett and Fraser 1993, Fraser and Corbett 1995, Brown and Hippisley 1994). In view of this basic principle it might be thought that the analysis to be presented below could be expressed as a DATR theory, but unfortunately the basic logic of DATR makes this impossible, as I shall now explain. Consequently we must conclude that either the proposed explanation for the **amn't* gap is wrong, or the logic of DATR needs revision.

DATR is designed in such a way as to rule out, as a matter of principle, conflicts such as the one that I am invoking as the explanation for the gap. It does this by allowing two different routes for inheritance of properties: down the isa hierarchy, or by stipulation for individual attributes (or attribute types). Conflict can arise only if one node inherits via two different isa links, so DATR will not recognise more than one isa link per node; all other inheritance must be stipulated on an attribute-by-attribute basis.

Consider the following very simple example of multiple inheritance: a past-tense verb which inherits its stem from its lexeme and its suffix from its inflection. For example, the past tense of *WAIT* inherits its stem from the lexeme *WAIT* and its suffix from the inflection Past. The following DATR sentences express all the relevant background facts:

```
[1]   a   Verb:        <whole> == "<stem>" "<suffix>".
      b   Past:        < > == Verb
                       <suffix> == ed.
      c   WAIT: < > == Verb
                       <stem> == wait.
```

In prose, [a] says that a verb's 'whole' - i.e. its completely inflected morphological form - consists of its stem and its suffix. (The quotation marks allow the stem and suffix to be determined 'globally', i.e. by consulting other sentences.) Sentences [b] and [c] say that for Past the suffix is *ed* and for *WAIT* the stem is *wait*. The crucial relationship is shown by the empty attribute, < >, which is the DATR representation of the isa relationship: both Past and *WAIT* isa Verb. The significance of the notation is that < > unifies with any attribute name, so any attribute of Verb applies to Past and *WAIT* by default; any node linked by < > to

another node must isa that node because this is what 'isa' means: that default inheritance applies automatically.

So far, so good. DATR allows us to express the obvious analysis, though it does not yet allow us to go beyond the stored sentences. The problem arises when we introduce a node which must inherit from both Past and *WAIT*, WAIT/past, and ask DATR to infer its 'whole'. The natural way to do this is to recognise two equal isa links for WAIT/past, one to Past and the other to *WAIT*, giving the next DATR sentence:

[2] WAIT/past: < > == WAIT
< > == Past.

However this fails, because DATR only recognises one of the isa links (whichever is later in the list). Thus it infers that WAIT/past isa Past, and since Past isa Verb the same must be true of WAIT/past; and it finds that <whole> is defined for Verb, so it then has to find a value for "<stem>" and "<suffix>", but cannot find any value for <stem> because this is not defined for Past, and it cannot access the value for *WAIT*. The DATR solution to this problem is to use isa for just one inheritance, and to stipulate the other inheritance for the attributes concerned. For example, if we replace [2] by [3a], everything works smoothly:

[3] a WAIT/past: < > == WAIT
<suffix> == Past.
b WAIT/past: <whole>
c WAIT/past: <whole> = wait ed

The query in [b] yields the answer in [c].

Though DATR allows an analysis which works in this case, the solution adopted here cannot be applied to the **amn't* gap precisely because the logic of DATR is designed so that it will always produce a solution, and not a gap. This is achieved in DATR by ensuring that multiple inheritance never produces two equal and competing values for the same attribute, so if taken as a model of human reasoning it predicts that a gap such as the one for **amn't* can never occur. But the **amn't* gap is a reality, and is certainly produced (in some sense) by human reasoning, so if the problem is indeed competing defaults, we must conclude that in this one respect DATR is not an accurate model of human default reasoning. In short, it is essential to our explanation that multiple inheritance should be carried by multiple isa relationships precisely because this permits a conflict of inheritance.

3.4. Multiple inheritance in the verb BE. We now apply these general ideas to our data, starting with the unproblematic form *being*, the present participle. Suppose this has the feature description <BE, present-participle>, which isa both <BE> and <present-participle> - an example of multiple inheritance, since neither of these categories isa the other. (The feature notation used here is a concession to intelligibility; and not the 'official' WG notation, in which every node name is an arbitrary atom and isa relationships are shown explicitly rather than implied by node names.) The multiple inheritance in this case is orthogonal, because the characteristics of the two supercategories do not overlap at all. As far as morphology is concerned, <BE> determines that the stem is *be*, and <present-participle> determines that this stem is combined with the suffix *-ing*.

Consider now the morphology of <BE, present>, the default form of present-tense BE, which I assume is *are* (rather than *is*, which is morphologically marked by the *-s* suffix even in the verb BE). The default morphology of <present> is normally the morphologically 'unmarked' form, i.e. the same as the stem - e.g. *walk* - but in this case the form is irregular. The grammar stipulates that the form is *are*, and the conflict between the expected *be* and the

stipulated *are* is resolved in favour of the latter by ordinary default inheritance because <BE, present> is more specific than <present>. (The analysis of *are* that will be suggested in the next section is somewhat more sophisticated than this, but the general point still holds: the stipulated form for *are* overrides the expected *be*.)

From now on the discussion is directly relevant to the **amn't* gap. The feature description <BE, present, negative> defines *aren't*, which is built quite regularly out of *are* and *-n't*; and <BE, present, 1, sg> defines *am*, which is totally irregular but beats *are* because <BE, present, 1, sg> subsumes <BE, present>. In other words, both the words *am* and *aren't* isa *are*, but neither isa the other. The (non-WG) feature descriptions for these forms of BE are summarised below:

(4) a *are* <BE, present>
b *aren't* <BE, present, negative>
c *am* <BE, present, 1, sg>

Finally we come to the word that should fill the gap in our paradigm. The feature description of **amn't* is as follows:

(5) <BE, present, negative, 1, sg>

It can be seen that this feature description subsumes all three of the words in (4), so (crucially) **amn't* isa both *aren't* and *am*, as shown in **Figure 1** - a classic example of the `Nixon diamond' mentioned earlier. Each of these models provides a different morphology, but the conflict cannot be resolved by default inheritance because neither isa the other. Provided we can show (in the next subsection) that the morphological conflict cannot be avoided in some other way, the generation of **amn't* must crash because it cannot inherit any form at all.

[Figure 1 about here]

3.5. Morphological conflict. According to this analysis, the crash of **amn't* depends on the existence of an unresolvable conflict between the demands of <BE, present, negative> and of <BE, present, 1, sg>. By assumption this conflict lies entirely in the morphology, so the next question is why the morphological demands of these two categories should conflict. We shall see that this question raises important issues in the theory of morphology. Some theories predict a conflict, but others do not, so if this explanation for the **amn't* gap is correct it provides evidence for the theories that do predict a conflict.

It is easy to imagine a morphological analysis of **amn't* which allows this form to be generated. Suppose that <negative> is associated with the morpheme *-n't*, and <BE, present, 1, sg> with the morpheme *am*; and suppose that the former is classified as a suffix and the latter as a stem. Then all we need is a general rule which requires a suffix to be attached to a stem, and success is guaranteed: the form required is **amn't*. It makes little difference whether the suffix is generated by a morphological rule triggered by a feature of the verb (Anderson 1992, Spencer 1991:216), or by a syntactic rule which treats the suffix as a separate word-like element (Halle and Marantz 1993), though I assume that it is in fact an inflectional suffix (Zwicky and Pullum 1983). Nor does it matter whether *-n't* is recognised as a morpheme (as in most theories) or simply as a phonological pattern (Anderson 1992). So long as the rule relates <negative> to the presence of *-n't* after the stem, and a similar rule relates <BE, present, 1, sg> to the choice of *am* as stem, the grammar will allow **amn't* - which, of course, is the wrong outcome.

What is missing from these theories of morphology is the idea that a word's morphological structure is a FUNCTION of its classification, in the mathematical sense of function as a relationship with a single possible value for a given argument (Kaplan and Bresnan 1982:182). For example, the form *walk* is a function of the lexeme *WALK*, for which there is a traditional name: STEM[vi]; once *walk* is defined as the value for this function by a rule such as "stem(*WALK*) = *walk*", no other value is permitted. Similarly, *walked* is a function of the word category <*WALK*,past>, but there is no established name for this function which is why I use the term WHOLE, meaning the fully inflected form; thus *walked* is the whole of <*WALK*, past>. This functional approach is much more important than it may seem, as it immediately provides a potential source of conflict between the feature structures <BE, present, negative> and <BE, present, 1, sg>, provided that we remember that Whole[vii] is one of the characteristics that is inherited by default inheritance. In a nutshell, the conflict lies in the fact that the forms *aren't* and *am* are in competition as values for Whole as applied to <BE,present, 1, sg, negative>.

We shall now consider why this conclusion follows from the grammar for verb-forms. The grammar will be presented as a collection of `facts' expressed in ordinary prose, but we shall consider a WG formalisation in the next section.

The explanation will revolve around two facts:

(6) a Negative verbs are formed by adding *n't* to the corresponding positive form.
b BE is the only verb which has a special form for <1, sg>.

The problem is that each of these facts leads to a different definition for the whole of a word whose feature structure is <BE, negative, 1, sg>.

The rules for forming negative verbs define the whole as `the corresponding positive form' followed by *n't*; so for example the whole of *isn't* is based on *is*. Accordingly, the positive form *is* on which it is based must have some other functional relationship, which we shall call simply POS-FORM. Thus to build a negative verb we first build its pos-form, and then add *n't*. The pos-form in turn is defined by another function which varies with the verb's other features: its stem (defined above) or one of a small number of functions such as `S-FORM', which we can generalise as `X-FORMS'. (This notion is justified in Creider and Hudson forthcoming.) Thus *is* is the s-form of BE, which is formed regularly by the addition of *s* to the stem (even though the stem is irregular). Here, then, is the functional analysis of *isn't*, whose feature structure is <BE, tensed, 3, sg, negative>:

(7) a The stem of <BE, tensed, 3, sg, negative> is *i*.
b The s-form of <BE, tensed, 3, sg, negative> is *i* + *s*.
c The pos-form of <BE, tensed, 3, sg, negative> is *i* + *s*.
d The whole of <BE, tensed, 3, sg, negative> is *i* + *s* + *n't*.

Each of these functions (stem, s-form, pos-form and whole) permits a different range of generalisations, so if human grammars are indeed based on functional definitions, we may assume that humans have these functions in their grammars too. (It makes no difference to the present argument whether we assume that these functions are learned or innate.)

The crucial fact here is that the pos-form is a function whose value is defined by another function - for example, the pos-form of <3, sg> is defined as its s-form, and similarly for all the other possible pos-forms. Here are the rules for tensed verbs:

(8) a The pos-form of <tensed> is its stem.
b The pos-form of <3, sg> is its s-form.
c The pos-form of <past> is its ed-form.

In principle a verb's pos-form could be defined directly as some string of letters or phonemes,

but we shall assume that this possibility is not in fact realised: all verb-forms are defined indirectly in terms of their X-forms and not directly in terms of Whole. As we shall see in the next section, the same is generally true even for the highly irregular verb BE.

Now we turn to the one exception, the form *am*, the only verb-form that is used only with the pronoun *I*. This unique status means that we cannot use one of the existing X-forms, and there is no reason to recognise a new one as this would not allow any generalisations. This means that *am* is not the value for any X-form, so it also cannot be the value for the word's pos-form. The only function which remains for defining *am*, is Whole, which gives a satisfactorily simple solution for positive examples:

(9) The whole of <BE, tensed, 1, sg> is *am*.

However this solution has a price: it prevents the generation of a negative, because the latter can only be built on a pos-form. Recall that according to our analysis, the route to a negative verb-form is as follows:

stem → X-form → pos-form → whole

If *am* is not an X-form, it cannot be mapped onto a pos-form by the usual rules, all of which identify a pos-form in terms of some existing X-form. It is true (as one reviewer noted) that *am* could be stipulated as the pos-form for <BE, present, 1, sg>, but what motivation would a learner have for taking this step? The system of pos-forms is driven by the existence of the corresponding negative forms; so if English had no synthetic negative, it would also have no pos-form. Thus in a dialect where *amn't* exists, a learner may well identify *am* as the pos-form on which the negative is built; but in the absence of a negative form, there is no reason to take *am* as anything but an irregular whole (just like the irregular whole of the negative *can't*, which would have been **cann't* if it had been regular). If, then, *am* is not a pos-form, it cannot be the first part of the whole of a negative. Nor, however, can rule (9) be reconciled with the general rule for forming negatives, because the two rules compete for the function Whole, and neither can win this competition because of the Nixon-Diamond effect explained earlier. Therefore **amn't* is not possible.

Section 4 will present a more formal version of this argument, and will also allow further details to be considered which I have ignored here for the sake of clarity.

3.6. Inverted *amn't I* and formality. The analysis just given wrongly predicts that the gap is unaffected by the position of the subject, but even in dialects where *I aren't* is ungrammatical, its inverted equivalent *Aren't I* is grammatical:

(10) a Aren't I your friend?
b I'm your friend, aren't I?
c Not only aren't I her friend, but I'm not even an acquaintance.

(Notice that example (c) shows that the crucial fact here is the inversion of the subject and auxiliary, and not the interrogative sentence-type as in Bresnan (forthcoming b).). Where does this form *aren't I* come from? More precisely, how does it escape the conflict just described?

The crucial question is whether we can assume that this *aren't* is the ordinary default negative present-tense *aren't* which has somehow managed to avoid the conflict. This assumption seems natural, and is explicit in Bresnan (forthcoming a, b), but there is some evidence that it is wrong. Part of the evidence comes from dialects other than English Standard English (ESE). As Bresnan (forthcoming b) shows in detail, the inverted form is not *aren't* in all dialects; *amn't*, or even *am't*, is also possible in some varieties of Scots and Scots-based Irish English, even though these dialects too ban the uninverted equivalent **I amn't/am't*[viii] and (of course) have *aren't* as the default present-tense synthetic negative

(alongside the much more commonly used analytic negative *are nae*). In these dialects it is clear that the inverted form is specified by one of the following rules, in which `inverted' is a feature which reflects the subject's position.

(11) The whole of <BE, present, negative, 1, sg, inverted> is *am + n't/am't*.

In other words, the grammar plugs the gap at a lower level by another stipulation, though the stipulation is motivated by identifying the first morpheme of *amn't/am't* with the morpheme found in the positive *am*: *am + n't/t*. (This kind of stipulated morpheme-identification is common in other parts of the vocabulary; to take an obvious example, *MALE* and *FEMALE* share the morpheme *male* by stipulation, rather than by rule.)

If this analysis is right for these other dialects, it seems reasonable to assume that ESE too has a stipulated plug for the **amn't* gap in inverted structures, but that in this case the plug is *aren't*, with rule (12) replacing rules (11):

(12) The whole of <BE, present, negative, 1, sg, inverted> is *are + n't*.

The present analysis thus contrasts sharply with the analysis of Bresnan who assumes that inverted *aren't* is the default[ix]. The history of *Aren't I* in ESE confirms my view, since it seems that for a long time the accepted form was (rather surprisingly) *Ain't I*[x] even when *ain't* was otherwise rejected. In short, the grammar reflects the hierarchy in **Figure 2**, which includes the one in **Figure 1**.

[Figure 2 about here]

The question then is why the grammar should plug this gap, while leaving the more general **amn't* conflict unresolved. The explanation for the unfilled gap was logical or cognitive (if we assume that default inheritance underlies reasoning), i.e. it followed automatically from the internal organisation of the grammar. For the filling of the inverted gap, however, the explanation will be purely functional: it is filled because a gap would cause communicative problems. What we have to explain, therefore, is why speakers need to be able to say *Aren't I* (or *Amn't I*) but not **I amn't* or **I aren't*.

The answer is that there is a satisfactory alternative in the declarative pattern but not in the inverted one. Instead of **I aren't* we can say *I'm not*, but there is no such alternative to *Aren't I*. However this answer assumes that we take seriously the parameter of STYLE, and more specifically formality. Sentences (b) and (c) in (13) are virtually indistinguishable not only in terms of content, but also in terms of their style; in any social context where (b) would be appropriate, (c) would do just as well. We can call them both `REDUCED' forms, with the earlier distinction between 'analytic' and 'synthetic'.

(13) a He is not your friend.
b He's not your friend.
c He isn't your friend.

In contrast, (a) is much more formal, so it is not a serious alternative to the others. We must assume that if a speaker plans to express the meaning which is expressed by all these sentences, they must choose between (a) and either (b) or (c) on purely stylistic grounds. A wrong choice can have important social consequences (one 'sounds like a school-teacher', or one sounds 'too familiar'). It is even possible that reduced forms of auxiliary verbs were developed specifically in order to express such sociolinguistic contrasts (Hudson 1997); Labov (1969) is a thorough empirical study of the contrast. But suppose the meaning to be expressed involved `I', not `he'. Then the alternatives are the following:

(14) a I am not your friend.

b I'm not your friend.
c *I amn't your friend.

Here the choice is limited to two, but the analytic reduced form *'m not* is still available so the **I amn't* gap does not really matter.

Consider now the situation where the speaker needs an invertible form. In this case there are only two possibilities with *he* as subject:

(15) a Is he not your friend?
b *'s not he your friend?
c Isn't he your friend?

As (b) shows, the analytic alternative is not possible because the inverted auxiliary must be immediately followed by its subject; however in this case the synthetic reduced form is available for informal speech, contrasting with the more formal full form in (a). But this reliance on synthetic reduced forms creates a serious problem for the speaker who wants to express the same meaning with `I' as subject:

(16) a Am I not your friend?
b *'m not I your friend?
c Aren't I your friend?

If (c) were ungrammatical the only choice would be the formal (a), which would be socially unacceptable - which is why the gap had to be plugged within the grammar. Some form had to be chosen for the stipulation, and either *aren't* or *amn't* would do - *aren't* because it is the default for other subjects, and *amn't* because it is morphologically motivated for use with *I*.

One possible objection to this explanation for the stipulated *aren't I* is that there are other patterns where we seem to manage without informal reduced alternative. For example, we have no reduced form at all for some of the more marginal modals (MAY/MIGHT, MUST, USED, OUGHT), so why did the **amn't I* gap matter so much? Here we can only speculate, but one plausible explanation is that negative interrogatives are especially in need of the distinction between formal and casual because of their illocutionary force; for example, *Aren't I your friend?* is a leading question (meaning 'surely I am ..'). Another relevant fact is that a gap in the paradigm of a very frequent verb such as BE is more significant than one that involves the marginal modals. Other possible explanations are easy to imagine, but it is hard to think how one might choose among them.

To summarise, the choice between reduced and unreduced forms is sensitive to the formality of the situation, which is socially very important. Without inversion we can use either a reduced positive form with *not* (*he's not*) or a synthetic negative (*he isn't*), so when the latter is not available, we can use the former; but this is not possible with inversion, where the synthetic negative is the only possibility for casual style. Consequently there would be a serious social problem if we had no synthetic negative form of *Am I*, so our linguistic ancestors plugged the gap by recognising either *Aren't I* or *Amn't I* (depending on dialect) as grammatical.

3.7. Dialects in which there is no gap. In a number of other dialects the **amn't* gap has been plugged in declarative as well as inverted structures. In Irish English (as opposed to the Scottish-based English of Belfast discussed above) it is plugged by *amn't* (Bresnan forthcoming b); in some dialects of England it is plugged by *aren't* (Trudgill 1990:97); and of course in a great number there is the universal *ain't*. Each of these alternatives implies a somewhat different grammar.

First, we take the grammars with *amn't* or *aren't*. These are presumably just the same

as for ESE except that the Nixon-diamond conflict is resolved by stipulating a winning form for ESE **amn't*, <BE, present, negative, 1, sg>. As we might expect, some dialects side with *aren't*, and others with a negative version of *am*. We can only speculate about the reason why the gap was filled, but once it was filled by stipulation it was easy for later generations to learn the correct form by observation.

In contrast, the dialects with *ain't* have a different organisation in which the gap is simply avoided, rather than filled by stipulation. Non-standard dialects in general show a strong tendency to eliminate subject-verb agreement, and especially so in auxiliary verbs (Trudgill 1990:94, Trudgill and Chambers 1991:51). Even in Standard English levelling has always applied to modal verbs so it may be modals that set the pattern for other auxiliary verbs. Be that as it may, the trend seems to have gone furthest in negative auxiliaries, with *ain't* as the only negative present-tense shape for either *HAVE* or BE, and *don't* as the only one for *DO*:

(17) a I/she/they *ain't* finished yet.
b I/she/they *ain't* ready yet.
c I/she/they *don't* know.

As one would expect, *ain't* is just as good with *I* as it is with any other subject, so there is no gap either with or without inversion.

One interpretation of these data is that these dialects have just the same grammar as ESE except that their morphology has more syncretism: so *ain't* is ambiguous between <1, sg> and unmarked subject. However this explanation would miss the simplifying effects of the difference. Instead I shall assume that *ain't* has no inherent agreement features, so(just like a typical past-tense verb) it is compatible with any subject. If this is so, then there is an important difference between this grammar and ESE: <negative> never combines with any agreement feature (including <1, sg>). The result is a grammar which is more consistent:

- No word has more than one inflectional suffix, in contrast with ESE where *isn't, hasn't* and *doesn't* all contain *-s* as well as *-n't*.
- No negative auxiliary has agreement, whereas ESE has agreement in *HAVE,* BE and *DO* but not in modals.
- There is no **amn't* gap.

The reason for this brief survey of dialect variation was to show that ESE has arrived at only one of the possible solutions to the asymmetries which have arisen in the English auxiliary verb system during the last few centuries. These alternatives are all easy to accommodate by minor changes to the analysis developed for ESE, so it may be reasonable to hope that the same will turn out to be true of all the other dialects that remain unexplored[xi].

4. A word-grammar analysis

4.1. Lexical and inflectional classification of words.

Having suggested an analysis, it is important to show that the analysis is compatible with a more general theory of language structure. I shall do this by outlining briefly the relevant parts of a grammar compatible with WORD GRAMMAR (WG)[xii]. One of the distinctive characteristics of this theory is the prominent place that it accords to both default inheritance and morphological functions, which makes it particularly appropriate for the analysis suggested above.

According to WG, linguistic competence, like a great many other areas of knowledge, takes the form of a network of concepts linked by labelled relationships which are functions, in the sense defined earlier. The concepts with which we are concerned here are word types such as BE, Auxiliary Verb and Tensed, and the most important relationship is Isa, though

we shall also recognise a range of relationships between a word and its various parts - Stem, Whole and a number of others. We start, therefore, with the isa hierarchy of word types. A small sample of this hierarchy is shown in **Figure 4** which introduces the WG notation for Isa, a small triangle whose base rests on the supercategory and whose apex is connected by lines to the subcategories. This figure shows that BE isa Aux, which isa Verb. It also shows that Tensed isa Verb, which is possible because co-subcategories need not be mutually exclusive. This is important for our purposes, because it opens the possibility of multiple inheritance: for example, the word *are* isa both BE and Tensed.

[Figure 3 about here]

This little hierarchy is part of the larger one shown in **Figure 4**, which formalises the distinction between Lexeme and Inflection that gives the double classification of words assumed in all analyses. Thus a lexeme such as *DOG* or BE isa word, but an inflection - i.e. an inflectionally defined word-type - such as Plural or Past also isa word; and an inflection of a lexeme, such as the plural of *DOG*, isa both the lexeme and the inflection. This double classification is reflected in WG category names by combining the two names into a single atomic name such as DOG_{plural}. (In Chomskyan analyses, of course, the double classification for verbs is formalised as the structural distinction between V(erb) and I(nflection), but the basic insight is the same.) The traditional word classes such as Verb and Aux are really classes of lexemes, so they belong under Lexeme, in parallel with the Inflectional categories; but the two systems interact because every inflection is an inflection of some word class, and every word form is defined by both an inflection and a lexeme. These interactions are illustrated in the figure for Tensed and BE_{tensed}, i.e. the default tensed form of BE. (The dotted line will be replaced in a later diagram.)

[Figure 4 about here]

Among the most noticeable characteristics of these diagrams, in comparison with the dominant tradition in formal grammar, are the names given to categories. Category names are atomic, rather than feature descriptions - e.g. BE, not <BE, verb>, and BE_{tensed}, not <BE, tensed>. This follows from the use of isa hierarchies, because complex feature descriptions would be redundant. For example, there is no need to include Verb in the name of the category BE, because the hierarchy shows that it isa Verb.

The logic which is applied to these categories is default inheritance, so the name of a category can double up as that of its default member. For example, according to the analysis in 3.4 *are* is the default present tense of BE, so we give it the same name as the present tense of BE; and if we assume that Present is itself the default tense, the name is simply BE_{tensed}. In short, BE_{tensed} is the official, and only, WG name for the word (whose form is) *are*. But if *are* is the default tensed inflection of BE, the non-default inflections must isa it. Consequently other word types may be recognised as subcategories of BE as shown in **Figure 5**, where BE_{1s} (*am*) isa BE_{tensed}. Similarly BE_{sing} (*is)* and BE_{past} (*were*) both isa BE_{tensed}. The links between these word types and their morphological forms will be dealt with in the next subsection.

[Figure 5 about here]

It is perhaps worth pointing out one of the incidental benefits of this approach, in which lexemes are sub-classified into more specific categories (which we can call 'sub-lexemes'). The logic of default inheritance never yields more than one outcome - either the default, or some more specific value which overrides the default. But it is well known that in morphology (as in other parts of grammar) two forms may in fact be alternatives to one another. For example, there are a few dozen English verbs which allow either a regular or an irregular past tense form - *dreamt / dreamed*, *spelt / spelled*, and so on. In each case, one of the alternatives is the default regular one, and only one is irregular. This pattern is easily accommodated simply by recognising, for each of the verbs concerned, a sub-lexeme whose past tense is irregular, but which is completely regular in other respects. For example, alongside the basic lexeme DREAM we recognise a sub-lexeme $\text{DREAM}_{\text{irregular}}$, which inherits all the characteristics of DREAM except its past tense (which it overrides with *dreamt*). Thus the sub-lexeme has just the same meaning and syntax as the main lexeme, so *dreamt* and *dreamed* are completely interchangeable.

Figure 6 takes the analysis a step nearer to our target word by introducing the contrasts that are specific to tensed auxiliaries (i.e. `Operator'). The marked categories are called Negative, Reduced and Inverted, but as before the unmarked category in each case is simply Operator, which carries the default properties such as having an uninverted subject. The one part of the analysis that needs further comment is the relationship between Negative (e.g. *aren't*) and Reduced (e.g. *'re*). The reason for combining them in this way is that both signal casual style, and the result is a single generalisation to the effect that the style of Reduced is casual which automatically extends to synthetic negative forms as well as positive reduced forms. The analysis explains the interchangeability of pairs like *'re not* and *aren't*, which have the same style because they both include a reduced verb (*'re* and *aren't*), and which have the same meaning because *not* maps to the same semantic structures as a negative operator.

[Figure 6 about here]

Finally we have the target words themselves, **amn't* and inverted *aren't*. The categories that are relevant are BE_{1s}, Negative and Inverted. The relevant part of the grammar is shown in **Figure 7**. The main point of this grammar is that it does not include nodes for every possible combination of the various categories, on the grounds that those that can be inherited will be created ad hoc whenever needed. For example, it recognises BE_{1s} (i.e. *am*) and Inverted as separate categories, but not their intersection $\text{BE}_{1s.inv}$ (*Am I?*) because the grammar has nothing special to say about it - all its properties inherit by default from the two supercategories. Crucially, it does NOT recognise the intersection of BE_{1s} and Negative, which would define **amn't*; so this is part of the explanation for the **amn't* gap. Unlike the analysis in Bresnan (forthcoming b), this one assumes that negative verbs, like other word forms, are generated `by rule' (i.e. by default inheritance) except when they have to be stipulated to reflect exceptional positive evidence (as with irregular forms such as *won't*). Such evidence is not available for **amn't*, so there is nothing to stipulate. Consequently we cannot find this form by simple look-up; but neither can we find it by default inheritance because of the `Nixon diamond' logic. It isa both BE_{1s} and Negative, but neither of these categories isa the other so neither wins, and both lose.

[Figure 7 about here]

In contrast with **amn't*, of course, inverted *aren't* is often experienced in sentences like *Aren't I your friend?*, so it is easily learned (as a stipulation). In order to allow the form to be stipulated, the category must be stored separately, hence the category $BE_{1s.neg.inv}$. From a historical point of view, we explained this form as essential for maintaining casual style[xiii].

Most of the dialect variation which was discussed earlier is easy to accommodate in this grammar. The hierarchy of word types just presented applies (without change) to most of the dialects discussed above, and we shall find that their differences are only a matter of morphology (e.g. the choice between *amn't* and *aren't*). However as noted earlier there is a strong tendency among modern dialects to eliminate subject-verb agreement, which has already produced dialects in which there is no agreement in any negative auxiliary verbs (*ain't*, *don't* and the modals). These variations go beyond the scope of the present article but are discussed in some detail in Hudson (forthcoming), which also presents a WG analysis of subject-verb agreement.

4.2. Inflectional morphology. Inflectional morphology is handled in a WG network by rules which relate the values of two functions of the same word, and its goal is to define each word's whole (its fully inflected form) while revealing its morphological similarities to other words. (For more details, justification and exemplification see Creider and Hudson forthcoming.) WG rules can be presented in ordinary prose, as in our earlier examples in which we adhered to the conventions of the mainstream, but unlike the earlier rules we shall now adopt the WG convention of using atomic category names.

In the simplest case, a word's whole is the same as its stem:

(18) a The whole of a word is its stem.
b The stem of *DOG* is *dog*.

Given that *DOG* isa word, default inheritance allows us to infer that the whole of *DOG* is *dog*. 'Inflected forms' (i.e. non-default inflections) have a whole which is distinct from the stem.

(19) a The whole of a $noun_{plural}$ is its stem + *s*.
b The whole of $PERSON_{plural}$ is *people*.

Rule (a) overrides the general default, and provides the default for plural nouns, which in turn is overridden in the case of irregular nouns like *PERSON*.

Verbs are much more complicated (even in English, which generally has so little inflectional morphology), as they require two more functions in addition to the whole and the stem. As we saw earlier, they have a pos-form which is distinguished from the whole in the case of negative verbs, and which by default is the same as the stem.

(20) a The whole of a verb is its pos-form.
b The pos-form of a verb is its stem.

For example, *do* is the whole, the pos-form and the stem of DO_{tensed} in both the following examples:

(21) a I do like it.
b I do the washing-up.

As the examples show, these rules apply to all verbs, auxiliary or not, although it is only auxiliaries that allow a negative form. Here is the rule for negatives that generates words like *don't*:

(22) The whole of an $operator_{negative}$ is its pos-form + *n't*.

This overrides the default (20a) because $Operator_{negative}$ isa verb.

Pos-form generalises across all verbs which have a negative form, capturing the notion `corresponding positive form'. However not all pos-forms are the same as the verb's stem. To allow systematic mismatches between the two we need the range of X-forms discussed in the previous section. Those relevant to tensed verbs in general are s-form and ed-form, found respectively in singular and past verbs:

(23) a The pos-form of a $\text{verb}_{\text{sing}}$ is its s-form.
b The pos-form of a $\text{verb}_{\text{past}}$ is its ed-form.

These X-forms in turn have default relations to the stem:

(24) a The s-form of a word is its stem + *s*.
b The ed-form of a verb is its stem + *ed*.

The X-forms allow generalisations which would not otherwise be possible. S-form is equally relevant to plural nouns, and (in a more complete treatment) will probably allow the same allomorphic rules to apply to both. Ed-form, on the other hand, generalises within verbs to their passive participles and perfects, though in some irregular verbs its form past tense forms are different from these two; to allow such distinctions we recognise en-form as a sub-case of ed-form. The following rules can therefore be assumed to exist in the grammar alongside the above:

(25) a The whole of a $\text{noun}_{\text{plural}}$ is its s-form.
b The whole of a $\text{verb}_{\text{past}}$ is its ed-form.
c En-form isa ed-form.
d The whole of a $\text{verb}_{\text{perfect}}$ is its en-form.
e The whole of a $\text{verb}_{\text{passive}}$ is its en-form.

Thus X-forms are the main device for handling syncretism (the systematic identity of form between distinct inflections such as perfect and passive participle).

These functions accommodate almost all of the complexities and irregularities of inflectional morphology. For example, it is easy to handle lexical irregularities among past-tense forms by giving a non-default value for the ed-form of the verb concerned:

(26) a The ed-form of *GO* is *went*.
b The ed-form of *SING* is *sang*.
c The ed-form of *WEEP* is *wept*.

Better still, the grammar can distinguish between suppletive cases like *GO* and less extreme irregularities such as *sang* and *wept* by localising the irregularity. The main parts affected are the stem-vowel and the suffix, so these can be recognised as functions of the X-form: the stem-vowel (or suffix) of the ed-form of such-and-such verb.

(27) a The stem-vowel of the ed-form of *SING* is *a*.
b The ed-form of *SING* has no suffix.
c The stem-vowel of the ed-form of *WEEP* is *e*.

It should be easy to see how this apparatus can be extended to other irregularities.

However, there remains one verb which cannot be accommodated in this system, and which is particularly important for us: BE. The problem is that this verb makes more morphological distinctions than other verbs, so the apparatus of X-forms which suits other verbs breaks down. The forms with which we are concerned are the tensed forms: *is*, *was*, *are*, *were* and (of course) *am.*

▪ The least problematic is the form *is*, because it does at least have the morphological structure that we expect in an s-form: stem + *s*. The complication is that the stem is suppletive, but that can be handled within the framework established for other verbs:

(28) The stem of the s-form of BE is *i*.

▪ The past-tense singular form *was* can also be accommodated, since it too has the final *s* that we expect of an s-form, and s-forms are what we expect for singular verbs. Admittedly it is syntactically different from other singular verbs in that it combines with *I* (*I was* but *I walk*, not **I walks*), but this fact can be handled in a more complete analysis[xiv]. We can therefore let the default rule for singular verbs assign it an s-form, leaving the suppletive stem as the locus of irregularity. However we have to distinguish *was* from *is*, which means that the tense must be mentioned:

(29) The stem of $BE_{past.sing}$ is *wa*.

▪ The default present-tense form *are* is more difficult because BE is the only verb whose default present is different from its stem, so the system of X-forms does not make enough distinctions. One possibility is to treat it like the irregular stem of *was*, using a rule which mentions the verb's tense.

(30) *The stem of BE_{tensed} is *are*.

However, as shown by the star, this rule is inadequate because it misses another partial similarity: that between *are* and *were*, which is supported by the partial similarity between *were* and *was*. It seems likely that speakers build grammars which reflect the fact that the first two both end in *re* in spelling, and with /r/ or equivalent in speech; and that the second pair both start with *w* plus vowel - indeed, we have already recognised a division of *is* and *was* into *i* + *s* and *wa* + *s*, which points to the same conclusion.

These parallels suggest a morphological analysis of all these words into two parts each: *i-s*, *wa-s*, *a-re*, *we-re*. If the first two are the s-form of the verb, the last two must be its `re-form'. In short, the list of X-forms given above needs to be extended by the addition of Re-form, which applies solely to the verb BE.

(31) a The pos-form of BE_{tensed} is its re-form.
b The re-form of BE is its stem + *re*.
c The stem of BE_{tensed} is *a*.
d The stem of BE_{past} is *we*.

In short, whereas other verbs use their ordinary stem as a default tensed form, BE uses a special form which combines with suppletive stems, just as in the case of *is*. (With a slightly different set of rules we could reveal the partial similarity between the two past stems, *wa* and *we*, but this would be irrelevant here.)

Another complication that we have already discussed informally is the inverted *Aren't I* form, which cannot be explained in the usual way as the result of adding *n't* to the expected pos-form. This can easily be stipulated as a special negative form by a rule which overrides the default negative rule (22). This rule could simply stipulate the form *aren't*, but we can do better than that by cross-referring to its historical source, which is a connection that native speakers presumably recognise as well:

(32) The whole of $BE_{1s.neg.inv}$ is the whole of $BE_{tensed.neg}$.

As we saw in the earlier discussion this rule can easily be learned on the basis of positive evidence, and is motivated functionally.

The reason for this detailed analysis of BE is the light that it sheds on the one form that we have not covered, which is *am*. We have found that with the addition of re-form, all the other unreduced[xv] forms can be handled by means of rules of one of the following forms:

(33) a The [X-form] of [lexeme+inflection] is ...
b The [stem/stem-vowel] of the [X-form] of [lexeme] is ....
c The [X-form] of [lexeme] has no suffix.

The same is not true of *am*. As an example of BE_{tensed} the rules in (31) predict the re-form

are, so we somehow need to override these rules, but we cannot define *am* as a different X-form of BE because none of the X-forms is relevant and there are no generalisations which would justify adding another X-form. (It is true that we could specify *am* as the re-form of $_{\text{Betensed. 1s}}$, but there would simply be no motivation for doing so in terms of permitted generalisations or revealed similarities.) This means that we cannot use any of the rule-forms listed in (33).

The conclusion is that *am* is the only form which cannot be defined in terms of Pos-form and an X-form. This leaves only one option in the morphology: to use the function Whole.

(34) The whole of $BE_{tensed,1s}$ is *am*.

If this conclusion is correct, then we have completed the explanation for the impossibility of **amn't* by showing that the rule for $BE_{tensed,\ 1s}$ fills the slot Whole[xvi]. As we saw above, the same is true for the rule for $operator_{negative}$ in (22), so when they are in competition one must win; but neither can win because of the Nixon-diamond effect, and no form at all is possible.

As promised earlier, this grammar can easily be varied to allow dialect variation - or indeed to allow alternatives to coexist in the speech of one person. There seem to be four different alternatives to the ESE (English Standard English) pattern (though the further complications of note 11 must be borne in mind):

▪ Scottish (and Ulster) dialects have *Amn't I* but reject **I amn't*. These dialects replace rule (32) by one which stipulates *amn't*, but which does so by using the same two morphemes that are found in *am* and in all the negative verbs. This explains the motivation for the form without building one whole on another, respecting the principle that a word's whole is its final and completely inflected form, ready for use (apart from phonological adjustments).

(35) The whole of $BE_{1s.neg.inv}$ is *am + n't*.

▪ Irish dialects allow both *Amn't I* and *I amn't*. These are like the Scottish dialects except that the stipulation applies to a more general category which isa just BE_{1s} and Negative:

(36) The whole of $BE_{1s.neg}$ is *am + n't*.

▪ Some English dialects have *aren't* both before and after *I*. These are the same as the Irish ones except for the form which is chose, and the fact that this form can be defined directly as a whole:

(37) The whole of $BE_{1s.neg}$ is the whole of $BE_{tensed.neg}$.

▪ Finally, there are all those dialects in which negative operators have no subject-verb agreement, so the one form *ain't* combines with any subject, and in either order. As I explained at the end of the last subsection these dialects have a somewhat different system of word classes and inflections which we cannot explore here.

5. Theoretical consequences

5.1. The rigidity of inheritance. Although this article has focussed on one tiny detail of a single language, it has broader implications for linguistic theory which I shall now draw out. We start with the surprising rigidity in the inference mechanism which leads to the **amn't* gap. Most theories of learning and generalisation credit us with enough intelligence to be able to fill a gap such as this with no trouble at all. It can be presented as a very simple example of analogy:

is: isn't :: am: ??

When presented in this way, our refusal to fill the gap is quite astonishing. According to the explanation advanced here, we are locked into a system of logic (multiple default inheritance) which prevents us from accepting the obvious solution.

Needless to say, if multiple default inheritance really is the explanation for the **amn't* gap, its relevance must go well beyond this particular example. If it applies here, it must also apply throughout morphology, but (according to word grammar) its effects can be found throughout language and beyond. It is often invoked in Artificial Intelligence (Luger and Stubblefield 1993:386), so one conclusion of the present paper is that it should be taken more seriously in linguistics as well.

5.2. Multiple inheritance: orthogonal or free? A related issue involves the theory of default inheritance. Assuming that multiple inheritance is possible, what restrictions, if any, should the logic impose on inheritance from competing models? This is a major question in the logic of inheritance systems (Touretzky 1986), and one well-defended position which we reviewed in section 3.3 underlies the programming language DATR, which allows only 'orthogonal' multiple inheritance (Evans and Gazdar 1996). According to this view the 'Nixon diamond' is a logical impossibility, because the multiple inheritance involved is not orthogonal - Nixon inherits values for the same attribute from both his model categories. Because of this, the premises concerned cannot even be expressed in DATR.

Insisting on orthogonality may be defensible in formal logic and mathematics, but it is surely wrong in an attempt to model human cognition. After all, Nixon did exist, and he was both a Republican and a Quaker, and these allegiances did lead to conflicts of principle. On the basis of the present paper, however, we can now go further. The Nixon diamond is not just a regrettable consequence of human frailty, but an essential component of an explanation for at least one part of human language, the **amn't* gap. In short, multiple inheritance must be left free to model whatever data need to be modelled; and if the data contain a conflict, the model should crash.

Seen in this light, the 'Nixon diamond' is a very poor example of an inheritance conflict precisely because Nixon in fact solved the problem. For whatever reason, the principles of Republicanism triumphed over those of Quakerism, whereas the logic of inheritance should have left him paralysed and unable to make decisions. Real life is of course full of such examples where we have 'functional' reasons for ranking competing models, and we have seen an example of precisely this kind in English grammar: the fact that our linguistic ancestors resolved the conflict for inverted first-person negative BE in favour of either *Aren't I?* or *Amn't I?*. However the example of **amn't* shows that these solutions are arrived at not by weakening the logic, but by stipulating solutions.

5.3. Morphology: realisation or functions? Finally, we have touched on the nature of morphological rules. What was needed was a theory of morphology which was strict enough to force a conflict between the competing demands of the two models from which our target word has to inherit. Most theories fail this test because they allow syntactic categories to map directly onto morphemes which are then combined by simple rules such as `affixes follow stems'. Given a theoretical framework of this type, nothing would prevent *am* from combining with *-n't* to give **amn't*, because the multiple inheritance would in effect be orthogonal - different features determine different morphemes.

The theory that passed the test was one in which words have morphological `functions' which yield a single morphological form as their value. One of these functions is the traditional Stem, but the crucial one is Whole which forced a conflict between the forms required by the categories Negative and First-person. However in order to prove that this conflict was unavoidable we had to justify a number of other morphological functions: Pos-

form and the various X-forms. These are all justified independently, but their role in the explanation for the **amn't* gap counts as further evidence in their favour.

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i. The most extended discussion of the **amn't* gap is in two papers by Bresnan (forthcoming a and especially b). Bresnan offers a careful and detailed analysis of the gap in terms of Optimality Theory, but the analysis rests on the stipulation that **amn't* is 'unpronounceable', in the sense that the relevant feature bundle is listed in lexicon as having no phonology. The analysis explains HOW we manage without *amn't* (by using *am not* or *'m not* instead), but not WHY we have to do without it, so it is irrelevant to the concerns of this paper. One of the important insights of Bresnan's analysis is the link that it establishes between the gap and the fact that BE is the only verb in English which has a special form for use with a first-person singular subject. We shall build on this fact in the analysis proposed here.

ii. Anecdotally, I find two relevant examples in the diaries I kept for my own daughters when they were toddlers: *I naren't* and *are I?*.

iii. Footnote 58 of Denison (1999) cites James Sully, Jespersen and Visser as recognising the existence of *bettern't* in children's speech. There are also a number of anecdotal reports from colleagues collected independently by Debra Ziegeler and myself, summarised in part in a Linguist message (6.435, 26th March 1995). One British linguist remembers *bettern't* being used regularly by his young children and another remembers hearing it used by a teenager in Liverpool; and two British linguists remember using it themselves as children but consciously abandoning it in adolescence. Two Australian linguists report (independently) that the tag *bettern't we?* is normal in adult Australian English, so clearly we should ignore evidence of its use by Australian children.

iv. Competition between forms is also invoked as an explanatory principle in other areas of linguistic theory. Lexical theory (Hoffman 1982) has for some time recognised the existence of 'lexical blocking', whereby an existing lexical item can block a phrase (e.g. *TODAY* and *TONIGHT* block *this day* and *this night*); and morphological theory (Aronoff 1994) recognises 'morphological blocking', where an existing lexeme blocks a potentially derivable form (e.g. *GLORY* blocks *GLORIOSITY*). In the area of language processing, MacWhinney's 'Competition theory' (1989a, b) applies to choices made in processing, whereby (for example) alternative meanings of a single polysemous form compete with each other for choice as the intended meaning; and in pragmatics, Relevance Theory recognises a competition between alternative interpretations which yields a single maximally relevant winner (Sperber and Wilson 1986).

v. I now drop the scare quotes round 'isa', with apologies to the grammatically sensitive.

vi. The term *stem* is traditionally used in various ways, so I should explain that it is used here to mean the form which is defined by a lexeme, minus any affixes which are due to inflectional morphology.

vii. Grammatical terms have a capital letter when used as proper nouns and lower case when used as common nouns: for example, Auxiliary Verb is a category, but BE is an auxiliary verb.

viii. I have discovered that two colleagues from Belfast and two from Edinburgh all reject **I amn't* while accepting *amn't I*; for the latter form see Harris (1993:158) and Miller (1993:114).

ix. Bresnan wrongly describes the present analysis, as presented in an earlier draft, as an example of `overspecification of the general form' (forthcoming b, fn. 5), a term she applies to analyses which use disjunctions and negations.

x. Denison (1999) quotes the following examples:

(1) but then again, *ain't I* rather too smartly dress'd to look like a money-Lender? (1777 Sheridan, `School for Scandal' III.i 389.25)

(2) I have a lively faith that yours is the very gem of all Childre. *Ain't I* its unkle? (1820 Keats, `Letters' 172 p. 448)

According to Denison, Jespersen explains the form *Aren't I* as a respelling of *an't*. George Eliot uses it only in lower-class speech, but by the early 20th century it was used (in literature) by educated speakers. However even then it was resisted for some time, as explained in a message sent by Denis Baron to the Linguist list on 24 November 1992 (message 3.936, at http://linguistlist.org/issues/3-936.html#3):

> *Aren't I* begins to draw attention in the early 20th century, when usage critics label it pretentious, ungrammatical, and in at least one case, `feminine'. They all opt for *Ain't I* instead, if a contraction is required, though they all preferred the uncontracted *Am I not?* The usage critics all condemn *ain't* when used with 2nd and 3rd person and plural, and they reject *Amn't I?*, attributing it to black or Irish speakers. According to Webster's Dictionary of English Usage ... *Aren't I* is still occasionally questioned by today's usagists and usageasters. The present spelling apparently replaces the older spelling *An't*, once common in British drama.

xi. For example, I have been told of varieties in England in which I aren't is possible but only

when used without a complement; so (a) below is possible, but not (b):

(**Error! Main Document Only.**) a A. Are you my friend? B. No, I aren't.

b I aren't your friend.

It is hard to see how this odd constraint can be incorporated into the present grammar (or any other kind of grammar of which I am aware).

xii. See Hudson 1984, 1990, 1995, 1998. The web site at http://www.phon.ucl.ac.uk/home/dick/wg.htm gives access to down-loadable material, including a 30-page outline of the theory and an 'Encyclopedia of English Grammar and Word Grammar' which is updated each year.

xiii. A small weakness of the proposed analysis is that it forces us to treat *'m* as a stipulated reduction of *am*, because it would otherwise be blocked by the same Nixon diamond as **amn't*. It is represented in the diagram as $BE_{1s.red}$, whose form is stipulated. This consequence seems reasonable, given that *'m* is always cliticized to the subject *I* and the resultant phonological word is often pronounced with a mere schwa for the pronoun: [em]. Assuming that this pronunciation cannot be predicted phonologically, it must be stipulated.

xiv. The extension of the Singular inflection to the past tense of BE is further supported by the fact that the first-singular form is irregular in the past tense of BE as well as in the present tense. As we noted earlier, the singular/plural contrast between *was* and *were* is different from the one found in the present tense in that *was* is used with *I*. We can explain this by treating the *was* after *I* as an irregular variant of *were*, just as *am* is an irregular variant of *are*. We make the rule for *was* override that for *am* by giving them the same format, as in (a) and (b). However there are two important differences between *I was* and *I am*: *was* is motivated by the

ordinary singular form *was*, and *was* has a negative *wasn't*. We show both of these differences by the following rules. These do not stipulate the form *was* directly, as we did with *am*, but derive it from the normal singular *was* in (b); and they classify both of them as pos-forms, which allows the negative to be stipulated in (d). This stipulation may be motivated functionally in the same way as the inverted *Aren't I*.

(i) a The whole of BE_{1s} is *am*.

b The whole of $BE_{past.1s}$ is its pos-form.

c The pos-form of $BE_{past.1s}$ is the pos-form of $BE_{past.sing}$.

d The whole of $BE_{past.1s.neg}$ is its pos-form + *n't*.

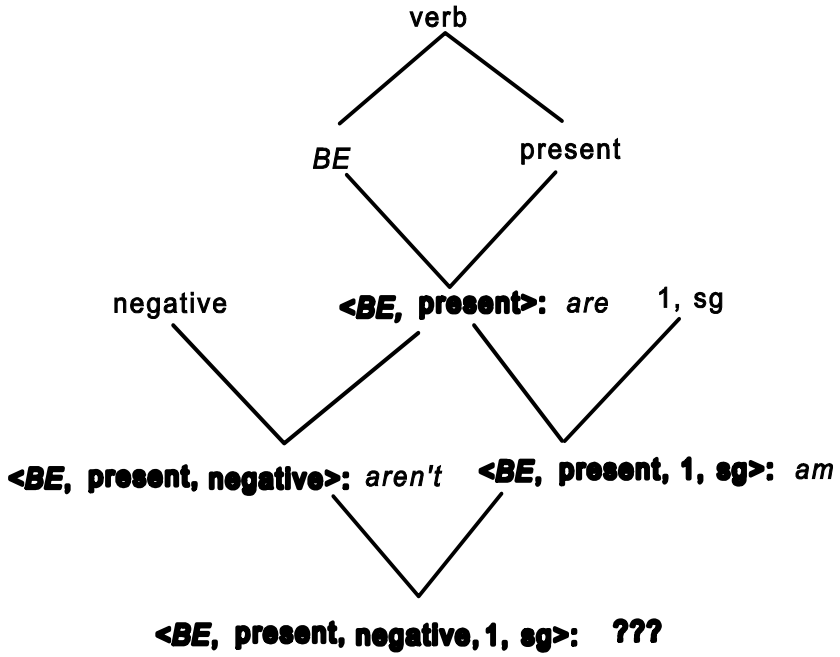
For more details of the agreement rules see Hudson forthcoming.

xv. There is one kind of irregularity that we have ignored: reduced forms such as *'s* and *'re*, which could be accommodated in various ways. For example, we could define `reduction' as a function from one form to another, and then define the whole of a reduced verb as the reduction of its pos-form:

(1) a The reduction of *is* is *'s*.

b The whole of a $verb_{reduced}$ is the reduction of its pos-form.

The treatment of reduced forms is not directly relevant here.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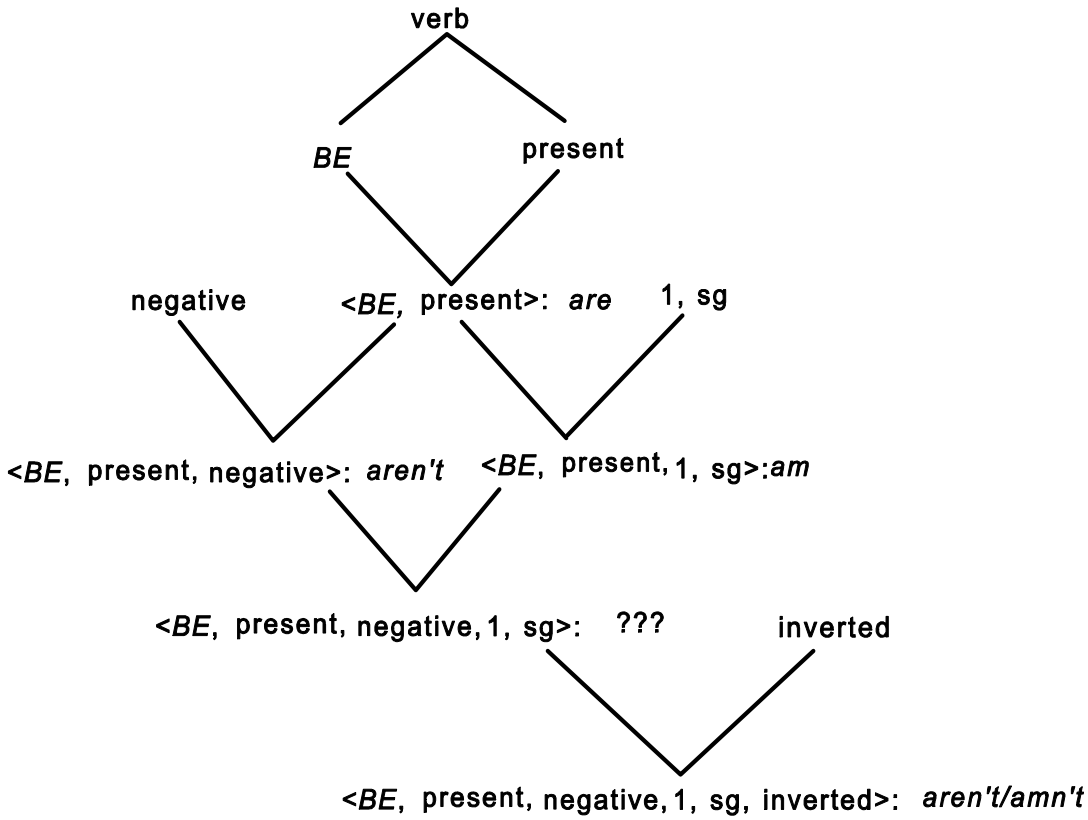
BE
present
negative
<BE, present>: are
1, sg
<BE, present, negative>: aren't
<BE, present, 1, sg>: am
<BE, present, negative, 1, sg>: ???


verb
BE
present
negative
<BE, present>: are
1, sg
<BE, present, negative>: aren't
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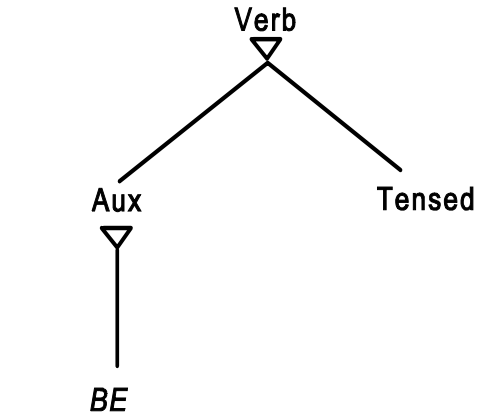
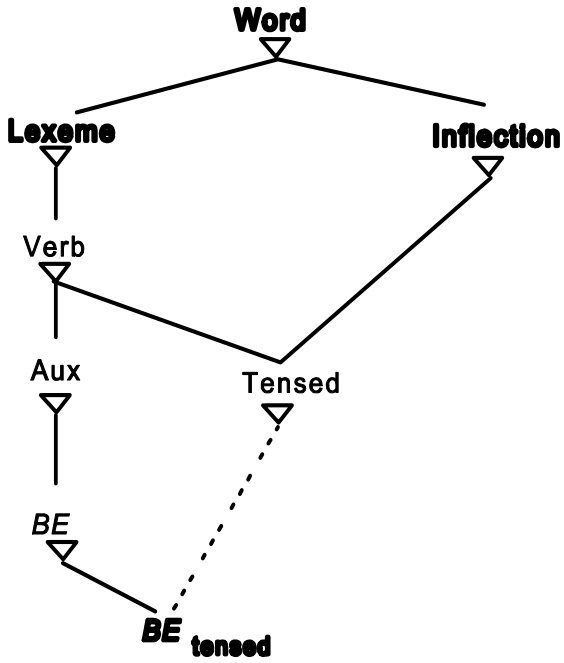
inverted
<BE, present, negative, 1, sg, inverted>: aren't/amn't


Verb
Aux
Tensed
BE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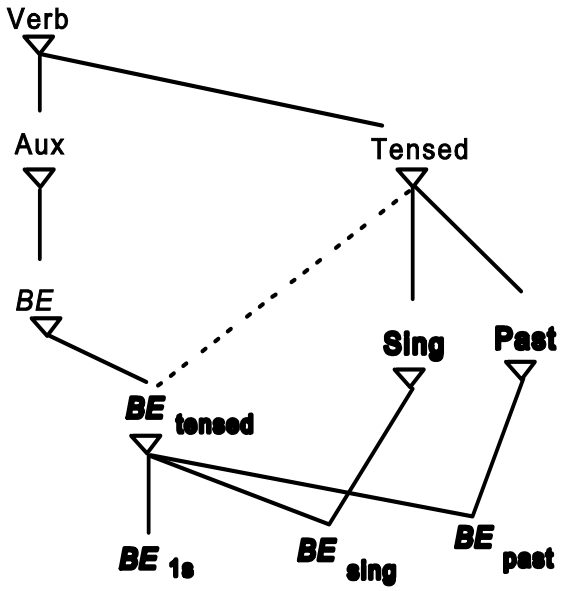
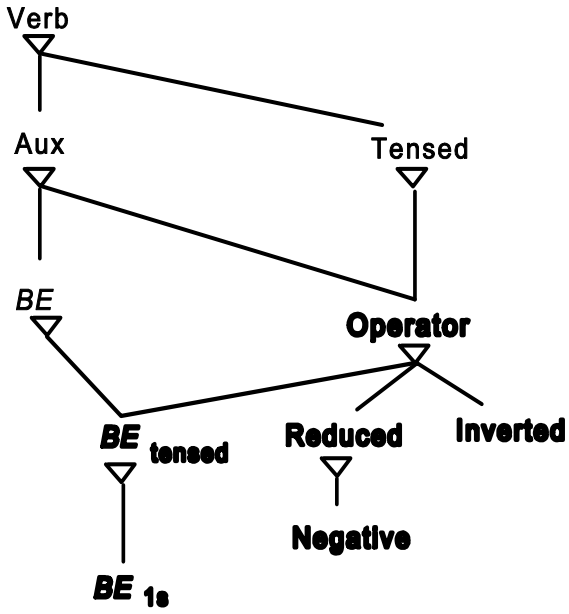
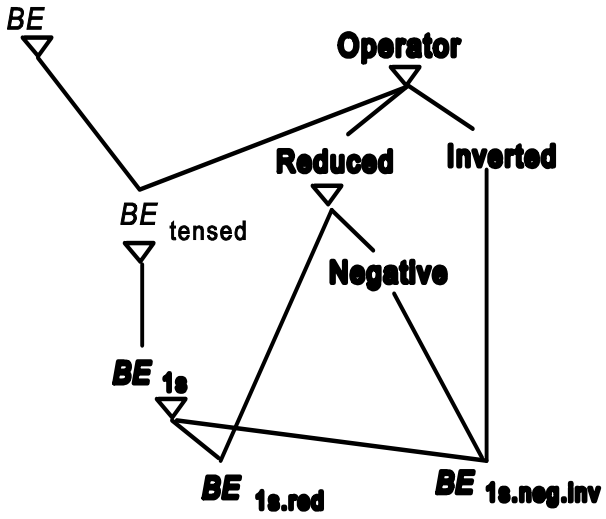
Lexeme
Inflection
Verb
Aux
Tensed
BE
BE
tensed


Verb
Aux
Tensed
BE
Sing
Past
BE tensed
BE 1s
BE sing
BE past


Verb
Aux
Tensed
BE
Operator
BE tensed
Reduced
Inverted
Negative
BE 1s


BE
Operator
Reduced
Inverted
BE tensed
Negative
BE 1s
BE 1s.red
BE 1s.neg.inv