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RONNIE CANN

TOWARDS A DYNAMIC ACCOUNT OF *BE* IN ENGLISH

1   ANALYSING 'BE'

The perennial problem with analysing the copula is that it appears in a wide range of constructions, apparently involving postcopular elements of different sorts, and giving rise to a variety of different interpretations.[1] For example, in English *be* may apparently do little more than hosting tense and agreement information with ad0704jective, prepositional and nominal phrases in predicatives (1a); induce an interpretation of identity with a noun phrase complement in equatives (1b); give rise to existential interpretation in construction with *there* (1c); act as some sort of presentational marker with an expletive subject (1d); as part of a construction determining focus in cleft (1e), and pseudo-cleft (1f) constructions; (rarely) provide 'existential focus' in certain intransitive constructions (1g), and with present and past participles give rise to progressive and passive readings, respectively (1h,i):

(1)   a. Mary is happy/in the gym/a student.

     b. John is the teacher.

     c. There is a riot on Princes Street.

     d. It's me.

     e. It is Mary who is the dancer.

     f. What I want is a good review.

     g. Neuroses just ARE (they don't need a cause).

     h. Kim was running to the shops.

     i. The fool was hit by a truck.

The variability in the interpretation of *be* in (1) is further compounded by the subtle differences in meaning exhibited by very similar sentences. For example, copular clauses involving a definite noun phrase give rise to slightly different interpretations according to whether the definite NP precedes or follows the copula. Equative clauses, as in (2a), involve a post-copular definite which appears to be fully referential, while specificational clauses, as in (2b) involve an initial definite which appears to provide a description of an unknown entity, rather than to pick out some specific object.[2]

(2)   a. John is the culprit.

       b. The culprit is John.

Such subtle variation in interpretation, again generally according to the properties of a postcopular noun phrase, is found also in constructions of the copula with the expletive pronoun *there*. So, for example, when the postcopular noun phrase (the *associate*) has a weak (or intersective, Keenan 1987, 2001) determiner, this gives rise to the 'standard' existential interpretation illustrated in (3a,b). With postcopular definites, however, we have presentational or locative readings as in (3c,d), while numerals may give rise to existential, presentational or locative interpretations depending on context, as in (3e).

(3)   a. There's a riot on Princes Street.

       b. There's a rabbit in the garden.

       c. There is the student that you wanted to see in the corridor.

       d. There's that cat again.

       e. There are three students in the common room.

Reconciling these different interpretations of copular clauses in English is not straightforward.[3] There is little apparent semantic similarity between existence, equation, presentation and predication, let alone the progressive and passive. Yet treating *be* as multiply homonymous is not an attractive option, neglecting as it would the interaction of whatever meaning the copula has with the semantics of the expressions with which it combines. Hence, many discussions in the literature try to reconcile the different interpretations as far as possible. Such accounts tend to be restricted to reconciling predicate and equative (and specificational) readings which minimally seem to require two homonyms with distinct semantic structures. Montague (1973) treats the copula as equative, giving it a translation $\lambda\wp\lambda x\wp\{\hat{y}[^{\vee}x =^{\vee} y]\}$. This permits an account of predicational uses with indefinite postcopula expressions, but does

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[2]See Heycock 1994, Heycock and Kroch 1999, Mikkelsen 2004, etc.

[3]I restrict all my remarks in this paper to English. There are languages with more than one true copula verb (such as Lakhota, Malayalam, Thai) and others with no overt copulas at all (such as Bambara, Tagalog, Maori) to which the current discussion is unlikely to generalise in its entirety. See Pustet 2003 for a typological overview of copula systems.

not treat adjectival predicative constructions. Other semantic attempts to resolve this ambiguity, such as those in Williams (1983) and Partee (1986) favour treating the copula as 'essentially' predicative. Partee's account, for example, provides the copula with a semantic type $(e \rightarrow t) \rightarrow (e \rightarrow t)$ with the semantic structure: $\lambda P \lambda x.P(x)$[4]. The difference between predicative and equative readings is derived through a type shifting operation (**Ident**) on a postcopular term to turn it into an identity predicate, thus shifting the homonymy to the term rather than the copula.

The details of Partee's analysis (and other similar ones) are not important here but one of the things such an analysis fails to account for is the existential effect of *be* exhibited not only in the *there be* construction in (1c) but also in the intransitive usages in (1g) and the more common (although quasi-idiomatic) strings in (4).[5]

(4) a. I think therefore I am.

  b. To be or not to be.

But this gets us back to an apparently irreconcilable homonymy for the copular verb between denoting existence and providing no semantic content at all. It also signally fails to account for the context sensitivity of the interpretation of *be* in various constructions. As noted above, whether a string consisting of two noun phrases and a form of the copula is interpreted as predicative or equative depends largely on the definiteness of the postcopular term: an equative reading is only possible if this is definite.[6] Furthermore, if both noun phrases are definite, then either an equative or a specificational reading may result, depending on whether the postcopular term may (or must) be interpreted as fully referential in context and whether the initial term need not be. A sentence such as that in (5) where both noun phrases contain the definite article may be interpreted as equative or specificational according to the context of utterance.

(5) The culprit is the teacher.

There have, of course, been a number of interesting and elegant attempts to deal with this problem semantically (see in particular Heycock and Kroch 1999). However, the problem of context dependence reasserts itself, more strongly, with respect to constructions involving *there be*. This construction gives rise to a range of different interpretations, depending on the properties of the postcopular noun phrase (the 'associate') and the rest of the clause (often referred to

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[4]Partee, in fact, allows a variable type and analysis with the arguments of the expression appearing in either order, i.e. $\lambda x \lambda P.P(x) : e \rightarrow ((e \rightarrow t) \rightarrow t)$.

[5]It is, of course, considerations like these that have led to the longstanding philosophical debate about the ambiguity of *be* and the relation between *be* and *exist* which I do not go into here, but see Miller 2002 for a summary of the principal issues.

[6]The interpretation of specific indefinites seem to be able to induce quasi-equative readings:

i. Mary is a student I've been waiting for for twenty years.

as the 'coda'). In the examples in (6) below, we have existential, presentational and locative readings associated with minimally different syntactic contexts.

(6)   a. There's a chemist shop on Princes Street.

       b. There is the chemist shop on Princes Street that you wanted to go to.

       c. There's that chemist shop again.

The existential/presentational distinction seems to correlate with the definiteness of the post-copular noun phrase. Clauses with definite associates are thus typically interpreted as locative or 'presentational' (the latter being a catchall term that seems to refer to interpretations that are neither existential nor locative). Consider again example (3c), repeated below.

(3)   c. There is the student that you wanted to see in the corridor.

This sentence might be used locatively to tell the hearer that some specified student is here (in the corridor) or 'presentationally' to bring the situation as a whole to the hearer's attention, perhaps reminding her that her afternoon appointments are not completed yet. Interestingly enough, the simple copula clause without *there*, *the student you wanted to see in the corridor*, can be used to express the locative reading but not the presentational one.

The differences between existential, locative and presentational readings might be taken to indicate differences in the meaning of *there be*. This cannot be the case, however, because definite and indefinite associates can be conjoined, giving rise to apparently mixed readings. Consider the examples in (7).

(7)   a. There's a crow on the lawn.

       b. There's that bloody cat fighting on the lawn.

       c. There's a crow and that bloody cat fighting it out on the lawn.

While (7a,b) seem to be indisputably existential and presentational, respectively, (7c) may be interpreted variously: as existential (there is a fight on the lawn between the cat and a crow); presentational (the cat is fighting on the lawn with a crow); or with a mixed reading (there is a fight on the lawn and the cat is fighting with a crow on the lawn). Such a mixed reading is more obvious in the example in (8) and this should be impossible if the constructional subtypes are semantically discrete.

(8)   There's/are a student and the lecturer (you wanted to see) outside.

The context-dependence of *there be* constructions is further shown in examples with associates with non-definite strong quantifiers. Although not frequent and often quite marked, universally and other quantified NPs can appear after *there be*, but the interpretation of such sentences depends strongly on context. Compare the acceptable example in (9a) with the odd, but minimally different, example in (9b).

(9)   a. There's every PhD student of mine coming to my inaugural.

       b. ??There's every student in the garden.

The example in (9a) is likely to be acceptable only in a context which supports the open proposition *There are n students coming to y's inaugural*, the determiner providing the value for n (and the pronoun providing that of y). This would give rise to a focus effect, which might be considered to be precluded by the universal quantifier *every*. The example in (9b), peculiar out of context, would seem similarly to require some context such as *There are n students in the garden* to be acceptable, and indeed the exchange in (10) appears to be well-formed. In a null context, however, the sentence is odd, if interpretable at all.

(10)   I think there are only one or two students in the garden.
       No, there's EVERY student in the garden.

Another example[7], is interpretable without further contextualisation but requires inference over *every chain restaurant* to *every type of chain restaurant*. The example in (11b), on the other hand, while it could be interpreted in a similar fashion requires more effort and a more elaborated context to achieve a similar result, because it is pragmatically unlikely that every type of restaurant (*tout court*) could be found on a single street.

(11)   a. Within 15 minutes, there is every chain restaurant in the USA.

       b. ??Within 15 minutes, there is every restaurant in the USA.

Again this construction does not seem to involve different interpretations for *there be*, as illustrated in (12) where a definite or an indefinite may be conjoined with a universal to give possible mixed readings.

(12)   There's the Chancellor/a lord of the realm and every student of mine
       coming to my inaugural.

If it is true that the phrase *there be* itself does not have different interpretations directly, then the interpretation of the various constructions involving this string must result from inference over whatever single meaning it has and the meanings of its associates and codas.

    Analyses of the existential construction typically concentrate on properties of the associate and mostly on the existential reading. As already noted, in one of the most influential semantic accounts, Keenan (1987) identifies associates as needing to be intersective DPs in order to give rise to an existential reading. Musan (1995), on the other hand, analyses the construction in terms of a temporal variable indicating stage level predication, while McNally (1998) interprets the construction in terms of the properties of non-particulars. In

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[7]From http://www.24hoursofadrenalin.com/sched_mass.cfm, October 2002

a more pragmatic account, Zucchi (1995) argues that the existential reading occurs just in case the associate presupposes neither the existence nor the non-existence of some entity. Ward and Birner (1995), concentrating on definite associates, again adopt a pragmatic approach to the felicity of such constructions, attributing acceptability to the possibility of construing the postcopular definite as providing 'hearer-new' information.

We do not go into a discussion of these various accounts, but it is notable that in none of them is there an analysis of the string *there be*. The following statement by Louise McNally sums up the apparent attitude of most researchers in this area (although very few even acknowledge this lacuna in their discussion):[8]

> 'I treat *there be* as an unanalyzed unit; I do this ... partly because there is no decisive evidence concerning the individual semantic contributions of the individual words' (McNally 1998:354).

The existential force of the construction is hypothesized to come from the way that associates and codas are interpreted or it is just assumed. Little attempt is made to derive the interpretations compositionally or to explore how (and indeed why) definiteness interacts with *there be* to give rise to different interpretations. The variability in interpretation of such clauses and, in particular the possibility of conjoining different types of coda to give mixed readings strongly indicates that existential, presentational and locative readings cannot be semantically distinct. A pragmatic account seems, therefore, to be favoured.

In this paper, I hypothesize that *there be* should be assigned some semantically underspecified meaning which is enriched through inference over the properties of the associate, the coda and the context of utterance. Indeed, I extend the idea to copula constructions in general. In other words, my explanation not only for the peculiarities of the various constructions involving *be* in conjunction with *there*, but also for the variability in interpretation of all clauses involving *be* is couched in terms of semantic underspecification and pragmatic enrichment, providing *be* with an interpretation that is context-dependent and uniform across all usages.

Adopting this hypothesis still leaves the problem of the arity of the under-specified predicate that is associated with *be*. That this is a non-trivial problem is shown by the fact that it appears to be able to take complements of various numbers and types. So, as the constructions in (1) illustrate, the copula may appear variously with following definite and indefinite noun phrases, prepositional phrases, present and past participles and adjectives (amongst others). This flexibility of complement type is not matched by other auxiliary verbs, including *have*, compare (13) with (14).

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[8]See, however, Rooryck and Barbiers (1998) for a notable exception within a theory that utilises multiple Topic projections at the left periphery.

(13)   A: Kim is | a friend of yours
                  | the teacher
                  | in the garden
                  | playing football
                  | disliked by Hannibal
                  | happy
                  | misunderstood
                  | *play cricket

(14)   A: Kim has | a friend of yours
                  | the teacher
                  | in the garden   (ellipsis only)
                  | *playing football
                  | *disliked by Hannibal
                  | *happy
                  | misunderstood
                  | *play cricket

This variability in apparent complement type presents quite a serious problem in trying to establish the syntactic properties of the copula, leading in frameworks like GPSG (and HPSG) to the postulation of *syntactic* homonymy for *be*.[9] If *be* is semantically non-homonymous, however, syntactic homonymy should also be excluded and I take the data given above to indicate *be* is uniformly intransitive and that it licenses **no** complements directly. This position is further supported by the data in (15) below. Uses of *be* can give rise to a non-elliptical interpretation in intransitive contexts, unlike other auxiliaries. So, for example, *may* and *can* without VP complements, do not license interpretations where the general modality, such as possibility and ability, are ascribed to the subject. Without a complement VP, modals can only be interpreted elliptically, whereas, as we have already seen, *be* can give rise to a non-elliptical interpretation of existence in intransitive contexts. This strongly indicates that there is no necessary 'complement position'.[10]

(15)   a. Neuroses just ARE. (= Neuroses exist)

       b. Neuroses just MAY. (≠ Neuroses are possible)

       c. The students just CAN. (≠ The students are able)

The central hypothesis of this paper is, therefore, that the copula in English projects a semantically underspecified one-place predicate, a semantic placeholder of type $e \rightarrow t$[11] whose content has to be established in context

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[9]See Gazdar, Pullum and Sag (1982) and Warner (1993).

[10]Lamarche 2003 comes to essentially the same conclusion, though for very different reasons.

[11]It may be that this has to be modified to allow for propositional and property subjects as exemplified in (i) and (ii):

through inference. In this paper, I discuss how this characterisation allows a
uniform account of certain types of ellipsis involving *be*, the existential focus
construction, predicative uses and *there be* constructions involving definite and
indefinite associates.[12]

2   DYNAMIC SYNTAX

The framework I use to account for the vagaries of the copula is that of *Dynamic
Syntax* (Kempson et al 2001, Kempson et al. forthcoming) according to which
the process of natural language understanding is a monotonic tree growth pro-
cess defined over the left-right sequence of words, with the goal of establishing
some propositional formula as interpretation. Taking information from words,
pragmatic processes and general rules, the theory derives partial tree structures
that represent the propositional content of a string as interpreted in context up
to the current point. Intrinsic to this process are concepts of underspecification
whose resolution is driven by requirements which determine the process of tree
growth, having to be satisfied for a parse to be successful. For the purposes of
this paper, a central role is given to the underspecification of semantic content
and of the status of some element within an emerging propositional structure.

To model the process of establishing such a structure as interpretation, all
nodes in the semantic trees constructed during a parse are introduced with
requirements to be fulfilled, reflecting the idea that the tree is underspecified
with respect to some property that needs to be specified as the parse proceeds.
Requirements may be to specify values for any of the labels that decorate a
node, but the principal drivers of the parsing process are requirements to es-
tablish nodes of certain types, starting from the initial (universal) requirement
to build a representation of the propositional content expressed by a string in
context: $?Ty(t)$, an instruction to build a tree rooted in $Ty(t)$, the type of a
proposition.

To satisfy such requirements, a parse relies on information from various
sources. In the first place, there are general processes of construction which
give templates for building trees that may be universally available or specific
to a language. One such rule determines that a tree rooted in $?Ty(Y)$ may
be expanded to one with argument daughter $?Ty(X)$ and functor daughter
$?Ty(X \rightarrow Y)$. This is shown in the construction Rule in (16) where an input
tree with a node matching the description on the topline (i.e. one decorated
simply by a requirement to build a node of type Y) is transformed into tree

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i.   That he will be here soon is highly unlikely.

ii. Honest is honest.

I do not further explore these constructions here, but they do not undermine the essence
of the current analysis. The important point here is that *be* does not project an internal
argument, whatever the properties of its subject argument may be.

[12]See Cann (to appear) and Kempson et al. (fcmg): ch 8 for discussion of other copular
constructions using the hypotheses put forward in this paper, particularly with respect to
equative and specificational clauses.

where that node is expanded to provide two daughters, one with a requirement to be decorated by some (argument) formula of type X and one with a requirement to be decorated by a (functor) formula of type $X \to Y$.[13] The predicate Tn provides an address for the node in question and the expressions $\langle \uparrow_0 \rangle Tn(a)$ and $\langle \uparrow_1 \rangle Tn(a)$ are modalities addressing the argument and functor daughters of treenode with address a (see below). The 'pointer', $\diamondsuit$, marks the node that is currently being developed.

(16) INTRODUCTION

$$\frac{\{\ldots \{Tn(a), ?Ty(Y), \diamondsuit\}, \ldots\}}{\{\ldots \{\{Tn(a), ?Ty(Y)\},}$$
$$\{\langle \uparrow_0 \rangle Tn(a), ?Ty(X), \diamondsuit\}, \{\langle \uparrow_1 \rangle Tn(a), ?Ty(X \to Y)\} \ldots\}$$

Thus, the rule of INTRODUCTION allows the initial unfolding of a requirement $?Ty(t)$ to be established through the construction of subgoals $?Ty(e)$ and $?Ty(e \to t)$ decorating daughter nodes, requirements to build the subject and predicate nodes, respectively, as shown in Figure 1.

$$?Ty(t) \quad \longmapsto \quad ?Ty(t)$$

with daughters $?Ty(e), \diamondsuit$ and $?Ty(e \to t)$
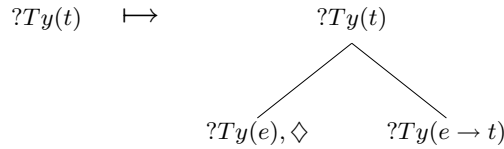
Figure 1: An initial expansion of $?Ty(t)$

Information about tree building also comes from packages of actions encoded in lexical entries which are accessed as words are parsed. An entry for a word contains conditional information initiated by a trigger (the condition that provides the context under which subsequent development takes place), a sequence of actions (possibly involving the building of nodes and/or the annotation of a node with type and formula information) and a failure statement (commonly an instruction to abort the parsing sequence) if the conditional action fails. For example, parsing the word *John* gives rise to the set of actions in (17) which annotate the current node with a formula ($Fo(John')$) expressing the content of the concept projected by the word *John'* which is of type e, thus satisfying the requirement imposed by INTRODUCTION.[14]

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[13]In fact, formally (16) collapses two rules, INTRODUCTION and PREDICTION. This refinement will not be discussed in this paper. See Kempson et al. (2001) ch. 3 and Kempson et al. (fcmg) ch. 3 for details. Understanding how the construction rules work is not important for understanding the analyses given in this paper and the rules are provided for the sake of completeness. Readers are invited (even encouraged) to ignore the rules (which will from now on be relegated to footnotes) and concentrate on the tree displays which show their workings directly.

[14]See below for a discussion of the modality $[\downarrow]\bot$.

(17) *John* $\left|\begin{array}{ll} \text{IF} & Ty(e) \\ \text{THEN} & put(Ty(e), Fo(John'), [\downarrow]\bot) \\ \text{ELSE} & \text{ABORT} \end{array}\right.$

Thus, given as input the second tree in Figure 1 with the pinter on the open subject node, parsing the word *John* yields the tree in Figure 2, with the subject node now complete and the pointer having moved to the open predicate node.[15]

$$?Ty(t)$$

$$Ty(e), Fo(John'), [\downarrow]\bot \qquad ?Ty(e \to t), \diamondsuit$$

Figure 2: Parsing *John*

Parsing words other than proper names, however, may give rise to a more complex set of actions that build, as well as annotate, nodes. Such is found with parsing transitive verbs, for example. The sequence of actions given in (18) yields the tree in Figure 3, given the input in Figure 2.[16]

(18) *upset* $\left|\begin{array}{ll} \text{IF} & ?Ty(e \to t) \\ \text{THEN} & make(\langle\downarrow_1\rangle); go(\langle\downarrow_1\rangle); \\ & put(Ty(e \to e \to t), Fo(Upset'), [\downarrow]\bot); \\ & go(\langle\uparrow_1\rangle); make(\langle\downarrow_0\rangle); go(\langle\downarrow_0\rangle); \\ & put(?Ty(e)) \\ \text{ELSE} & \text{ABORT} \end{array}\right.$

$$?Ty(t)$$

$$Ty(e), Fo(John'), [\downarrow]\bot$$

$$?Ty(e \to t)$$

$$?Ty(e), \diamondsuit \qquad Ty(e \to e \to t), Fo(Upset'), [\downarrow]\bot$$

Figure 3: Parsing *John upset*

Parsing will continue just in case there the next word has a trigger of the appropriate type, i.e. $?Ty(e)$, such as another proper noun like *Mary* to ensure that all terminal nodes are type and formula complete. The remaining

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[15]Again, this simplifies the formal apparatus considerably, but is all that is required for present purposes.

[16]Here and below, all tense information is ignored as not germane to the current discussion.

open type requirements on the predicate and propositional nodes are satisfied through the process of COMPILING the tree through functional application over types, yielding the completed tree in Figure 4. Since the tree has no remaining requirements, the parse is successful and the input string accepted as well-formed with the interpretation given.

$$Ty(t), Fo(Upset'(Mary')(John')), \diamondsuit$$

$$Ty(e), Fo(John') \qquad Ty(e \to t), Fo(Upset(Mary))$$

$$Ty(e), \qquad Ty(e \to e \to t),$$
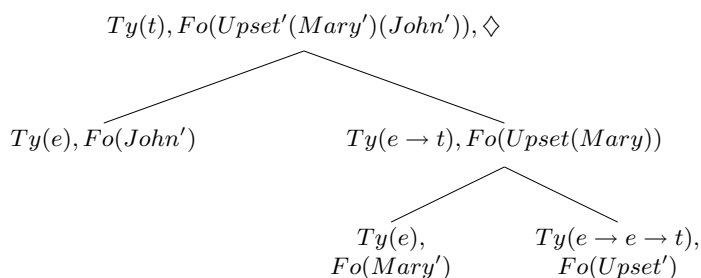$$Fo(Mary') \qquad Fo(Upset')$$

Figure 4: Completing a parse of *John upset Mary*

It is important to note at this point that the tree representations in Figures 1 to 4 (and throughout) do not have nodes decorated by **words** but by the **concepts** expressed by words. Order in the trees is, therefore, entirely irrelevant and an arbitrary decision has been made to order trees in this paper so that arguments appear to the left of their functors. The order of functors and arguments in figure 4 thus does not reflect string order (English is not SOV), because the trees represent only the *content* expressed by the string, not any phrasal structure. Word order itself is determined by properties of *pointer movement* within the content trees, interacting with computational and lexical actions, induced by the words in the string *in strict linear sequence*. In this way, Dynamic Syntax characterises the syntax of natural languages as the **process** by which the (representation) of interpretative content of a string of words uttered in context is progressively built up on a word-by-word basis.[17]

2.1 Left Dislocation

The driving force of the parsing process is thus the need to resolve requirements to specify underspecified information, of which the most important is the requirement to construct a formula value with a particular type. However, any predicate used to decorate tree nodes may be associated with a requirement and this will drive the parsing process in different ways. One such requirement is the requirement to find a fixed position within a tree. Every node in a tree is associated with an ADDRESS which is encoded as a value to the TREENODE predicate, Tn. The topnode of a tree has an address $Tn(0)$ from

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[17]See Kempson et al. (fcmg) chapters 1 and 2 for the conceptual underpinnings of the theory and its technical apparatus.

which other addresses are constructed regularly: the functor daughter of a node with address $Tn(n)$ has an address $Tn(n1)$ while the argument daughter has an address $Tn(n0)$. In Figure 4, for example, the node labelled by $Fo(John')$ has an address of $Tn(00)$, the predicate node has address $Tn(01)$ and the node decorated with $Fo(Upset')$ has address $Tn(011)$ and so on.

This method of defining treenode addresses is related to one of the principal descriptive mechanisms of Dynamic Syntax: the Logic of Finite Trees (LOFT, Blackburn and Meyer-Viol 1994). This modal logic provides a means of referring to arbitrary nodes in a tree using the following modal operators (amongst others): $\langle\downarrow\rangle$ the general daughter relation; $\langle\downarrow_0\rangle$ and $\langle\downarrow_1\rangle$ the argument and functor daughter relations, respectively; $\langle\downarrow_*\rangle$ the dominance relation (the reflexive, transitive closure of the daughter relation); and the inverses of these using the mother relation, $\uparrow$.

The underspecified modalities $\langle\downarrow^*\rangle$ and $\langle\uparrow^*\rangle$ provide the means of accounting for dislocated expressions within Dynamic Syntax. When an expression is parsed, it need not be associated with a fixed position within a tree but will have an underspecified dominance relation with respect to some other node. This is represented from the dominated node as $\langle\uparrow^*\rangle Tn(a)$, where $Tn(a)$ is the address of the dominating node and the modality is defined as:

$$\langle\uparrow^*\rangle\alpha \rightarrow \langle\uparrow\rangle\alpha \vee \langle\uparrow\rangle\langle\uparrow^*\rangle\alpha.$$

This initial underspecification of tree position must be resolved during the course of a parse and so is associated with a requirement to establish a proper treenode address, shown as $?\exists\mathbf{x}.Tn(\mathbf{x})$.

Positional underspecification is principally used to account for long distance dependencies in terms of initially unfixed nodes whose position in an emergent tree structure is fixed at a later stage in the parsing process. Although this paper is not concerned with left dislocation, it will be useful for the later discussion to show how simple left dislocation structures are analysed within the theory. A construction rule of *ADJUNCTION introduces a left peripheral unfixed node, defining a transition from an incomplete tree rooted in $?Ty(t)$ with only a single node to a tree that contains in addition a node characterised as dominated by a tree node a with requirements to identify the address of the unfixed node and to construct a type e decoration. This is shown schematically in terms of the transition in Figure 5.[18]

Analysing the string *Mary, John dislikes* in these terms is illustrated in Figure 2 with an initially projected unfixed node and the pointer at the object position. At the point in the parse at which all words in the string have been processed, there remains outstanding an unfixed node and a requirement to construct a node of type e. In this environment, a process of MERGE may

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[18] *ADJUNCTION

$$\frac{\{\{Tn(a), ?Ty(t), \diamondsuit\}\}}{\{\{Tn(a), ?Ty(t)\}, \{\langle\uparrow_*\rangle Tn(a), ?Ty(e), ?\exists x.Tn(x), \diamondsuit\}\}}$$

$$Tn(a), ?Ty(t) \qquad \mapsto \qquad ?Ty(t)$$

$$\langle\uparrow^*\rangle Tn(a), ?Ty(e), ?\exists\mathbf{x}.Tn(\mathbf{x})$$

Figure 5: Introducing an unfixed node

$$Tn(a), ?Ty(t)$$

$$\langle\uparrow_*\rangle Tn(a), Ty(e), \qquad Ty(e), Fo(John') \qquad\qquad ?Ty(e \to t)$$
$$Fo(Mary')$$

$$?Ty(e), \diamondsuit \qquad\qquad Ty(e \to e \to t),$$
$$Fo(Dislike')$$

Figure 6: Parsing *Mary, John dislikes*

take place which identifies the unfixed treenode with the node currently under construction.[19] MERGE is defined as a process that unifies the descriptions (sets of labels) of two nodes, the unfixed node and the current node. The process is therefore successful just in case no contradictory decorations result from the combination of the descriptions of the two nodes.[20] MERGE (indicated by a dashed curved line) applied to Figure 6 satisfies both outstanding requirements: the unfixed node provides the necessary type and formula decorations, while the fixed node provides the appropriate treenode address for the unfixed tree. Ultimately, completion of the tree yields a $Ty(t)$ Formula value, $Dislike'(Mary')(John')$ decorating the topnode, with all requirements fulfilled.

In Dynamic Syntax, it is therefore the interaction of computational, lexical and pragmatic processes which determines the interpretation of a string. A wellformed string is one for which at least one logical form can be constructed from the words in sequence within the context of a given class of computational and pragmatic actions with no requirements outstanding. In consequence, the imposition of requirements and their subsequent satisfaction are central to explanations to be given to syntactic phenomena.

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[19]Note that this process is not the same, technically or conceptually, as the process of the same name in the Minimalist Program (Chomsky 1995).

[20]Well-formed treenode descriptions are thus rather like the categories of Generalised Phrase Structure Grammar which are defined as partial functions from attributes to values (Gazdar et al. 1985).

2.2 Representing the content of noun phrases

In section 1, it was argued (following others) that the interpretation *there be* clauses (and other clauses involving the copula) depends on the properties of any postcopular noun phrase, in particular its definiteness. This sections sketches the analysis of indefinites, pronouns and definites within Dynamic Syntax which all project expressions of type e. This is made possible[21] by the use of the epsilon calculus of Hilbert and Bernays (1939) where indefinite noun phrases, for example, project epsilon terms, expressions that denote arbitrary witnesses for the set denoted by the common noun (see also Egli and von Heusinger 1995, Kempson et al 2001, Meyer-Viol 1995). Despite being of type e, the tree structures that represent the content of such quantified terms is complex, containing two nodes of type e, that of the top node and one embedded within the structure that hosts the variable bound by the quantifier. A quantified term thus consists of a triple: a quantifier, a variable, and a restrictor containing an instance of the variable determined by the content of the common noun. Formulae of the type of common nouns ($Ty(cn)$) consist of an ordered pair of the distinguished variable and an open proposition in which the variable occurs free. So the content of *happy student* is $Fo(x, Student'(x) \wedge Happy'(x))$.

   Although it will not be a direct concern of this paper, scope relations are determined through scope statements collected at the relevant propositional node. This is shown as an ordering relation between variables introduced by indefinites and universals and the 'index of evaluation' S_i.[22] Figure 7 shows the structure projected on parsing the indefinite noun phrase *a student*, in the string *A student sings* (with the scope of the indefinite shown as dependent on the index of evaluation).
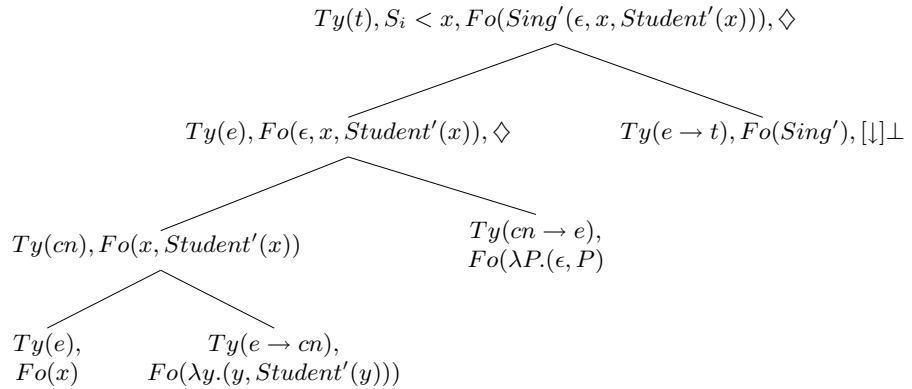

Figure 7: Parsing *a student sings*

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[21]At least with respect to definite, indefinite and universally quantified noun phrases.
[22]See Kempson et al. (2001) ch. 7 and Kempson et al. (fcmg) ch. 3 for details.

Interacting with tree growth processes of the sort sketched so far is the context-dependent processing of anaphoric expressions. This phenomenon of content underspecification, which is taken here in a representationalist spirit (see Kempson et al. 1998, Kempson et al. 2001:ch.1 for arguments), involves the lexical projection of a placeholder for some formula value, a METAVARI-ABLE, that needs to be replaced by some selected term during the construction process. Such replacement is associated with a substitution process that is pragmatic, and system-external, restricted only in so far as locality considerations distinguishing individual anaphoric expressions preclude certain formulae as putative values of the projected metavariable (i.e. analogues of the Binding Principles, Chomsky 1981, etc.).

(19) Q: Who upset Mary?
      Ans: John upset her.

In processing the pronoun in (19), the object node is first decorated with a metavariable $\mathbf{U}$, with an associated requirement, $?\exists\mathbf{x}.Fo(\mathbf{x})$ to find a contentful value for the formula label. Construed in the context provided, substitution will determine that the formula $\mathbf{U}$ is replaced by $Mary$:[23]

$$
(20)\quad her\;\left|\;
\begin{array}{ll}
\text{IF} & ?Ty(e) \\
\text{THEN} & put(Fo(\mathbf{U}), Ty(e), ?\exists\mathbf{x}.Fo(\mathbf{x}), [\downarrow]\bot) \\
\text{ELSE} & \text{ABORT}
\end{array}
\right.
$$

Note the modality $[\downarrow]\bot$ in (20) which is also projected by contentive expressions such as *John* and *upset* above. This is the 'bottom restriction' which requires that no properties hold of any node below the node so annotated and thus prevents further elaboration of that node. This means that pronouns behave, in English, like contentive expressions in that they must decorate a 'terminal node' on a tree. This has an effect in preventing dislocated expressions from being associated with a position labelled with a pronoun by the process of MERGE and thus being able to be associated with some dislocated expression. So we find that the use of resumptive pronouns with topic constructions and WH questions is marginal or excluded.[24]

(21)   a. ??Many types of beans, I like them, but much meat, I don't like it.

        b. *Who did you see them?

As already noted, metavariables may be replaced by other formula values through a pragmatic process of substitution. This I leave largely undefined in this paper (although the principles of Relevance Theory are assumed, see

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[23]A more detailed specification of *her* would include a first sub-entry that caused the update sequence of actions to abort in an environment in which the node to be decorated was a subject node, but I ignore this complexity here.

[24]See Cann, Kaplan and Kempson (to appear) for some discussion of resumptive pronouns in topic and relative clause constructions.

Sperber and Wilson 1989/1995), but pronouns also come with restrictions on the content of the expressions that may act as antecedents. Thus, *her* requires to be identified with a referent that is female. We may, following Kempson et al. (2001) display such presuppositions as annotations on a metavariable, yielding such formula representations for pronouns like *her* as $Fo(\mathbf{U}_{\text{Female}'(\mathbf{U})})$. The function of such 'presuppositions' is to act as a constraint on the process of SUBSTITUTION: the property associated with a metavariable guides the hearer towards a relevant choice of term as substituend. The substitution of *Mary* rather than (say) *Bill* for the metavariable in (19) is thus supported by the fact that Mary is assumed generally to be a name for a female while Bill is not. The fact that the pronoun *her* could be used to refer to Bill (or some other male) in a different context[25] (e.g. because Bill is dressed as a woman) does not undermine the *use* of the pronoun to identify a relevant term (e.g. by identifying a term picking out something that is dressed as a woman). The property of being female would not, in such circumstances, cash out truth conditionally as a property of whatever term is substituted for the metavariable: the presupposition is a constraint on a pragmatic process, not an assertion that some property holds of some particular term.

Definite noun phrases are treated analogously to pronouns in Dynamic Syntax in projecting underspecified content which requires to be enriched. However, the presuppositional content of such expressions is not projected from the lexicon, as part of the actions associated with parsing *the*, but from the information contained in the common noun phrase associated with the definite article. Thus, the formula projected by a phrase like *the man* may be represented as $Fo(\mathbf{U}_{\text{Man}'(\mathbf{U})})$. The question, however, is how a compositional account of definite noun phrases can be given that ensures that the right presuppositional content is associated with a definite noun phrase. To achieve this, we need the concept of LINK structures.

We have so far seen how individual trees can be built up following information provided by both general rules and lexical instructions. However, the more general perspective is to model how multiple structures are built up in context. One of the innovative aspects of Dynamic Syntax is that it allows for the building of structures in tandem, constructing first one partial structure, and then another which uses the first as its context. This process is displayed in particular by relative clauses. The characteristic property of such "linked" structures is that they share a common term, making their clearest application in the characterisation of relative clauses. They may, however, also be used to model definites and their associated presuppositions.

The definite article, like a pronoun, is analysed as projecting a metavariable[26], but additionally induces the construction of a propositional structure linked to the node so decorated. The propositional tree is partially constructed

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[25]Not in the current context because of the Principle B restriction on substituting a co-argument, see Kempson et al. 2001.

[26]A reflection of its diachronic development from a demonstrative pronoun.

with a copy of the metavariable in the first argument position and a requirement to find a predicate.[27] The effect of parsing *the* is shown in Figure 8 where the LINK modality is indicated by the thick black arrow. The appropriate set of actions is given in (22) which uses the modal operators $\langle L \rangle$ and $\langle L^{-1} \rangle$ to signify the LINK relation and its inverse.[28]

$$
(22) \quad the \quad
\begin{array}{ll}
\text{IF} & ?Ty(e) \\
\text{THEN} & put(Ty(e), Fo(\mathbf{U}), ?\exists \mathbf{x}.Fo(\mathbf{x})) \\
& make(\langle L \rangle), go(\langle L \rangle), put(?Ty(t)) \\
& make(\langle \downarrow_0 \rangle), go(\langle \uparrow_0 \rangle), put(Ty(e), Fo(\mathbf{U}), ?\exists \mathbf{x}.Fo(\mathbf{x})) \\
& go(\langle \uparrow_0 \rangle), make(\langle \downarrow_1 \rangle), go(\langle \downarrow_1 \rangle), put(?Ty(e \rightarrow t))) \\
\text{ELSE} & \text{ABORT}
\end{array}
$$

$$
Tn(n), ?Ty(e) \quad \longmapsto \quad Tn(n), Ty(e), Fo(\mathbf{U}), ?\exists \mathbf{x}.Fo(\mathbf{x})
$$

$$
\langle L^{-1} \rangle Tn(n), ?Ty(t)
$$

$$
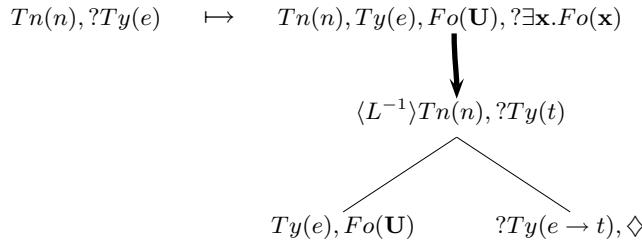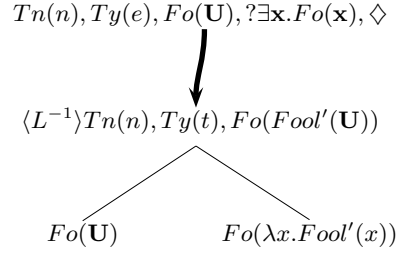Ty(e), Fo(\mathbf{U}) \qquad ?Ty(e \rightarrow t), \diamondsuit
$$

Figure 8: Parsing *The*

Kempson et al. (2001) utilise a type *cn* for common nouns and not a predicate type. This is necessary in the system (for reasons to do with the introduction of fresh variables into the nominal structure), but obscures the fact that common nouns express properties like verbs, even though their syntax is very different. To account for the common properties I take common nouns to be parsable in common noun ($?Ty(cn)$) and predicate ($?Ty(e \rightarrow t)$) contexts. The parse of a definite expression like *the fool* proceeds as illustrated in Figure 9 with the definite providing a LINK structure

As noted above, SUBSTITUTION is a pragmatic, system external process that substitutes an appropriate *Formula* value for a metavariable from the context, so satisfying the requirement to find such a value. However, substitution (or any other construction rule) may not intervene in the course of tree transitions induced by the lexical actions associated with parsing some word. Since the lexical actions associated with *the* force the pointer into the presuppositional LINK structure, substitution cannot occur with definites until after the processing of the structure provided by the common noun phrase, once the LINK

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[27]I omit the mechanism needed to restrict the predicates to common nouns for simplicity.
[28]For more details of the LINK mechanism and its interpretation see Kempson et al 2001:ch.4, Kempson 2003.

$$Tn(n), Ty(e), Fo(\mathbf{U}), ?\exists \mathbf{x}.Fo(\mathbf{x}), \diamondsuit$$

$$\langle L^{-1}\rangle Tn(n), Ty(t), Fo(Fool'(\mathbf{U}))$$

$$Fo(\mathbf{U}) \qquad Fo(\lambda x.Fool'(x))$$

Figure 9: Parsing *The fool*

structure has been compiled and the pointer has moved back to the type e node. At this point, the information provided by the common noun phrase is available to be used as a constraint on the substitution operation.

The effect of the metavariable is thus to force some inferential effort to satisfy the associated requirement to find a formula value. This process involves the identification of some relevant term constructed from the local context which may be some name, actual or arbitrary, or an epsilon term constructed from information already provided within the discourse. Consider the small text in (23).

(23) Bill's coming to Jane's party. She detests the fool.

Here, the first sentence provides the context for interpreting the definite in the second. So we have (something like) $Come'(To - J - party')(Bill')$ as the formula value for the former. Parsing the definite NP in the latter requires the identification of some contextually salient term that also satisfies the property of being a fool. Given the choice of *she* as the subject, identified as Jane as the only potential female referent, the only possible term to substitute for the definite metavariable is $Fo(Bill')$. The second clause is thus given the formula value in (24).[29]

(24) $Detest'(Bill'_{\rightsquigarrow Fool'(Bill')})(Jane')$.

The information projected by the common noun *fool* is used to identify an appropriate substituend, by constraining the set of terms that may be considered for substitution of the metavariable. In this case, there is only only possible candidate (in a richer context there might not be), but there remains the question of how the LINK structure induced by the definite article ultimately contributes to the interpretation of the whole proposition. In other

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[29]Note that to indicate constraints of the sort associated with definites the content of a phrase like *the fool* will be shown as $Fo(\mathbf{U}_{\rightsquigarrow Fool'(\mathbf{U})})$, the symbol $\rightsquigarrow$ indicating the LINK relation.

words, what is the precise interpretation of formulae like (24)? Kempson (2003) proposes a general rule of LINK evaluation for non-restrictive relative clauses that simply conjoins the propositional formula provided by the LINKed tree to that of the principal propositional structure.[30] The details are not important here, but the rule provides a sentence like *She detests the fool* in the above context with the formula value in (25).

(25) $Detest'(Bill')(Jane') \wedge Fool'(Bill')$

This interpretation of the definite provides a condition on the substituend that cashes out in this case as an entailment. The concept of 'presupposition' invoked here is thus essentially Russellian, since the failure to establish the existence of something that has the property expressed by the common noun will yield a formula that is false on normal model-theoretic assumptions. However, because of the pragmatic nature of substitution and the assumption that contextual matters may affect how a propositional structure, whether LINKed or not, is to be interpreted, any existential presupposition and the information actually conveyed by a definite expression is pragmatically mediated and so 'presupposition failure' is most likely to lead to a negotiation of what is being referred to by the definite noun phrase or to a modification of the property expressed by the common noun. Hence, although *That woman works as a male nurse* ought logically to lead to a contradiction that x is and is not a woman, pragmatic inference over the **representation** of the proposition expressed by this sentence will lead to a manipulation in context of either the information provided by *that woman* (such as that x is dressed as a woman) or *works as a male nurse* (such as that x is a substitute worker for a male nurse) to avoid the contradiction and resolve the apparent presupposition failure. In such cases, the rule for interpreting LINK structures in 30 is not invoked, the information provided merely being used to select an appropriate substituend, a situation that is in accord with the optionality of all transitions in Dynamic Syntax except those induced by lexical actions. This does not involve a loss of compositionality or monotonicity. The *structure* induced by parsing the common noun phrase remains part of the representation of the string even though its *content* does not contribute to the truth conditions of the projected proposition. This analysis of definite noun phrases as LINK structures thus provides a strategy for parsing such expressions that is compositional and monotonic, at least in terms of information content if not in terms of direct contribution to truth conditional content (e.g. where presuppositions fail).[31] The fact that some term has to be identified from context to substitute for the metavariable

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[30]Link Tree Evaluation

$$\frac{\{..\{Tn(X)\dots Fo(\phi), Ty(t), \Diamond\}, \{\langle L\rangle MOD(Tn(X))\dots Fo(\psi), Ty(t)\}\dots\}}{\{..\{Tn(X)\dots Fo(\phi \wedge \psi), Ty(t), \Diamond\}, \{\langle L\rangle MOD(Tn(X))\dots Fo(\psi), Ty(t)\}\dots\}}$$
$$MOD \in \{\langle\uparrow_0\rangle, \langle\uparrow_1\rangle\}^*$$

[31]The sort of interaction between pragmatics and semantic content envisaged here and

projected by a definite noun phrase induces the 'existence presupposition' of such phrases, even in cases where the descriptive content of the common noun phrase is not met.

2.3 Expletives in Dynamic Syntax

The analysis of copula constructions developed in the next section utilises underspecification of both formula value and position within a tree and takes as its starting point the analysis of expletive expressions in Cann (2001) and Cann, Kempson and Otsuka (2003) which I now present.

As already stated, pronouns in English share the property of contentive expressions that they decorate a terminal node in a tree, guaranteed by the 'bottom restriction' $[\downarrow]\bot$. However, there are pronouns that are systematically associated with material that occurs elsewhere in a string. Amongst these are the expletive pronouns *it* and *there* in English whose expletive properties can be characterised as a failure to project the bottom restriction, thus permitting development of the tree from a parse of words later in the string. The function of an expletive use of a pronoun, accordingly, is to keep the parsing process alive: it first provides a metavariable as an interim value to some type requirement associated with one node and then moves the pointer on to another node. Because the pointer is moved on as part of the actions determined by it, no substitution can take place and an open formula requirement necessarily remains on the node decorated by the metavariable.

Consider the pronoun, *it* in extraposition constructions such as (26)

(26) It appears that Bill drinks too much beer.

This example may be analysed as involving the annotation by the pronoun of a propositional node in subject position with a metavariable $\mathbf{U}$ and associated requirement, $?\exists\mathbf{x}.Fo(\mathbf{x})$, to find a contentful formula value, as given by the lexical actions in (27).[32]

$$
(27)\quad it_{expl}\quad
\begin{array}{|l l l}
\text{IF} & ?Ty(t) & \\
\text{THEN} & \text{IF} & \langle\uparrow\rangle\bot \\
 & \text{THEN} & \text{ABORT} \\
 & \text{ELSE} & put(Fo(\mathbf{U}), Ty(t), ?\exists\mathbf{x}.Fo(\mathbf{x})), go(\langle\uparrow\rangle\langle\downarrow_1\rangle) \\
\text{ELSE} & \text{ABORT} &
\end{array}
$$

In parsing (26), the tree unfolds with requirements for nodes of types t and $t \to t$, a permissible instantiation of INTRODUCTION. The word *it* is then parsed and the pointer moves to the predicate node ($\langle\uparrow\rangle\langle\downarrow_1\rangle$ 'up then down to the

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in Relevance theory in general leads to a number of interesting questions about monotonic interpretations of compositionality that could have quite a significant effect on the way such concepts are used in semantics. I leave this to one side, however.

[32]The initial condition prevents the word from decorating the topmost propositional node, thus disallowing strings such as *It Bill drinks too much beer.*

functor daughter'), preventing pragmatic substitution of the metavariable.[33] After parsing the verb (which projects a formula value $\lambda p.Appear'(p)$ of type $t \to t$), the tree constructed so far cannot be completed because the subject node still carries an open requirement which needs to be satisfied.

In order to complete the parse of the current string, therefore, some means has to exist for developing the subject node further to provide the requisite propositional formula. To do this, we may invoke a general construction rule that licenses unfixed nodes at the right periphery. This rule, LATE *AD-JUNCTION, takes as input a type-complete propositional tree and constructs an unfixed node of arbitrary type.[34] Unlike the version of *ADJUNCTION above, LATE *ADJUNCTION projects an unfixed node with a requirement for the same type as the node from it is projected. Since no further direct development of the fixed node is possible, this version of *ADJUNCTION thus defines directly the structural context to which Merge applies, i.e. the unfixed node and the fixed node from which it is projected.[35]

Applying the rule to the tree induced by parsing *it appears* permits the construction of an unfixed propositional node that allows the parsing of the string final clause. This unfixed tree carries a requirement that a fixed position is to be found within the propositional tree currently under construction, just as with left dislocation sketched in Section 2.1, and must, therefore, MERGE with some node in this structure. As illustrated in Figure 10 (where the dashed line indicates an unfixed relation and the dashed arrow indicates the merge process, as above), the only node with which the unfixed node can merge coherently is that decorated by the metavariable. This is so, because only the subject node lacks the bottom restriction and only its formula value is consistent with that decorating the unfixed propositional tree.[36] Merging the unfixed tree with the subject node, yields a completed propositional with a final formula for (26) as

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[33]The evidence that one of the effects of parsing *it* is to move on the pointer comes from two sources. Firstly, extraposition cannot be to the left (i) which indicates that the pointer does not remain at the subject node as would be necessary for an operation of MERGE to take place. Secondly, expletive *it* cannot be anaphoric to some other expression in context, but requires the use of *so* in these cases (ii), indicating that it is *so* that is the truly anaphoric expression in these instances and not *it*. Both of these facts point to a situation in which substitution is directly prevented from occurring immediately after the pronoun has been parsed.

  i. *That I am wrong, it seems.
  ii. A: I heard that the Principal has resigned.
     B: It seems *(so).

[34]See Cann, Kempson and Otsuka (2003) for a justification of a somewhat different rule with a similar effect.

[35]LATE*ADJUNCTION

$$\frac{\{Tn(n),\ldots,\{\uparrow_* Tn(n), Tn(a),\ldots, Ty(X), \diamondsuit\},\ldots\}}{\{Tn(n),\ldots,\{\uparrow_* Tn(n), Tn(a),\ldots, Ty(X)\}, \quad \{\langle\uparrow^*\rangle Tn(a), ?Ty(X), \diamondsuit\},\ldots\}}$$

[36]In these and later trees, type information is left off nodes which are not under discussion, for ease of reading.

$Tn(0), ?Ty(t)$

$Tn(00), Ty(t), Fo(\mathbf{U})$
$?\exists\mathbf{x}.Fo(\mathbf{x}), \diamondsuit$

$Ty(t \to t),$
$Fo(\lambda p.Appear'(p))$
$[\downarrow]\bot$

$Ty(t), Fo(Drink'(Beer'')(Bill')),$
$?\exists\mathbf{x}.Tn(\mathbf{x})$

$Fo(Bill')$

$?Ty(e \to t)$

$Fo(Beer')$ $Fo(Drink')$
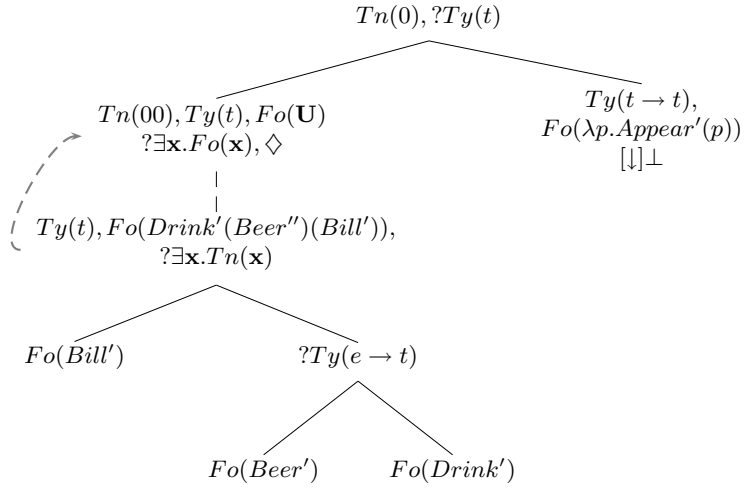
Figure 10: Parsing *It appears that Bill drinks too much beer*

$Fo(Appear'(Drink'(Beer')(Bill')))$.

Note that if *it* were to project a bottom restriction, no merge could take place as the effect is to 'grow' a tree under the node decorated by the metavariable. This is precisely the characterisation needed for expletive expressions: they satisfy a type requirement, allowing further parsing to take place, but are replaced later in the parse by possibly complex structures which supply the semantic information needed.

3   INTERPRETING *BE*

In section 1, I argued for the hypothesis that *be* uniformly projects a one-place predicate whose content is determined by context. In other words, the copula projects a semantically underspecified predicate, whose content has to be enriched in some way to provide a final interpretation. As we saw in the last section, underspecified content when associated with a pronoun is represented by a metavariable of type *e* whose actual content is determined either by a pragmatic process of SUBSTITUTION or, if the pronoun is expletive, through an update provided by the parse of later material (i.e. through LATE*ADJUNCTION). This is exactly what is needed to analyse the copula, except that the metavariable associated with it is of predicate $(Ty(e \to t))$ type. The lexical entries for the various forms of *be* thus all contain an instruction to annotate a predicate node

with the appropriate type label and a metavariable, $\mathbf{BE}$[37] together with an associated requirement to find some contentful predicate to act as substituend.

It is not the case that just any predicate can associate with *be*, however, but only stative predicates that are associated with non-verbal expressions.

(28)   a. *Kim knows the answer and Lou is, too.

         b. *Kim is know the answer.

Maienborn (this volume) argues for a differentiation between Davidsonian states (or D-states) and states that she refers to as K-states following Kim (1969, 1976)'s notion of temporally bounded property exemplifications. She suggests that such states are not eventualities but form a separate class of abstract object (in the sense of Asher 1993) somewhere between world bound facts and spatio-temporally defined eventualities. I adopt the hypothesis here (without discussion) that copula clauses denote some sort of state that differs from the classic Davidsonian notion and is only associated with the denotata of non-verbal expressions. This requires the lexical definition of the copula to project an annotation to ensure that any predicate that substitutes for the metavariable projected by *be* is restricted to K-states by an index on the metavariable: $\mathbf{BE}_{S_K}$.[38] The lexical entry for *is* is therefore as shown in (29).

(29)   *is* $\begin{array}{ll} \text{IF} & ?Ty(e \to t) \\ \text{THEN} & \mathtt{go}(\langle\uparrow_1\rangle), \mathtt{put}(Tns(PRES)), \mathtt{go}(\langle\downarrow_1\rangle) \\ & \mathtt{put}(Ty(e \to t), Fo(\mathbf{BE}_{S_K}), ?\exists\mathbf{x}.Fo(\mathbf{x})) \\ \text{ELSE} & \text{ABORT} \end{array}$

3.1   Ellipsis and the existential focus construction

The analysis of *be* as a predicate underspecified for content allows us to tackle the bewildering variety of copular constructions in English in a uniform manner, the burden of explanation shifting from considerations of the core 'meaning' of *be* as denoting existence or identity to an account of inference in context that derives the correct interpretations of sentences. Assuming that the copula does project underspecified content, the value of the metavariable, $\mathbf{BE_{S_K}}$, that it projects must be established. This, like all other values for metavariables, may be freely identified in context which gives us a way to account for certain types of ellipsis involving the copula, as illustrated in (30).

(30)   a. John's really happy, John is.

---

[37]This could be shown as $\mathbf{U}$ or $\mathbf{V}$, but I use the different form for mnemonic purposes: $\mathbf{BE}$ is a metavariable over one-place predicates.

[38]Note that this is not defined in terms of a LINK structure. In fact, the annotation would be best construed as a K-state variable, so that $\mathbf{BE}_{S_K}$ might be better interpreted as $\lambda x.\mathbf{BE}(\epsilon, e, S_K(e))(x)$. However, in the absence of a coherent theory of events within DS, I leave this possibility to one side.

     b. A. Who was at the meeting?
        B. Mary was.

Under the assumption that *be* projects a metavariable, the elliptical utterances in (30) will be well-formed because the preceding utterance includes an accessible (and relevant) one place predicate which can substitute for the metavariable in the normal way. The situation resulting from parsing the second clause in (30b) is shown in Figure 11 up to the point of substitution. The resulting formula is, as required, $Fo(At'(Mary', (\epsilon, y, Meeting'(y))))$.

$$?Ty(t)$$

$$Fo(Mary') \qquad Fo(\mathbf{BE}_{S_K})$$
$$\Uparrow$$
$$Fo(\lambda x.At'(x, (\epsilon, y, Meeting'(y))))$$
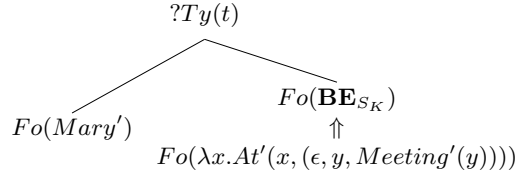
Figure 11: Parsing *Mary was*

Interestingly enough, this analysis also directly accounts for the possible interpretation of *be* as existential in the existential focus constructions illustrated in (1h) repeated below:

(1)   h. Neuroses just ARE.

In identifying the potential substituends for the predicate metavariable **BE**, the context also includes predicates derivable from the tree currently under construction. Thus, instead of identifying a predicate from the previous discourse, a hearer may construct one from the immediate context (the tree currently under construction) and substitute that for the predicate metavariable. In the tree constructed to parse (1h), the only available predicate is that derived from the common noun in the subject position, as illustrated in Figure 12. Making

$$?Ty(t)$$

$$Fo(\epsilon, x, Neuroses'(x)) \qquad Fo(\mathbf{BE_{S_K}})$$
$$\Uparrow$$
$$Fo(\lambda x.Neuroses'(x))$$

$$Fo(x, Neuroses'(x)) \qquad Fo(\lambda P.(\epsilon, P))$$
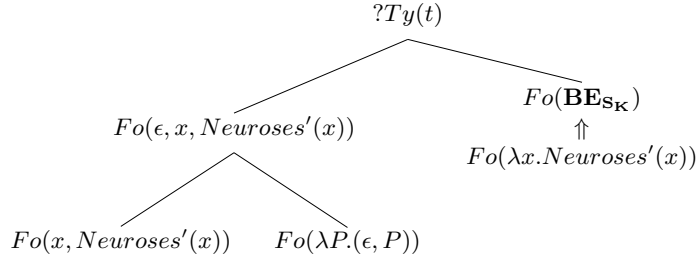
Figure 12: Parsing *Neuroses (just)* ARE

this substitution gives rise to the output formula in (31a) which, by the established equivalence in the epsilon calculus shown in (31b), gives rise to the existential statement in (31c).

(31)   a. $Fo(Neuroses'(\epsilon, x, Neuroses'(x)))$

        b. $F(\epsilon, x, F(x)) \leftrightarrow \exists x.F(x)$

        c. $\exists x.Neuroses'(x)$

While more needs to be said about the existential focus construction, especially with respect to the possibility of quantified subjects and the interaction with tense, it should be clear from this discussion that the treatment of *be* as projecting semantically underspecified content that may be pragmatically enriched provides a basis of a unified account of both ellipsis in copula clauses and existential focus readings, an unexpected result.

3.2 Predicative constructions

In the copula constructions discussed above, its underspecified semantics is pragmatically specified during the course of constructing the proposition conveyed by an utterance in context. However, there is a construction in which the appropriate predicate is supplied syntactically without the intervention of pragmatics. This is the basic predicative construction where a non-verbal predicate appears post verbally.

The lexical entry for *be* in (29) does not annotate the predicate node with a bottom restriction, giving it the properties of an expletive, thus permitting an application of Late*Adjunction to allow the parse of a postcopular predicate. The unfixed predicate tree may then Merge with the predicate node decorated by **BE**, yielding the familiar predicate construction with postcopular adjectives, prepositional and other phrases that can be construed as predicates.[39]

As an example, consider the parse of *Kim is happy*. The first two words are parsed and annotate the subject and predicate nodes, respectively. The tree cannot be compiled, however, until the content of the copula is established. This may be through substitution as in the previous subsection, in which case the parse will fail as there will be no position in the tree for the adjective to decorate. Or the predicate node may be updated through an application of Late*Adjunction. This may apply to give an unfixed node decorated by a predicate requirement, $?Ty(e \rightarrow t)$ which permits the parse of any one-place predicate, in this case the simple adjective *happy*. The node decorated by the adjective then merges with the underspecified main predicate expression, satisfying both the requirement of the unfixed node to find a fixed position within the tree and the requirement that **BE** be replaced by some contentful concept. Since *happy* denotes a Kimian state, the merge is successful and yields a final formula value $Happy(Kim)$. This process is illustrated in Figure 13.

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[39]This may also be the appropriate analysis for passives and progressives in English, but this topic will not be pursued here.

$$?Ty(t) \qquad\qquad \mapsto \qquad\qquad Ty(t), Fo(Happy'(Kim'))$$

$$Fo(Kim' \qquad\qquad \begin{array}{c} Ty(e \to t), \\ Fo(\mathbf{BE}_{S_K}), \\ ?\exists\mathbf{x}.Fo(\mathbf{x}) \end{array}$$

$$Fo(Kim') \qquad \begin{array}{c} Ty(e \to t), \\ Fo(\lambda y.Happy(y)), \\ [\downarrow]\bot \end{array}$$

$$\begin{array}{c} Fo(\lambda y.Happy'(y)), \\ Ty(e \to t), [\downarrow]\bot \end{array}$$
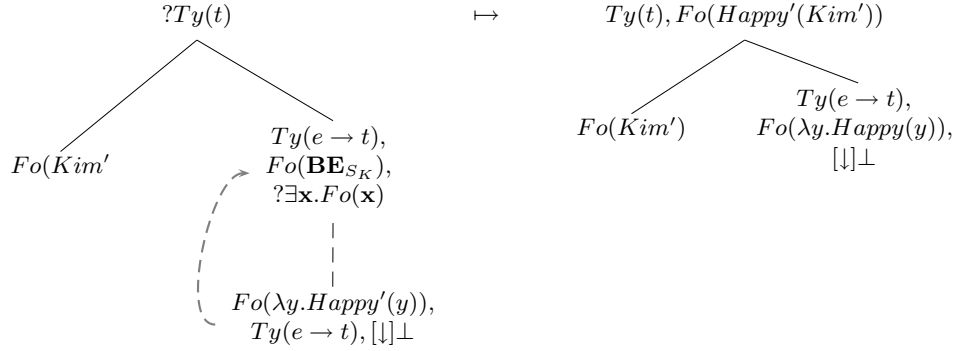
Figure 13: Parsing *Kim is happy.*

Other predicates may be treated in the same way, under the (natural) assumption that such expressions may be of predicate type. So, a sentence like that in (32a) gets the formula value in (32b).

(32)   a. Robert is on a train.

   b. $\lambda x.(On'(\epsilon, y, Train'(y))(x))(Robert')$.

For indefinite nominal predicates in English, the story is more complex and will not be discussed here (but see Kempson et al. (fcmg) ch. 8 for some discussion). However, in all cases of predicative uses of *be* the content of the copula is directly provided by the parse of an appropriate predicate.[40]

4   TOWARDS AN ACCOUNT OF *THERE BE*

In this section, I use the analysis of the copula as projecting a semantically underspecified predicate to provide a sketch of an account of *there be* constructions in English. To begin we need some characterisation of the contribution

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[40]One of the referees of this paper objects to the radical underspecification of the copula assumed here, particularly with respect to the account of predicative clauses. S/he suggests that predicative copular clauses share properties with depictives such as that in (i):
i. Jane arrived drunk.
and suggests the adoption of an analysis like that of Rothstein (2001) in which the predicate is an adjunct of the copula which is taken to denote a function that maps an individual onto the set of states of that individual being in a discourse given place, the underspecification of the copula then being with respect to what is to be taken as the discourse given place (literally or figuratively). This is an interesting idea which would be worth exploring (and may be handled by treating the notion that copular constructions denote K-states). However, it is highly unclear how this notion of the contribution of *be* would extend to non-predicative cases, particularly if grammaticalised uses are taken into account. Hence, I maintain the expletive treatment of this paper.

of *there*. Clearly, in its adverbial use, the expression is a locative pronoun standing for a place where something is, used demonstratively as in (33a) or anaphorically as in (33b).

(33)   a. Bill's keys are there.

     b. Did you see Bill at the clubhouse? I meet him there all the time.

Generally, *there* may be interpreted as projecting an underspecified locative relation involving an object and a location: $LOC(\mathbf{THING}, \mathbf{PLACE})$ (see Jackendoff 1983, etc.). In the predicative example in (33a) the expression will project a predicate version of this ($\lambda x.LOC(x, \mathbf{PLACE})$) which can be substituted by a specific locative predicate that locates the keys (such as, for example, being on the table), as illustrated in Figure 14, where the output propositional formula is:

$$Fo(On'((\epsilon, x, Keys'(x) \wedge POSS(Bill', x)), (\epsilon, y, Table'(y)))).$$

$$?Ty(t)$$

$$Fo(\epsilon, x, Keys'(x) \wedge Poss(Bill', x)) \qquad Fo(\mathbf{BE}_{S_K})$$

$$Fo(\lambda y.LOC(x, \mathbf{V})), ?\exists \mathbf{x}.Fo(\mathbf{x})$$
$$\Uparrow$$
$$Fo(\lambda x.On'(x, (\epsilon, y, Table'(y))))$$

Figure 14: Parsing *Bill's keys are there*

As a locative anaphor operating as an adjunct, the locativity of *there* may be treated not as projecting an underspecified locative predicate, but as an underspecified term, i.e. a metavariable, but with the locative content of the adverbial being a 'presupposition'. In the case of a locative anaphor, the presupposition constrains substitution of the metavariable to a **PLACE**: $\mathbf{U}_{\leadsto LOC(\mathbf{THING}, \mathbf{U})}$. I do not discuss adjuncts in this paper, but adopt the general hypothesis of Marten (2002) that such expressions are analysed as optional arguments of type e. In interpreting (33b), therefore, the metavariable projected by *there* appears as an argument of the verb *meet* and is substituted with the content of *the clubhouse* with a presupposition that something (in this context, *I* or *Bill*) is at that place: $Fo(\epsilon, x, Clubhouse'(x)_{\leadsto LOC(John', \epsilon, x, Clubhouse'(x))})$. We thus get an interpretation in which John often meets Bill at the clubhouse (when John is at the clubhouse).[41]

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[41]I do not provide a full analysis of this example, as the discussion would take me too far from the current topic, nor do I address the question of the variability in type associated with PPs by this hypothesis.

What of the expletive uses of *there*? One hypothesis is that some remnant of the locative presupposition remains with the expletive, but that the projected metavariable satisfies not the place of the locative relation, but the thing: $\mathbf{U}_{\leadsto LOC(\mathbf{U},\mathbf{PLACE})}$. In other words, part of the grammaticalisation of the locative proform into an expletive subject involves a shift in perspective from the place where something is to the thing itself. This shift has the effect of associating the expletive with the associate (the postcopular DP) rather than directly with any locative expression. In other words, *there* projects the information: $Fo(\mathbf{U}_{\leadsto LOC(\mathbf{U},\mathbf{V})})$.

Put together, parsing *there be* thus involves the projection of a radically underspecified propositional structure, where both subject and predicate are decorated by metavariables, as shown in Figure 15. The account I propose of the interpretation of clauses containing some form of this string then rests on how the content of these two nodes is established in context, given the other material provided by the string. The properties of the substituend of the other argument thus determine in part how the *there be* clause is to be interpreted.[42] We turn now to a consideration of the existential construction.

$$?Ty(t), \diamondsuit$$

$$Ty(e), Fo(\mathbf{U}_{\leadsto LOC(\mathbf{U},\mathbf{V})}) \qquad Ty(e \to t),$$
$$?\exists\mathbf{x}.Fo(\mathbf{x}) \qquad\qquad ?\exists\mathbf{x}.Fo(\mathbf{x}), Fo(\mathbf{BE_{S_K}})$$

Figure 15: Parsing *There's*

4.1 The existential construction

We begin with an analysis of the existential example in *There's a riot on Princes Street* is provided. Figure 15 above shows the structure after parsing *there's* with metavariables in both subject and predicate position, requiring completion. The pointer is on the top node but completion cannot occur because neither daughter is complete and so the pointer moves onto the subject node and an application of Late*Adjunction may apply as shown in Figure 16. This allows the parse of the postcopular indefinite noun phrase, *a riot*, which merges with the subject node to provide the content of the metavariable as illustrated in Figure 17.

At this point, the subject node is complete and the pointer moves to the predicate node which provides a means of analysing the coda,*on Princes Street*, as a straightforward prepositional predicate phrase. Just as with normal pred-

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[42]This approach provides a means of incorporating the Perspective Structure in existential constructions of Borschev and Partee (1998), Partee and Borschev (this volume). But I leave this to one side.

$$?Ty(t)$$

$$Ty(e), Fo(\mathbf{U}_{\rightsquigarrow LOC(\mathbf{U},\mathbf{V})}) \qquad\qquad ?\exists\mathbf{x}.Fo(\mathbf{x}),$$
$$?\exists\mathbf{x}.Fo(\mathbf{x}) \qquad\qquad Fo(\mathbf{BE_{S_K}})$$

$$?Ty(e), \diamond$$

Figure 16: Parsing *There's* after LATE*ADJUNCTION

$$?Ty(t)$$

$$Ty(e), Fo(\mathbf{U}_{\rightsquigarrow LOC(\mathbf{U},\mathbf{V})}) \qquad\qquad ?\exists\mathbf{x}.Fo(\mathbf{x}),$$
$$?\exists\mathbf{x}.Fo(\mathbf{x}) \qquad\qquad Fo(\mathbf{BE_{S_K}})$$

$$Ty(e), Fo(\epsilon, x, Riot'(x)), \diamond$$

$$Fo(x, Riot'(x)) \qquad Fo(\lambda P.(\epsilon, P))$$

Figure 17: Parsing *There's a riot*

icative constructions, this is achieved through an application of LATE *AD-JUNCTION and MERGE, as shown in Figure 18[43], which complies to give the formula: $On'((\epsilon, x, Riot'(x))_{\rightsquigarrow LOC(\epsilon,x,Riot'(x),\mathbf{V})}, PrincesSt)$.

There remains in this formula an uninstantiated metavariable, $\mathbf{V}$ which, although not associated with a formula requirement, needs to be instantiated for interpretation to take place. Using the LINK evaluation rule, we may derive for Figure 18 the conjoined expression in (34a). Here, because of the generality of the locative relation, LOC, the metavariable and the shared subject term in the second conjunct, this subsumes the information provided by first conjunct and effectively derives the content in (34b).

(34)   a. $On'((\epsilon, x, Riot'(x)), PrincesST') \wedge LOC(\epsilon, x, Riot'(x), \mathbf{V})$
        b. $On'((\epsilon, x, Riot'(x)), PrincesST')$

The interpretation I derive for the existential construction is effectively

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[43]The internal structure of the prepositional predicate is not shown.

$$?Ty(t), \diamondsuit$$

$$Ty(e), Fo(\epsilon, x, Riot'(x)_{\rightsquigarrow LOC(\epsilon,x,Riot'(x),\mathbf{V})})$$

$$?\exists\mathbf{x}.Fo(\mathbf{x})$$
$$Fo(\mathbf{BE_{S_K}})$$

$$Fo(x, Riot'(x)) \qquad Fo(\lambda P.(\epsilon, P))$$

$$Ty(e \rightarrow t), Fo(\lambda x.On'(x, PrincesST'))$$
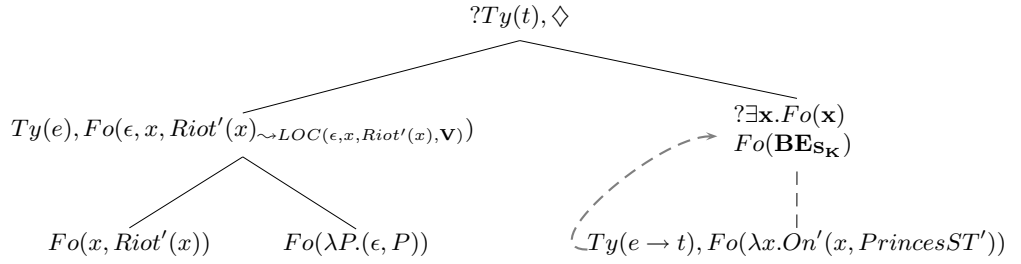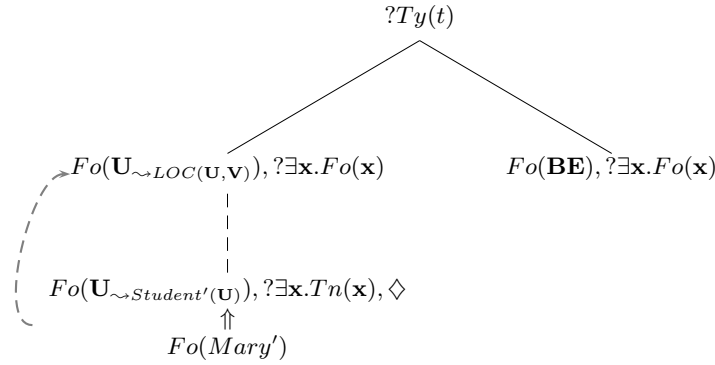
Figure 18: Parsing *There's a riot on Princes Street*

equivalent to a small clause analysis, the content of the proposition being provided by the associate and the locative coda. However, the informational effect is different from an assertion of *A riot is (happening) on Princes Street*. This is because the process of interpreting *There is a riot on Princes Street* the hearer is initially presented with the information that some term needs to be identified that is associated with some locative presupposition. The content of this term is then presented by the associate which introduces a new variable, indicating new information. The coda then provides the required locative predicate, satisfying the initial presupposition.

4.2 Definite Associates

There is, therefore, no direct statement of existence in our account, the apparent focus on existence being given by the new information provided by the indefinite associate. Differences in interpretation can then be expected with a definite coda. As we have seen, the difference between definites and indefinites is that the former project metavariables whose content is supplied from context (and constrained by the 'presupposition' derived from the content of the common noun phrase) while indefinites project full quantificational structure as epsilon terms. It is this difference in analysis which can be exploited in accounting for the different interpretations of *there be* clauses.

Consider, for example, the analysis of *There's the student (you wanted to see)*. The parsing of *there's* proceeds as above and Late*Adjunction provides a means of analysing the definite. Substitution applies at this point of the term identifying the student you wanted to see and the node Merges with the subject node as illustrated in Figure 19.

Before the tree can be completed, however, the content of the predicate metavariable needs to be established. In keeping with the assumptions of Dynamic Syntax, I adopt a general Relevance Theoretic perspective on pragmatic processes such as substitution whereby there is a tradeoff between process-

$$?Ty(t)$$

$$Fo(\mathbf{U}_{\leadsto LOC(\mathbf{U},\mathbf{V})}),?\exists\mathbf{x}.Fo(\mathbf{x}) \qquad Fo(\mathbf{BE}),?\exists\mathbf{x}.Fo(\mathbf{x})$$

$$Fo(\mathbf{U}_{\leadsto Student'(\mathbf{U})}),?\exists\mathbf{x}.Tn(\mathbf{x}),\Diamond$$
$$\Uparrow$$
$$Fo(Mary')$$

Figure 19: Parsing *There's the student*

ing cost and information gained. Since Optimal Relevance is determined as a trade-off between cognitive effort and informativeness (the more effort required to access an interpretation the more informative it should be, see Sperber and Wilson 1986/1995), a hearer will be constrained to take as substituend the most accessible formula that is likely to yield significant inferential effects. The pragmatic process of substitution occurs *within* the construction of a propositional representation, however, and so will tend to prefer substituends which are provided by the immediate discourse because the domain over which other inferences are to be carried out may not yet be complete. In term of Figure 19, this will ensure that the predicate substituend will be supplied by some local predicate as far as possible. There are two potential predicate substituends in Figure 19, both from the presuppositional structures.

(35)   a. $\lambda y.Student'(y)$
         b. $\lambda x.LOC(x,\mathbf{V})$

(35b) has been used to identify the substituend for the definite associate and so its informativeness is weak, leaving the locative predicate in (35b) as both highly accessible and potentially the most informative predicate to choose.

   Making the appropriate substitution and compiling up the tree yields the formula value in (36a).[44] This leaves us with the need to identify the locative relation and the PLACE. Again, local substitution should be preferred, all things being equal. There is, however, very little information available with regard to potential substituends, except that there exists in the scope statement

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[44]The definite presupposition is not shown, having been 'discharged'.

induced by the tense of the verb, the index of evaluation S_i which may, following Lewis, Montague, etc., be construed as a world-time pair and therefore something that may be a PLACE. Substituting this index for $\mathbf{V}$ in (36a) yields (36b) which enables the inference to (36c) which in turn leads to the inference that Mary is here, (36d), which I take to be the content of *There's the student (you wanted to see)* in a situation in which Mary is indeed the student you wanted to see.

(36)   a. $LOC(Mary'), \mathbf{V})$

        b. $LOC(Mary'), S_i)$

        c. $\models At'(Mary'), S_i)$

        d. $\models Here'(Mary')$

Notice the importance of context here. The need to construe something informative to substitute for the predicate metavariable associated with the copula means that certain examples involving *there be* will be difficult to interpret except in rich contexts. For example, (37) is difficult to interpret in a null context

(37)   ??There's the student in the garden.

The explanation for this provided by the current pragmatic approach is that the predicate projected by the associate (*the student*) is not informative, having been used to identify some accessible individual. Additionally, a locative interpretation for $\mathbf{BE_{S_K}}$ is not obviously informative because the coda provides an explicit location for the referent of the associate. Hence, some other predicate must be construed from a wider context to deduce a relevant substituend for the predicate metavariable. In a null or restricted context, therefore, it is difficult if not impossible to identify an appropriate interpretation for the string in (37). But in a context in which (for example) there has been a prior utterance by the hearer of the question *Who's missing?*, the utterance of (37) provides an instantiation of the predicate $\lambda x.Missing'(x)$ derived from the question and being salient in the discourse. The actual content of (37) in such a context would be something like that in (38).

(38) $Missing'(Mary') \wedge In'(Mary', \epsilon, x, Garden'(x))$.

Further evidence in favour of a pragmatic approach to the interpretation of such clauses comes from the fact that extra information contained in modifier constructions can sufficiently enrich the context so that an interpretation can be given (something often noted but rarely explored). Hence, the predicate modifier *again* in (37a) provides a context in which the relevant rabbit is persistently in the garden, while the modifier and relative clause in (39b) indicates that where the student is now is relevant to the hearer.
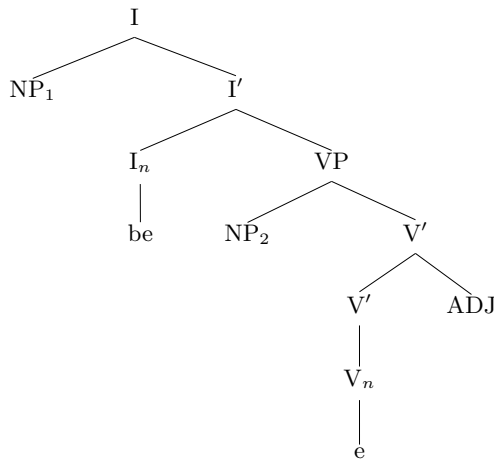
(39)   a. There's the rabbit in the garden again.

b. There's the student you wanted to see in the corridor (just now).

Notice that the analysis presented here says nothing directly about of definite associates having to be 'hearer new' (Ward and Birner 1995). As with indefinite associates, such an interpretation results from the *process* by which the interpretation of the string is ultimately derived. By uttering *there be*, the speaker induces the hearer to construct a skeletal propositional tree as a promissory note for following information. The associate (and any coda) provide the requisite updating of this structure and, by virtue of the fact that a nominal update of a propositional structure is interpreted as some sort of focus (see Kempson, Kiaer and Cann to appear), the associate gets construed as new information, even though the definite form requires the hearer to process its content as old (given) information. Given a dynamic system, the discourse properties of these sentences do not have to be directly encoded, but derive from the parsing process itself. [45]

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[45] One of my referees suggests that the analysis of copular constructions presented above may be usefully compared to more familar theories of grammar. S/he constructs the tree below and suggests that there are a number of syntactic, semantic or pragmatic 'links' between the nodes on this tree. With respect to the theory presented in this paper (which differs slightly from the earlier version), these links would be specified as follows:

i. where *there* is in NP_1: there is a semantic link from NP_1 to NP_2 and where NP_2 is definite there is a pragmatic link from NP_1 to V_n

ii. where *there* is not in NP_1 or where NP_2 is indefinite, there is additionally a syntactic link from V_n (or I_n) to ADJ.

```
                    I
          ┌─────────┴─────────┐
        NP_1                  I'
                       ┌──────┴──────┐
                      I_n            VP
                       │        ┌────┴────┐
                      be      NP_2        V'
                                      ┌───┴───┐
                                     V'      ADJ
                                      │
                                     V_n
                                      │
                                      e
```

If this helps the reader understand my suggestions, then I am happy. But it should be stressed that the above is only a metaphor for the actual analysis provided here.

5   CONCLUSION

In this paper, I have presented an analysis of the English copular verb, *be*, that treats it uniformly as a one-place predicate with underspecified content. Within the framework of Dynamic Syntax, this underspecification is represented as the projection of a metavariable whose actual value must be derived pragmatically from the context in which the copular clause is uttered. This context involves both external and local linguistic content and the latter determines to a large degree whether the copular clause is interpreted as predicative or existential. It is also shown how the pragmatic process of substitution, within an overall Relevance Theoretic framework, can explain how different interpretations are given to different *there* clauses and why certain combinations of expressions are difficult to interpret. The processes specified for the analyses of the different constructions are needed elsewhere in the grammar and so do not constitute an ad hoc set of assumptions to account for constructions involving the copula. The success of this style of analysis supports the dynamic view of utterance interpretation and the need to move away from static models of autonomous syntax.

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