NON-CONSTITUENT COORDINATION: THEORY AND PRACTICE*

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ABSTRACT

Despite the large amount of theoretical work done on non-constituent coordination during the last two decades, many computational systems still treat coordination using adapted parsing strategies, in a similar fashion to the SYSCONJ system developed for ATNs. This paper reviews the theoretical literature, and shows why many of the theoretical accounts actually have worse coverage than accounts based on processing. Finally, it shows how processing accounts can be described formally and declaratively in terms of Dynamic Grammars.

INTRODUCTION

This paper is concerned with *symmetrical* coordination, where the order of the conjuncts (the items being coordinated by a conjunction such as *and* or *or*) can be altered without affecting acceptability. Coordination of this kind is traditionally split into *constituent coordination*, where each conjunct forms a constituent according to 'standard' phrase structure grammars, and *non-constituent coordination*. Constituent and non-constituent coordination have been treated as entirely separate phenomena (see van Oirsouw, 1987 for discussion), and different mechanisms have been proposed for each. However, by considering grammaticality judgements alone, there seems little justification for such a division. To illustrate this, consider the sentence:

1) John gave Mary some books

Each of the final proper substrings of the sentence (i.e. *some books*, *Mary some books* etc.) can be used as a conjunct e.g.

2) a John gave Mary [some books] and [some papers]
   b John gave [Mary some books] and [Peter some papers]
   c John [gave Mary some books] and [lent Peter some papers]

Similarly, each of the initial substrings can be used as a conjunct e.g.

3) a [John gave] and [Peter lent] Mary some books
   b [John gave Mary] and [Peter lent George] some books
   c [John gave Mary some] and [Peter lent George many] books

and so can each of the middle substrings e.g.

4) a John [gave Mary some] and [lent Peter many] books
   b John [gave Mary] and [lent Peter] many books
   c John gave [Mary some] and [Peter many] books

Only examples (2a) and (2c) are constituent coordinations. Example (3c) seems slightly unnatural, but it is much improved if we replace *books* by a heavier string such as *books about gardening*. Thus, for this example, any substring of the sentence[1] can form a viable conjunct.

DELETION ACCOUNTS

In the last twenty to thirty years there have been a series of accounts of coordination involving various deletion mechanisms (from e.g. Gleitman, 1965 to van Oirsouw, 1987). For example, from the following 'antecedent' sentence,

5) Sue gave Fred a book by Chomsky and Sue gave Peter a paper by Chomsky

van Oirsouw allows deletion of words to the left and to the right of the conjunction,

Sue gave Fred a book ~~by Chomsky~~ and
~~Sue gave~~ Peter a paper by Chomsky

resulting in the sentence:

6) Sue gave Fred a book and Peter a paper by Chomsky

Most deletion accounts assume that deletion is performed under identity of words, but don't analyse what it means for two words to be identical (an exception is van Oirsouw who discusses phonological, morphological and referential identity). Consider the following example of deletion.

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[1] The examples above only consider substrings containing more than one word. Coordination of the individual words (which is necessarily constituent coordination) is also possible. Natural examples involving the determiner, *some*, are difficult to achieve, however determiner coordination is possible (consider: *I didn't know whether to expect few or many people to come*).

7) John will drive and Mary built the drive
* [John will] and [Mary built the] drive

Here the two cases of *drive* are phonologically identical, but have different syntactic categories. Now consider:

8) a * John bored [the new hole] and [his fellow workers]
   b * Mary came in [a hurry] and [a taxi]

These are cases of 'zeugma' and are unacceptable except as jokes. It therefore seems that the deleted words must have the same major syntactic category, and the same lexical meaning.

However, even if we fix both syntactic category and lexical meaning, we still get some weird coordinations. For example, consider:

9) a * Sue saw$_i$ the man$_j$ [through the telescope]$_i$ and [with the troublesome kid]$_j$
   b *I saw [a friend of] and [the manufacturer of] Mary's handbag

In example (a) the two prepositions are attached differently, one to the verb *saw*, the other to the noun, *man*. In example (b), attributed to Paul Dekker, the two conjuncts require *Mary's handbag* to have a different syntactic structure: the bracketing appropriate for the first conjunct is *[[a friend of Mary]'s handbag]*. The unacceptability of these examples suggests that word by word identity is insufficient, and that deleted material must have identical syntactic structure, as well as identical lexical meanings.

Some of the most compelling arguments against deletion have been semantic. For example, Lakoff and Peters (1969) argued that deletion accounts are inappropriate for certain constituent coordinations such as:

10) John and Mary are alike

since the 'antecedent' sentence *John are alike and Mary are alike* is nonsensical (it is also ungrammatical if we consider number agreement).

However, semantically inappropriate or nonsensical 'antecedents' are also possible when we consider non-constituent coordination. For example, consider 'antecedents' for the following:

11) a [The man who buys] and [the woman who sells] rattlesnakes met outside
   b Many former [soldiers living in England] and [resistance members living in France] have similar memories
   c John sold different dealers [a vase using his intensive sales technique] and [a bookcase using his market-stall technique]

(11b) is non-constituent coordination under the primary reading where the scope of *former* does not contain *living in England* i.e. where the semantic bracketing is:

12) [[former soldiers] living in England]

Examples (a) and (b) could be expanded out at the NP level, but not at the S level. However (c) cannot be expanded out at any constituent level, whilst retaining an appropriate semantics. For example, expansion at the VP level gives:

13) John sold different dealers a vase using his intensive sales technique and different dealers a bookcase using his market-stall technique

Thus, although Lakoff and Peters' arguments count against standard deletion analyses, they do not count as general arguments against a unified treatment of constituent and non-constituent coordination.

SHARED STRUCTURE

Consider the sentence:

14) John gave Mary a book and Peter a paper by Chomsky

Instead of thinking of *John gave* and *by Chomsky* as deleted, we can also think of them as shared by the two conjuncts. This structure can be represented as follows:

	Mary a book	
John gave	*and*	by Chomsky
	Peter a paper	

From the result of the previous section, each conjunct must share not just the phonological material, but also the syntactic structure and the lexical meanings.

There are three main methods by which this sharing of structure can be achieved: phrasal coordination, 3-D coordination, and processing strategies.

PHRASAL COORDINATION

At first sight, analysing non-constituent coordination using phrasal (i.e. constituent) coordination seems nonsensical. This is not the case. Coordinations are classified as non-constituent coordination if the conjuncts fail to be constituents in a 'standard' phrase structure grammar. However, they may well be constituents in other grammars. For example, it has been argued that the weaker notion of constituency provided by Categorial Grammars is exactly what is required to allow all conjuncts to be treated as constituents (Steedman 1985).

Phrasal coordination is exemplified by the schema [2]:

$$X \rightarrow X \;\; \text{Conj} \;\; X$$

[2] There have been various arguments (stemming from Ross 1967) for the adoption of a variant of this schema, in which the coordinating conjunctions is associated solely with the last conjunct. The schema is revised as follows:

$$X \rightarrow X \;\; X[\text{Conj}]$$

$$X[\text{Conj}] \rightarrow \text{Conj} \; X$$

The shared material is necessarily treated identically for each conjunct since there is only a single copy: the conjunction is embedded in a single syntax tree.

The phrasal coordination schema requires each conjunct to be given a single type, and for the conjuncts and the conjunction as a whole to be of the same type. Problems with the latter requirement were pointed out by Sag et al. (1985), who gave the following counterexamples:

15) a We walked slowly and with great care
    b Pat is a Republican and proud of it
    c I am hoping to get an invitation and optimistic about my chances

Sag et al. deal with these examples by treating categories as feature bundles, and allowing coordination in cases where there are features in common. For example, the two conjuncts in (15a) share the feature +*MANNER*[3]. As it stands, the account does not deal with examples such as the following,

16) TNT deliver efficiently and on Sundays

Here the adverbial phrase would presumably be +*MANNER*, and the prepositional phrase, +*TEMP*. Further examples which are problematic for Sag et al. are given by Jorgensen and Abeillé, (1992).

An alternative, suggested by Morrill (1990) and similar to Jorgensen and Abeillé (1992), is to use the following coordination schema:

$$\mathrm{X{\vee}Y} \rightarrow \mathrm{X}\quad \mathrm{Conj}\quad \mathrm{Y}$$

This does not impose any condition that the two categories **X** and **Y** share anything in common. However, the new category **X∨Y** is used to ensure that both categories are appropriate in the context. For example, (15b) is acceptable since the coordination type is **NP∨AP**, and *is* subcategorises for both NPs and APs.

A rather more difficult problem is that of providing types for all possible conjuncts. Consider the following:

17) a Sue gave Fred a book and Peter a paper
    b Mary admires and Sue thinks she likes Peter

(a) is a conjunction of two pairs of noun phrases. (b) is a case of 'unbounded Right-Node Raising' where the noun phrase *Peter* is embedded at different depths in the two conjuncts.

There have been two main approaches to dealing with examples such as (a) using phrasal coordination. The first is to introduce an explicit product operator (e.g. Wood 1988), allowing types of the form **NP∗NP**. The second is to use a calculus in which types can undergo 'type-raising' (e.g. Dowty 1988), or can be formed by abstraction (as in the Lambek Calculus, Lambek 1958). The effect is to treat *Fred a book* as a verb phrase missing its verb.

[3]Sag et al. also suggest an alternative treatment using an apparently otherwise unmotivated grammar rule AdvP → PP.

The advantage of adopting a general abstraction mechanism, as in the Lambek Calculus, is that this also provides a treatment of examples such as (b). Unfortunately, the ability to perform abstraction of categories with functional types (which is required for (a)) also allows shared material to get different syntactic analyses, resulting in acceptance of all the sentences predicted by deletion accounts where identity of lexical categories and lexical semantics is respected, but not identity of syntactic structure. Reconsider:

18) *I saw [a friend of] and [the manufacturer of] Mary's handbag

We can obtain identical syntactic types for *a friend of* and *the manufacturer of* by subtracting the lexical types of *I*, *saw*, *Mary*, *'s*, and *handbag* from the sentence type S[4]. Since the types are identical, coordination can then take place. Thus the ability to 'subtract' one type from another allows the Lambek Calculus to replicate a deletion account, and it thereby suffers from the same problems.

There have been some proposals to restrict the Lambek Calculus in order to prevent such overgeneration. Barry and Pickering (1993) propose a calculus in which (17a) is dealt with using a product operation, and abstraction is limited to categories which do not act as a function in the derivation. This account makes reasonably good empirical predictions, though it does fail for the following examples:

19) a You can call me directly or after 3pm through my secretary
    b Sue put a lamp on the table, and on the ledge a large antique punchbowl

In (a), each conjunct contains different numbers of modifiers of different types (an adverbial phrase with two prepositional phrases). In (b) the subcategorisation order is swapped in the two conjuncts.

Successful treatment of non-constituent coordination using phrasal coordination seems to require elaborate encoding in the conjunct type of a simple generalisation: conjuncts can coordinate provided they are acceptable within the same syntactic context. The 3-D approaches and processing strategies use syntactic context more directly, and it is to these methods which we now turn.

3-D Coordination

Let us briefly reconsider our explanation of deletion. Example (6) was explained by saying that the two strings *by Chomsky* and *Sue gave* are deleted under some notion of identity. However, we could equally well have described this as a process whereby the first instance of *by Chomsky* is merged with the second (under some notion of identity), and the second instance of *Sue gave* is merged with the first.

[4]The type given to both conjuncts, using reasonably standard type assignments and 'Lambek' notation, would be: (((NP\((NP\S)/NP\S))/NP)/(NP\NP)/NP)/NP

Merging word strings instead of deleting them does not help with the problems of deletion accounts which we outlined earlier. In particular, it does not help to exclude examples (9a) and (9b) which suggest shared material must have identical syntactic structure. However, once we have started to think in terms of merging, there is an obvious next step, which is to move from merging of word strings to merging of syntax trees. This is the move made by Goodall (1987), who advocates treating coordination as a union of phrase markers: "a 'pasting together' one on top of the other of two trees, with any identical nodes merging together" (Goodall, 1987, p.20). We can visualise the result in terms of a three-dimensional tree structure, where the merged material is on one plane, and the syntax trees for each conjunct are on two other planes. For example, consider the 3-D tree for example (17a) given in Fig. 1.

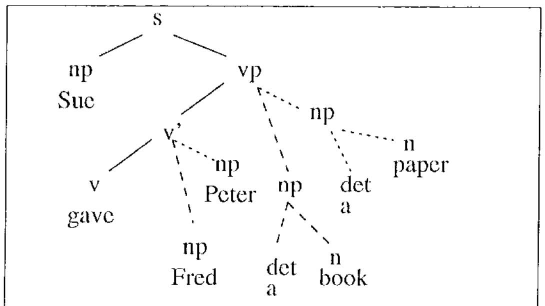

Fig. 1

The merged part of the tree includes all the nodes which dominate the shared material *Sue gave*. The conjuncts retain separate planes (denoted here by using dotted and dashed lines respectively).

Goodall's account does not deal with examples such as (17b), which he argues to be examples of a different phenomenon. However these can be incorporated into a 3-D account (e.g. Moltmann, 1992).

There are various technical difficulties with Goodall's account (see e.g. van Oirsouw, 1987, and Moltmann, 1992). There is also a fundamental problem concerning semantic interpretation of coordinated structures (see Moltmann, 1992 which provides a revised and more complex 3-D account based on Muadz, 1991).

For coordination of unlike categories, as in the examples in (15), Goodall proposes a treatment somewhat similar to Sag et al. (1985). However there is still a problem in dealing with examples where there are different numbers of modifiers, such as (19a) or the following:

20) a We can meet at the office or in London outside the theatre
b TNT deliver efficiently and after 5pm in Edinburgh

Consider example (b). The syntactic structure appropriate for *TNT deliver efficiently* has one S node and two VP nodes. However, the structure for *TNT deliver after 5pm in Edinburgh* requires one S node and three VP nodes (or three S nodes and one VP node). The two structures therefore fail to merge since the structure dominating the shared material *TNT deliver* must be identical. The use of ordered phrase structure trees also excludes examples such as (19b).

In summary, the 3-D approaches correctly enforce identity of syntactic structure for shared material. However, the way of characterising syntactic structure using (parts of) standard phrase structure trees results in an overly strict requirement of parallelism between the conjuncts. We will now consider processing strategies, where syntactic structure of shared material is characterised more indirectly by the state of the parser.

PROCESSING STRATEGIES

There have been several attempts to treat coordination by adapting pre-existing parsing strategies. For example, ATNs were adapted by Woods (1973), DCGs by Dahl and McCord (1983), and chart parsers by Haugeneder (1992). Woods and Dahl & McCord's system are similar. Haugeneder's system has very limited coverage.

In Wood's SYSCONJ system, the parser can back up to various points in the history of the parse, and parse the second conjunct according to the configuration found. For example, in parsing,

21) John gave some books to Peter and some papers to George

at the point after encountering *and*, the parser can reaccess the configuration after parsing *John gave* i.e. a stack consisting of a sentence and a verb-phrase, and an arc traversal by the verb. The second conjunct is then parsed according to this configuration.

SYSCONJ does not immediately merge the two stack configurations after completing the second conjunct, but, instead, separately parses both conjuncts in parallel until a constituent is completed. For example, on parsing the sentence,

22) John gave Mary a book and Peter a paper about subjacency

the SYSCONJ system separately parses *Peter a paper about subjacency* and *Mary a book about subjacency* before conjoining at the level of some enclosing constituent (for example the verb phase). The result is therefore similar to starting with the sentence:

23) John gave Mary a book about subjacency and gave Peter a paper about subjacency

As noted by Dahl and McCord, this mechanism means that SYSCONJ inherits the problems of nonsensical semantics which plague the deletion accounts, since *John and Mary are alike* is treated the same as *John are alike and Mary are alike*. The mechanism also causes problems for dealing with nested coordination.

Consider the sentence:

24) John wanted to study medicine when he was eleven, law when he was twelve, and to study nothing at all when he was eighteen

The smallest constituent containing *to study medicine when he was eleven* is the verb phase *wanted to study medicine when he was eleven*. However, if coordination of the first two conjuncts occurs at this level, it is difficult to see how to deal with the final conjunct.

Both Woods and Dahl & McCord use stack based configurations rather than a full parsing history. Thus once something is popped off the stack its internal structure cannot be accessed by the coordination routine. This rules out examples such as the following,

25) John gave some books to Mary and papers to George

where the NP, *some books* is completed prior to the conjunction being reached.

Although processing accounts can provide reasonable coverage of the coordination data, the exact predictions often require detailed examination of the code. This suggests a need for the more abstract level of description which dynamic grammars provide.

DYNAMIC GRAMMARS

Dynamics is just the study of states and transitions between states. It can be used to specify the states of a left to right parser and the possible mappings between states. For example, Milward (1992b) provides a dynamic description of a shift reduce parser, and a dynamic description of a fully incremental parser based on dependency grammar. Suitable languages for dynamics are both formal and declarative, and are therefore also appropriate to express linguistic generalisations.

In a Dynamic Grammar (Milward 1992b), each word is regarded as an action which performs some change in the syntactic and semantic context. For example, a parse of the sentence *John likes Mary* becomes a mapping between an initial state, c_i, through some intermediate states, c_a, c_b to a final state c_f i.e.

$$c_i \overset{John}{\mapsto} c_a \overset{likes}{\mapsto} c_b \overset{Mary}{\mapsto} c_f$$

If we use a dynamic grammar to describe a shift reduce parser, states encode the current stack configuration, and are related by rules which correspond to shifting and reducing [5]. Since there are arbitrarily large numbers of different stack configurations (the stack can be of arbitrary size), the dynamics for shift reduce parsing involves the use of an infinite number of states. It thus differs from, say ATNs (Woods 1973), which have a finite number of states, augmented by an explicit recursion mechanism.

Dynamic grammars can be presented as rewrite grammars by using *transition types* instead of the more usual S or NP. For example, to get the parse above we need the lexical entries:[6]

John:$c_i \mapsto c_a$ likes:$c_a \mapsto c_b$ Mary:$c_b \mapsto c_f$

and a single combination rule schema which states that,

For any C1, C2, C3,

$$C1 \mapsto C3 \quad \to \quad C1 \mapsto C2 \quad C2 \mapsto C3$$

A string of words is a sentence if it has the type,

$$c_i \mapsto c_f$$

where c_i and c_f are appropriate initial and final states for a parse[7].

In a dynamic grammar, any substring of a sentence can be assigned a type. For example, *likes* and *Mary* can be combined to get the type $c_a \mapsto c_f$. Thus we have an appropriate level to perform substring coordination. Dynamic grammars may be extended using the following combination rule (*and* and *or* are both given the special transition type **CONJ**):

For any C1, C2,

$$C1 \mapsto C2 \quad \to \quad C1 \mapsto C2 \quad \text{CONJ} \quad C1 \mapsto C2$$

Similar to SYSCONJ, this allows coordination when two conjuncts map between the same pairs of states. Processing is also similar, with the encountering of a conjunction causing back-up to an earlier stage in the parsing history. However, since there is no popping of a stack, the full parsing history is available[8]. For example, *Ben gave some books to Sue* has the transitions:

$$c_i \overset{Ben}{\to} c_k \overset{gave}{\to} c_l \overset{some}{\to} c_m \overset{books}{\to} c_n \overset{to}{\to} c_o \overset{Sue}{\to} c_f$$

we can then parse *papers to Joe* using the transitions:

$$c_m \overset{papers}{\to} c_n \overset{to}{\to} c_o \overset{Joe}{\to} c_f$$

Since the final state c_f matches the state immediately before the conjunction, the two strings can combine. The resulting transition diagram is as follows:

$$c_i \overset{Ben}{\to} c_k \overset{gave}{\to} c_l \overset{some}{\to} c_m \xrightarrow{\text{books to Sue and papers to Joe}} c_f$$

[5] Shift corresponds to: L $\mapsto$ <X> •L on input of a word, W, where L is a variable standing for a list of categories, '•' is list concatenation, and X is the category for W. Reduce corresponds to <C_n ... C_1> •L $\mapsto$ <C_0> •L on empty input, where $C_0 \to C_1 \ldots C_n$ is a phrase structure rule of the grammar.

[6] For example, for the shift reduce parser, the word *John* would get the type, L $\mapsto$ <np> •L, corresponding to a shifting of the NP onto the stack. The empty string gets the type, <C_n ... C_1> •L $\mapsto$ <C_0> •L where $C_0 \to C_1 \ldots C_n$ is a rule of the grammar, corresponding to reduction.

[7] For the shift reduce parser, the initial state is the empty list, <>, the final state is <s>.

[8] Something parallel to popping occurs only after a coordination. However this is exactly what is required since we do not want overlapping coordination as in *The girl and the or the boy and the adult came.*

Iterated coordination (e.g. for examples such as *Mary, Peter and Sue*) can be treated in the same way as iterated constituent coordination is treated in phrase structure grammars. For example, each transition type can be augmented with a feature (+/-) denoting whether or not that transition has been iterated. The coordination rule becomes:

For any C1, C2,

$C1 \mapsto^{-} C2 \quad \rightarrow \quad C1 \mapsto^{+/-} C2 \quad \text{CONJ} \quad C1 \mapsto^{-} C2$

Iterated types are formed as follows:

For any C1, C2,

$C1 \mapsto^{+} C2 \quad \rightarrow \quad C1 \mapsto^{+/-} C2 \quad C1 \mapsto^{-} C2$

The precise grammaticality predictions made by the dynamic approach depend upon the characterisation of the states, and hence depend on the particular parsing strategy which is specified by the dynamics. However there are some general predictions which can be made. Firstly, consider conjuncts which correspond one to one in the categories of the corresponding words. Here the conjuncts must provide the same transitions, and hence must be able to coordinate (this is a reflection of the fact that processing can back up to any point in the parsing history). This predicts that any substring of a sentence can coordinate with itself, and hence that any substring of a sentence can act as a conjunct. For convenience we will call this the *substring hypothesis*. This hypothesis has been broadly adopted in the work of van Oirsouw 1987, Barry and Pickering 1993, and by work on the Lambek Calculus (e.g. Moortgat 1988).

Apparent counterexamples are as follows:

26) a * The woman spoke to George and man to Peter
    b * John told [Mary Bill] and [Fred Sue] was coming (Barry and Pickering 1993)

However it is difficult to exclude these using syntactic constraints, without also excluding the more acceptable:

27) a Every woman spoke to George and man spoke to Peter
    b John told the mothers that their daughters and the fathers that their sons were all at the party[9]

More natural examples where conjuncts are formed by fragments from different constituents are the following:

28) a The police found some [cars inside] and [lorries outside] the warehouse
    b Everyone who I [admire most came] and [admire least stayed away]
    c Mary showed many [friends the weird books] and [colleagues the more respectable papers] written by her mother

The relative unacceptability of the examples in (26) is perhaps best explained as due to violations of intonational requirements, rather than syntactic requirements (cf. Steedman, 1989).

One case where the dynamic grammars correctly violate the substring hypothesis is when a string already involves a coordination. Here, the internal states are not accessible, so we can't get interleaving of two coordinations, as in:

29) * The girl and the or the boy and the adult came

There may be an argument for similarly blocking coordination in cases which would involve the breaking apart of idioms or other structures which are not standard cases of lexical subcategorisation. An example (due to Mark Steedman), which may be such a case, is the following,

30) * One man in [ten spoke against and twenty actually protested]

As noted above, the precise grammaticality predictions depend on the kind of parsing model which is encoded in the states. In Milward (1992a), the dynamics specifies a word-by-word incremental parser for a lexicalised version of dependency grammar. Each state is a recursively defined category, similar to a category in Categorial Grammar. For example, after parsing *You can call me* one possible state is a sentence missing a sentence modifier[10]. This state is appropriate as the initial state for a parse of both *directly*, or of *after 3pm through my secretary*, resulting in a final state of category sentence. Thus examples such as (19a) are dealt with, since the syntactic context after *You can call me* does not distinguish between one or more than one subsequent modifier. This lack of distinction as to whether one or more modifier is expected is actually a necessary prerequisite for performing decidable fully word-by-word incremental interpretation (see Milward and Cooper, 1994, in these proceedings).

Some of the problems with categorial grammar accounts of coordination do reoccur with a dynamic account based on the parser used in Milward (1992a). For example,

31) [John] and [Mary thought that Peter] slept

is predicted to be acceptable, as are the following,

32) a [Today John] and [Mary thought that Peter] slept
    b I heard [that] and [that no-one else knew that] Fred won the scholarship

This second batch of examples is particularly difficult to exclude without making changes to the characterisation of the states. A feature plus or minus tensed verb on each conjunct does block them, but is difficult to motivate.

Dynamic grammars can be regarded purely as formal systems, as direct representations of processing, or as something inbetween (for example, in the packed

[9] This example is attributed by Barry and Pickering (1993) to Janne Johannessen.

[10] Dependency grammar does not have VP modifiers

parallel parser described in Milward (1992b), the actual parsing states are packed versions of the states in the grammar). If we consider the dynamics to be a direct representation of processing, then a dependence of linguistic data upon parsing states would only seem plausible if the parsing process corresponds, at least to some extent, with actual human language processing. This brings up the intriguing possibility that we can predict coordination facts from known processing data, and vice versa. For example, consider the well known example of garden pathing:

33) The horse raced past the barn fell

The choice between the use of *raced* as the main verb, or as part of the reduced relative is usually assumed to be within the fragment *the horse raced*, suggesting that there are two distinguished parsing states after *raced*. Thus this correctly predicts the unacceptability of the following:

34) * The horse raced [past the barn fell] and [beside the hedge]

CONCLUSION

This paper has sketched various problems with some of the linguistic accounts of coordination. It suggested that this was primarily due to difficulty in encoding a proper notion of syntactic context. The paper then considered various processing accounts, where the syntactic context is encoded within the state of the parser. Finally it showed how dynamics can be used as a formal description of processing accounts which use a full parsing history, and how the characterisations of parsing states can be chosen to enforce the requisite degree of parallelism between conjuncts.

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