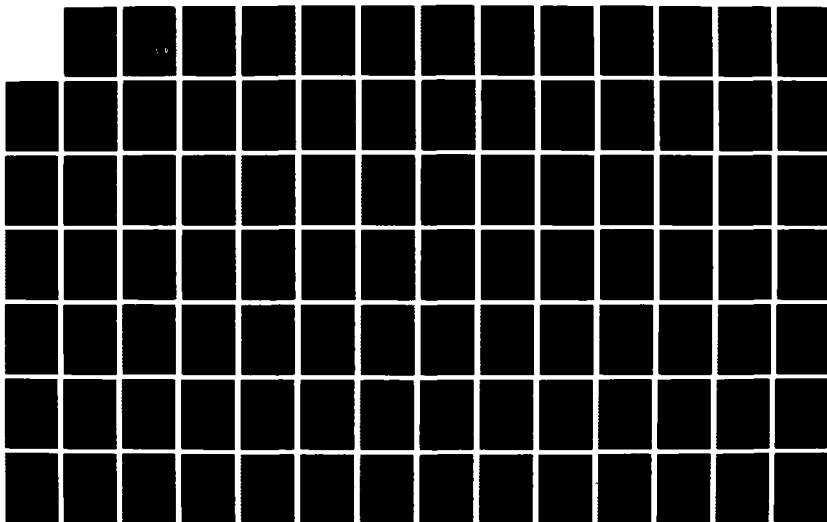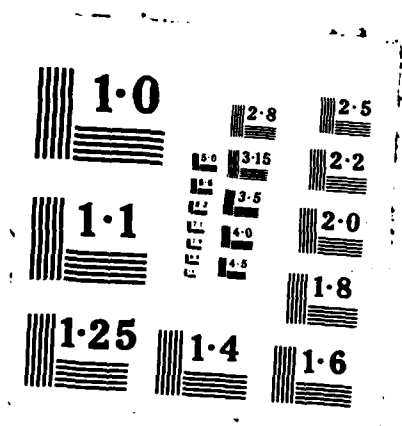AD-A188 907   THE LINGUISTIC DISCOURSE MODEL: TOWARDS A FORMAL THEORY   1/2
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The Linguistic Discourse Model: Towards a Formal Theory of Discourse Structure

L. Polanyi

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This paper reports on the development of a computational linguistic theory of discourse structure. The Linguistic Discourse Model (LDM) is a comprehensive theory of the structural, semantic and pragmatic relations obtaining among clauses in a discourse which has as its goal to account for how a semantic and pragmatic interpretation of a discourse may be built up from its constituent clauses on a left to right, clause by clause basis.

The Model consists of a set of discourse grammars which specify the constituent
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20 Abstract (cont'd.)

structure of possible linguistically and socially significant discourse units including "plans", "lists", "elaborations", "stories", "narratives", "conversations", "planning sessions", "doctor/patient interactions" etc. A set of recursive rules of discourse formation specifies how units may relate to one another and a set of semantic interpretation rules assigns a semantic and pragmatic interpretation to each clause and to the emerging discourse. Under the LDM analysis, discourse is shown to have a hierarchical structure: units which interrupt the forward development of units already begun are uniformly analyzed as embedded relative to those units.

   The basic unit of discourse formation is the discourse constituent unit (dcu). For the purpose of joining with other clauses to create complex discourses, each clasue is a one constituent elemental dcu. Discourse is constructed from individual clausal dcu's through recursive processes of sequencing and embedding. There are three types of semantically related dcu's: list structures (including narratives composed of chronologically ordered event clauses), expansion structures (in which one unit gives more detail about some aspect of a preceding unit) and binary structures such as and/or/but and if/then relations in which there is a logical connective connecting the constituents. Each dcu is associated with a semantic frame containing information relevant to the unit's syntactic and semantic properties expressed in terms of semantic values. The process of dcu's combining with other dcu's in list, elaboration or binary structures is a process of computations on these values creating new dcu structures representing the combined properties of the compositionally developing discourse unit. The LDM recognizes a hierarchy of discourse unit types. These higher level units, such as Discourse Units (including stories, arguments, descriptions), Speech Events such as doctor/patient interactions, conversations, lectures etc. and Interactions defined in terms of Kaplan Contexts of person, time, and real world spatial location provide Contexts of Interpretation for the semantic frame of each dcu. Dcu's must participate in the same Interaction, Speech Event and Discourse Unit in order to be coordinated to one another in list structures. These interpretive contexts are treated as indices on the semantic frame associated with the individual dcu.

   The LDM provides an account of the coherence relations in texts by means of explicit mechanisms for computing the semantic and structural congruence of strings of clauses. Simultaneously, it provides an account of the complexities of interrupted or highly attenuated discourse by providing a uniform treatment of all phenomena which can interrupt the completion of an ongoing discourse unit: elaborations on a point just made, digressions, flashbacks in narratives, or true interruptions of one Speech Event or Interaction by another are treated as subordinated or embedded relative to the activities whose completion they delay. Under an LDM analysis, discourse is shown to have a hierarchical tree structure. Discourse parsing is treated as the construction on a clause by clause basis of a Discourse History Parse Tree. All nodes in the Tree are labelled with the semantic and context value information of the discourse units which they dominate. Only the rightmost nodes of the Tree are structurally available for dcu attachment. Formal Tree climbing and Tree building rules involving computations on the values of the input dcu and available nodes determine how the attachment takes place.

   The LDM framework accounts both for the regularities of the discourse structures speakers interactively produce and for the ability of language users

20 Abstract (cont'd)

to "know where they are in the talk" despite the many incoherencies discourse
exhibit. The LDM resolves an apparently insoluable conflict in discourse
analysis: accounting simultaneously for the highly individual and often
"incoherent" nature of discourse (arising in part from the possibility that
any given utterance may be said at any time) while simultaneously accounting
for the fact that speakers are normally quite clear about the kind of
discourse activities underway at any given moment and reliably produce socially
appropriate "next" utterances and competently recover correct interpretations
of spatial, temporal and participant reference from under specified anaphoric
and deictic elements.

In the paper, the descriptive and explanatory power of the theory is demon-
strated with reference to numerous examples. Special attention is paid to
the "narrative".

Under an LDM analysis, narratives are characterized as sequential List
structures in which each element is an Event Clause assigned a temporal
interpretation at a discrete instant in time (t) in some possible world W.
The argument is made that apparent violations of the Strong Narrative
Constraint which requires "event clauses" encoding instantaneous, non-iterative,
non-habitual propositions in syntactically main clauses act to advance the
temporal referent point in narrative discourse forward along a time line can
be explained in terms of embedded discourse structures which interrupt the
development of an ongoing narrative unit and intersperse clauses to be
interpreted relative to other timelines in other Worlds. Repair sequences,
interruptions, asides and Flashbacks and flashaheads are thus treated as
discourse structures embedded relative to the mainline Narrative List. Correct
assignment of temporal interpretation thus becomes possible.

Report No. 6409

THE LINGUISTIC DISCOURSE MODEL:
TOWARDS A FORMAL THEORY OF DISCOURSE STRUCTURE

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TABLE OF CONTENTS

1. INTRODUCTION

Despite the apparent disfluency and disorganization of everyday talk, speakers all but flawlessly recover anaphoric references, interpret temporal and spatial deictic expressions and use language to shape utterances which demonstrate a clear and recoverable relationship to "the business at hand" in the talk and the contextualizing social setting. In the following paper, we shall present a comprehensive formal model of discourse structure, the *Linguistic Discourse Model*, the *LDM*, which provides a uniform account of how speakers accomplish these tasks in constructing and understanding both maximally coherent and highly attenuated discourse.

The LDM is both a competence model of linguistic structure above the sentence level and a performance model. In the present paper, we shall describe the linguistic discourse structuring resources and conventions available to speakers in carrying out communicative and interactional tasks and demonstrate how these resources are used in actual talk to create the complex discourses which speakers routinely produce and interpret. In our view, providing an adequate account of discourse structural relations is the first step towards what we believe to be the eventual goal of formal work in discourse understanding -- the development of a system capable of assigning a proper semantic interpretation to every clause in a discourse

2. THE LINGUISTIC DISCOURSE MODEL: A FORMAL THEORY OF DISCOURSE STRUCTURE AND SEMANTICS

The Linguistic Discourse Model is a comprehensive theory of the structural and semantic relations obtaining among clauses in discourse. The LDM integrates into one coherent framework the understanding into discourse organization which has emerged during the past decade from work done on discourse structure within theoretical linguistics [42], [37], [11], [18], [39] [38], Artificial Intelligence [14], [61], [25], [44], Anthropology [33], [2] and Sociology [9], [67], [69], [71], [1]. In designing the LDM we have built especially on the insights emerging from the seminal work done by Linde [40] and Grosz [13] in which it was demonstrated that for some genres of highly constrained natural discourse, the relationships between significant semantic entities in the text mirrored the hierarchical organization of the object being modelled.

In her early work on Task Oriented Dialog, Grosz demonstrated that the talk between an expert giving an apprentice advice about how to dismantle a water pump could be represented in the form of an outline or Tree in which the relationships among chunks of clauses replicated the goal/sub-goal structure of the original task Not altog ..er surprisingly, a flowchart of the task could be predictive for the order of mention of task related topics. What was surprising. however, was that the choice of possible referents for pronouns in the text reflected the structure of the task as well. Not only could one refer to an object being manipulated in a particular sub-task with a pronoun, but one could use a pronoun to refer as well to a larger object of which the manipulated object was a part. The pump as a whole was also available for pronomial reference However, pronouns could not be used to refer to objects involved in already completed subtasks. [13]

Similarly, Linde, in her investigation of apartment layout descriptions found that

such spontaneously created texts displayed an astonishingly consistent structure.
Speakers consistently reported spatial layouts as imaginary tree shaped journeys
through their apartments. [40] Speakers displayed regularities in their use of *it* and
that to refer to rooms as well. *It* was reserved for rooms currently in an available
position in the Tree of the corresponding to the apartment layout. [41]. In the Tree
structures which correspond to both the apartment description and the water pump
task, therefore, speakers were apparently operating in terms of a discourse convention
which blocks reference to an element to the left of the branch of the Task-Tree
currently being developed.

The LDM represents a generalization to all discourse of the insights into the
nature of discourse structure developed by Grosz and Linde for specialized task
domains. We maintain that all discourse displays a hierarchical structure which
emerges from the structural and semantic relationships obtaining among the linguistic
units which speakers use to build up their discourses.

The LDM framework assumes that discourse structure can be represented as the
recursive sequencing and embedding of discourse units of various types. Both
semantically related and semantically unrelated juxtaposed elements are handled by
the current theory which provides for construction of Discourse Parse Tree on a left
to right, clause by clause basis relying on a set of grammars of possible discourse
constituents and a limited set of possible structural and semantic relations to guide
the Tree building process.

In the discussion below, we shall provide an overview of the LDM framework and
shall demonstrate how the theoretical constructs and formal machinery associated with
the Model accounts for the segmentation into linguistically and socially significant
units of both maximally coherent written discourse and highly attenuated

interactionally constructed natural spoken discourse. In order to demonstrate the necessity of an adequate discourse parse algorithm to discourse understanding, we shall present a uniform solution to the problems natural discourse poses for recovery of temporal reference points for narrative discourse. In the concluding section, we shall suggest how competent speakers may manipulate the resources of discourse structuring captured by the LDM to accomplish complex strategic interactional tasks.

2.0.1 Overview of The Linguistic Discourse Model

The *Linguistic Discourse Model* (LDM) is a formal theory of discourse syntactic and semantic structure which takes as its goal accounting for how a semantic and pragmatic interpretation of any discourse may be incrementally built up from its constituent clauses.

The Model consists of a *set of discourse grammars* which specify the constituents of *possible discourse units, a set of recursive rules of discourse formation* which specify how units may relate to one another, and a *set of semantic interpretation rules* which assign a semantic and pragmatic interpretation to each clause and to the discourse as a whole.

Each discourse is viewed as composed of *discourse units* which can be of many different types: *jokes, stories, plans, question/answer sequences, lists, narratives*[3] , as well as *Speech Events* such as *doctor/patient interactions* and *casual conversations.* In the LDM every possible discourse unit type is associated with its own grammar — which specifies its characteristic constituent structure and is interpreted according to

---

[3]Temporally ordered lists.

specific rules of semantic interpretation.[4]

The basic unit of discourse formation is the *discourse constituent unit*. For the purpose of joining with other clauses to create a complex discourse, each clause is considered a one clause, elemental discourse constituent unit *(dcu)*. Dcu's are of four types: (1) *list structures* (including *narratives*, which are, linguistically speaking, sequentially ordered lists of events), (2) *expansion structures*, in which one unit gives more detail of some sort about some aspect of a preceding unit, (3) *binary structures* such as if/then, and/or/but relations in which there is a logical connective connecting the constituents, and (4) semantically unrelated *interruption units*. (Section X) **Discourse surface structure is constructed through recursive sequencing and embedding of dcu's.**

Discourse "genre" units (DU's) such as *stories* and *descriptions, arguments* and *plans* are composed of dcu's which encode the propositions, which taken together and properly interpreted, communicate elaborate semantic structures. Conversational Interactional Structures such as *question/answer pairs* and *compliment/response sequences* are characterized as *Discourse Adjacency Units*. Speakers make use of Discourse Adjacency Units in talk to accomplish specific interactive tasks. [70] DU's of both types display highly conventional constituent orderings.

Dcu's and DU's in their turn, are the means of realization of the information exchange which is so basic in *Speech Events*. [32] [33] Speech Events, in their turn, are constituents of *Interactions* which may be made up of one or more Speech Events (or may even consist of completely silent states of mutually recognized potential speech situations). [10]

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[4]See Appendix B for primitive approximation of discourse grammars corresponding to various discourse types.

Units of discourse structure are augmented with a semantic representation: all clauses making up a given discourse unit encode propositions which have interpretation in the same *world of interpretation* The semantic representation is a formal construct with no pretense of psychological reality. We shall assume a simple model theoretic construct detailing the states of affairs obtaining in a given world (or set of worlds) modelled by a discourse unit.

The LDM provides an account of the coherence relations in texts by means of an explicit mechanism for computing the semantic congruence and structural appropriateness of strings of clauses. This *context frame* represents the meaning and contexts of interpretation of every dcu in the form of a *semantic case frame* with *slots* for dcu temporal, spatial, activity, and participant information modified by *indices* indicating the Interaction, Speech event, DU and higher level dcu's (if any) which constitute the context of interpretation of the dcu. [55] [23] Each incoming discourse constituent unit has an associated context frame as does every dcu formed through coordination or subordination. Making use of the information in these frames and the grammars describing the structure of the various units in the discourse, the LDM, acting from left to right, incrementally constructs a Discourse Parse Tree by matching the parameter values of an incoming unit, against the values of units located at the open node, making use of world knowledge and inference to drive the semantic process.

The LDM provides an account of the complexities of interrupted or highly attenuated discourse by providing a uniform treatment of all phenomena which can interrupt the completion of an ongoing discourse unit: elaborations on a point just made, digressions to discuss something else, or true interruptions of one Speech Event by another or one ongoing Interaction by another one. All treated as *subordinated* or

embedded relative to activities which continue the development of an ongoing unit – whether it be a "story", a proposal for a course of action in a hypothetical world or a Speech Event such as a Planning Session.

The structure which results from the recursive embedding and sequencing of discourse units to one another has the form of a *Tree*. This *Discourse Parse Tree (DPT)* contains, for any moment in the discourse, a record of which units of what types have been completed, and which unit, having been interrupted *before* completion, remain to be completed.

Tree attachment is accomplished by a procedure of computing semantic congruence between the incoming unit and the semantic values of existing or possible open nodes in the existing tree. Assessing congruence is accomplished through computations involving degree of similarity and difference obtaining between concepts, , expresses as set inclusion and exclusion relations obtaining between semantic parameters deriving from the structure and content of the "context frames" associated with every node in the tree.

It should be emphasized that we are making a very strong claim about the structure of discourse by our claim that we can model it as a tree, or, even by an immediate precedence dominance structure of which a tree is the strongest form.

The restriction that we can only attach constituent at structurally–accessible levels in the tree and that structurally–accessible positions are only those rightmost nodes immediately dominating the last constituent parsed, means that there are positions in the tree which are inaccessible, unavailable for clause attachment. What this means, in fact, is that one cannot return to the construction of all units in the previously parsed discourse. Returns are only permitted to those units which are still

structurally accessible: not yet closed off by a discourse POP, or by the attachment of any unit to their right at an equivalent or higher level in the discourse tree. This restriction permits predictions to be made about the encoding forms of incoming propositions. Any attempt to add propositions to a closed unit will be accompanied by intonational repair or initiation signals and will receive a syntactic encoding as a new rather than a resumed unit. (Unstressed pronouns will not be used in topic position, for example.)[5]

2.1 The Complexity of Everyday Discourse: An Example

In order to illustrate the complexity of natural talk which necessitates the development of such a complex framework, let us take the following example modified from a corpus of Spatial Planning dialogues. There are five people involved: two primary speakers, A and B, who are jointly planning a journey in Europe in connection with a trip simulation in an experimental setting. C and D are researchers conducting the experiment and E is a secretary who came by.

---

[5]Grosz and Sidner also endorse this position [16].

Planning Discourse A

A.   We are in Spain, o.k. So, let's go to France next. I love
     France anyway. We had a great time there last year. and then
     Italy did I tell you about the little restaurant we went to in
     Florence?

B.   Yeah, I think you did. It was better than the place in Rome
     we ate at before we took the plane. But, anyway, no. Let's go
     to Belgium next. Then

C.   Could you move closer to the camera, please.

D.   You're out of range

A.   O.K. yeah. But not if we have to go through Antwerp

B.   Then Holland

A.   When do we do Italy then? We can't miss it?

B.   On the way back to

E.   Sorry. I was looking for Dave

C.   He's not here. We're running an experiment I'll talk to you
     later. You are still out of camera range, by the way

A.   Good

B.   Anyway. I saw the tulips last year. What about Italy?

A.   On the way back to Spain. You taking a vacation this year?
     Or loafing at work as usual?

B.   Haven't decided, you?

A.   Might go to Spain again. Then Germany's next, right?

Intuitively, competent language users would segment this discourse into sections

where A and B are planning -- actually developing their plan--and other sections

where they are commenting on places they have been, making small talk, or conversing

with the researchers. In one exchange, neither A nor B are talking at all, but are

listening in while C exchanges some quick words with the secretary who is looking for

someone who is not there. In order to make it somewhat easier to find the"planning",

we have arranged the text graphically as an outline, showing the"planning talk" in

leftmost position and moving further to the right to represent the embedded or

secondary status of the comments and other interruptions to the development of the

plan. It should be noted than when "other types of talk" are completed, A and B

return to developing their plan which is the focus of their attention throughout this

excerpt.

Planning Discourse B

A. We are in Spain, o.k.
    So, let's go to France next.
        I love France anyway.
            We had a great time there last year.
   and then Italy
        did I tell you about the little restaurant we
        went to in Florence?

B. Yeah.
           I think you did.
        It was better than the place in Rome we ate at
        before we took the plane..
  (But, anyway, no.)
 Let's go to Belgium next.
 Then

C. Could you move closer to the camera, please.

D. You're out of range

A. O.K. yeah.
    But not if we have to go through Antwerp

B. Then Holland.

A. When do we do Italy then?
      We can't miss it?

B. On the way back to

E. Sorry.
      I was looking for Dave

C. He's not here.
        We're running an experiment
          I'll talk to you later
            You are still out of camera range, by the way

B. (Anyway.)
      I saw the tulips last year.
  What about Italy?

A. On the way back to Spain.
    You taking a vacation this year?
    Or loafing at work as usual?

B. Haven't decided, you?

A. Might go to Spain for a few days.
    Then Germany's next, right?

Although this outlining procedure may make it easier to see at a glance which clauses encode propositions which can be interpreted as "proposals" relating the sequence of actions to be taken in some future time "Plan Execution World", not all leftmost clauses represent proposals which were taken into the final plan decided upon. Some proposals were made and then accepted -- like A's suggestion to visit "France" after "Spain" which was accepted by B without comment -- while other suggestions, such as A's next proposal to visit "Italy" next, were not accepted and were not included in the final agreed upon plan.

The plan finally agreed upon, consists ' a hypothetical itinerary which would take A and B, in their projected roles as travellers in the Game World to.

Spain, France, Belgium , Holland, Germany ... (Italy) (Spain)

in this sequence. It is important to notice how many different parameters must be kept track of in order to recover this itinerary.

- o Temporal reference points must be maintained and, if necessary, updated (To understand *when* in conceptual time an event would take place.)

- o Spatial reference points must be maintained and, if necessary, updated (To understand the speaker's orientation in conceptual space)

- o The identity of the speaker and hearer must be available (To be able to recover the intended referents of *I* and *You*)

- o The specific "world" in which events are to take place (or have taken place) must be known (In order to interpret a spatial location or temporal reference point in the "Game" world or in the "real" world. i.e. A is planning to vacation in *Spain* "this year" in the "real" world, A had a great time in *France* "last year" in the "real" world. "A"and "B" tokens in the "Game" world are in *Spain* and "planning a trip" from *Spain* to *France, Belgium* etc.)

In addition, it must be pointed out that correctly interpreting this discourse involves understanding the form and function of a number of linguistic and rhetorical structures, including:

o Narrative syntax–mechanisms, encoding update of temporal and spatial reference points

o Sentential syntax and semantics

o Question/answer sequences

o Discourse "operators" such as *o.k.*, *yes, no, well, anyway*

In order to understand exactly how a plan was created through the joint interaction of two or more planners, analytic machinery is necessary to abstract out a coherent semantic structure from the complexity of discourse surface structure. The Linguistic Discourse Model provides much of that machinery. Later in the paper we shall return to consider in some detail the plan extraction problem presented by this example. At that time, we will show how the LDM acting as a discourse parser extracts the plan from the talk.

3. THE DISCOURSE CONSTITUENT UNIT: BUILDING BLOCK OF DISCOURSE

The LDM is presented as a discourse parser which segments discourse into linguistically and socially relevant units on a clause by clause basis by proceeding through the discourse, examining the syntactic encoding form of each clause, its propositional content, and its situation of utterance.

This involves the consideration of each clause as a discourse constituent unit (dcu) which plays a role in the developing discourse. Each clause is assigned its context of interpretation and integrated into developing the Discourse Parse Tree (DPT).

The discourse constituent unit is the linguistic unit of discourse formation. There are four types of Discourse Constituent Unit: the *Sequence*, the *Expansion Unit*, the *Binary Structure*, and the *Interruption*. Sequential and Expansion dcu's are extensional semantic objects composed of conjoinable dcu's all of which are interpreted relative to the same set of possible worlds.

Sequences construct a dcu out of arbitrarily may constituents of the same type, while *Expansions* construct a dcu from a clause and a subordinated unit which expands upon the content of it in some way. *Binary structures* construct a dcu out of two dcus joined by an explicit logical operator such as *and, because, or, if* or *then*. [42]. Interruptions are formed when one dcu is interrupted by interceding semantically unrelated material.

Dcus take dcus as constituents recursively forming increasingly complex dcus as the discourse develops by co-ordinating and subordinating dcus to dcus according to rules of dcu formation. We shall deal with those issues in detail below.

3.1 Elemental units of Linguistic Structure: The clause and the discourse operator

3.1.1 The Clause

Discourse are composed of dcu's in the LDM. Dcu's are formed from *clauses* the minimal proposition carrying unit of structure in the LDM model. Structurally, a clause consists of one or more words (or parts of words) joined together in a syntactically legal manner up to the level of what is conventionally thought of as a *complete clause*: many one word utterances are thus considered clauses, as are *hesitations, false starts* and other linguistic *noise*.

In addition to clauses, however, we have one other primitive structural category: the *discourse operator*.

3.1.2 Discourse Operators

Discourse operators do not themselves carry propositional information as a rule.[6] *Yes, uh, ok, but, because, well, so, if, then, therefore, hello, goodbye, now, or, what, why, and, anyway* and *John* (or any proper name used as a vocative) are all *discourse operators*. Five types of discourse operators have been identified so far: *assigners, Speech Act markers, logical operators, connectors* and *discourse PUSH/POP markers*. All five operator types modify the force of discourse constituents in some way, and may have scope over multiple clauses. [17] [51] [62] [72]

---

[6]Although in some rare cases clauses such as *So where were we?* may function as a discourse operator.

3.1.2.1 Assigners

Hello, as well as proper names used as vocatives are examples of *assigners*. Assigners operate at the interaction and Speech Event level signaling socially relevant material such as who is present in the Interaction and precisely whom is implicated by a subsequent (or previous) utterance or set of utterances Although it is somewhat unconventional to construe *hello*, for example, as having scope over an entire Interaction, it is clear that once signed on with a greeting, an individual is accorded the status of participant in the Interaction and is therefore a possible candidate for referent for an *I, you,* or inclusive *we* uttered in the talk. The candidacy of the signed on person changes when he or she signs off from the Interaction. This is often accomplished by means of the *goodbye* assigner operator.

3.1.2.2 Speech Act Markers

Assigners are related to *Speech Act markers* such as exclamations and WH–words which also perform a social function. Exclamations express the speaker's attitude towards another utterance or occurrence in the environment; while WH–words implicate the recipient of the utterance to produce an appropriate response which will complete the semantic interpretation of the questioned element. WH–words in their functioning are closely connected to logical operators, such as *yes, no, maybe, probably, absolutely* etc. which often function as suppletive utterances to WH clauses. The LDM parser treats logical operators, Speech Act markers, and a third and very crucial class of operators, *connectors*, as directions for the modification of the semantic representations of proposition encoding structures which it is building up.

3.1.2.3 Connectors

Connectors such as *and, or therefore, because* etc. are often used to connect individual clauses together. However they often have scope over much larger

stretches of discourse and can connect dcu's and DUs to individual clauses and to one
another. There are conjunctive connectors and subordinating connectors. *And*, for
example, is a conjunctive connector while *because* is a subordinator. It is very
common to find *because* used to subordinate an entire complex discourse structure
such as a story or description to a given single clause as in

```
I don't like John because last year after I came home
from camp and I had lost my canoe paddle in the homecoming race
he wouldn't let me borrow his even after I said to him "John," I
said "don't you remember how after school got out last fall you
wanted to play baseball and I lent you my glove?" and he said
...etc.
```

And may also have very wide discourse scope. [55]

3.1.2.4 Push And Pop Markers

The last type of discourse operator is the *Discourse PUSH/POP Markers*. These
operators signal the embedding, continuation and returns to and from discourse
constituents at the various levels. [62] [4] [51]

In terms of our description of discourse, PUSH and POP markers such as *o.k.*,
well, so, anyway as well as extralinguistic markers such as change in tone of voice,
gaze direction, etc. do almost exactly what their names suggest. A PUSH marker
signals the creation of a new embedded discourse constituent while a POP marker
signals a return to an embedding constituent (although not necessarily to the
immediately embedding one) closing off the current constituent and all the
intermediate ones.

3.1.3 Clauses and Operators

Therefore, while

    a) *I like John*

    b) *I like John a lot*

    c) *I like J*

    d) *I*

are all legal single units, (e)-(n) are all composed of two units -- either two clauses,

two operators, or a clause and an operator.

    e) *I like John. I like Harry more.*

    f) *I like John. He's a nice guy.*

    g) *I like John, Harry.*

    h) *I I like .*

    i) *(well) Do you like John?*

    j) *I like John. Stop that!* (Addressed to separate recipients.)

    k) *(o.k.) (anyway)*

    l) *(Yes) I do.*

    m) *Why don't you like John?* (Speaker 1) *He's not my type.* (Speaker 2)

    n) *I like John (because)*

The second unit is underlined in (e)-(n) while discourse operators are in

parentheses.)

    o) *I like John (because) he was nice to Aunt Mary.*

is a three unit structure consisting of two clauses joined by an operator.

We shall now examine the syntax of the sequential and expansion dcu types in

some detail. We shall provide both informal and formal descriptions of their

properties, a detailed discussion of several sub-types of each one, and discuss some of their more important implications for understanding discourse within the LDM framework.

3.2 Sequential dcu

The *sequential* dcu is a dcu formed through the conjoining of arbitrarily many constituent elements. All elements of sequential dcu's are considered co-ordinate to one another. The List topic chain and narrative are common types of sequential dcu structures.

3.2.1 Lists

The paradigmatic sequential structure is the *list*: a series of clauses C, ..., C_K, which have a semantic structure of the form $F(a_1) = v(_1)$, ..., $F(a_k) = v_k$, i.e., the clauses express propositions which convey the values which one function has for a series of alternative arguments. [25] [3] For instance, when asked to describe the interior of a room, someone may give an answer structured like this:

```
"When I come into the door, then I see,
  to the left of me on the wall, a large window (...).
  Eh, the wall across form me, there is a eh basket chair
  (...).
  On the right wall is a mm chair (...).
  In the middle of the room there is, from left to right,
  an oblong table, next to that a round table, and next
  to that a tall cabinet.

Now I think I got everything".[7]
```

The list here occurs embedded under the phase *I see*, and is closed off by the phrase *Now I think I got everything.*

_____

[7] (Transcript by Ehrich and Koster [7], translated from Dutch; the constituents left out, indicated by parenthesized dots, are subordinated constituents appended to the NP they follow).

Often, the successive arguments in a list are mentioned in a non—random order
—— in the above case, for instance, we first get the locations successively encountered
in a "glance tour" from left to right along the walls; then the rest. The LDM treats
constituents of a List dcu as co—*ordinated* relative to one another.

3.2.2 Simple Topic—Chain dcu's

A more specific sequential structure is the *topic chain* dcu, which is an
important device in creating coherent discourses where a series of distinct
predications about the same argument are listed. A topic chain consists of a series of
clauses $C_1,...,C_k$, with a semantic structure of the form $P_1(a),...,P_k(a)$, where "a"
translates the topic NP's of the clauses.[8]

In the first clause of the chain, the topic is expressed by a phrase (either a full
NP or a pronoun) which occurs in subject position or as a preposed constituent. In
the other clauses, it is usually a pronoun, often in subject position.[9]

---

[8]We have chosen to use the Topic Chain as an example of a simple list dcu for didactic
reasons. We could as easily chosen a simple list structure involving multiple arguments on
one verbal element for example (a) or on properties of multiple referents (b):

(a) Running is fun.   (b) John is a nice guy.
    Running is good for you.   Harry is a little difficult.
    Running is America's newest sport.   Joe is very hard to handle.

[9]While we do acknowledge that there are serious theoretical and methodological problems
with the concept of "topic", we shall not engage the issue of what a sentence topic actually
is. We shall work with the informal description of a "topic" as a structural sentential or
clausal notion which refers to a semantic entity which the sentence or clause is to be taken
to be "about". [63]. We should like to point out, however, that linguists investigating
topic—chaining, switch reference, the trace of identity in discourse etc. will find that the
model of discourse structure sketched here provides a grasp on such hitherto slippery
notions as "already in the discourse", "new to the discourse", etc.   .

In the present framework, a dcu in which each clause expresses some predication of the same extensional entity encoded in the clause as clause topic is a Topic Chain dcu such as in the example below.

TOPIC CHAIN

    a. John is a blond
    b. He weighs about 215
    c. He's got a nice disposition
    d. He works as a guard at the bank.

All of the propositions encoded by clauses (1a–d) instantiate a higher level notion, not expressed, which might be thought of as the properties of John NOW. Each proposition tells us something about John. However, looking more carefully at those four propositions, we notice that not only does each concern a property of John at the present time, but each is predicated of some generally known and knowable property of John at the present time.

Topic-chain dcu's are thus conceived of here as more restrictive structures than merely chains of clauses sharing a common sentential topic: Topic–Chain dcu's specify complex semantic constraints set by the constituents on the dcu. In order to be a constituent of an existing Topic–Chain dcu a next clause would need to meet the same general semantic constraints and would then be able to continue precisely the same line of discourse development.

In the case of the example Topic–Chain dcu above, a next clause would also need to encode some generally known or knowable characteristic of that same John as the same time point. To do otherwise would take the discourse in a slightly different direction. If the next clause were:

    e. He has 100,000 white cells, OR
    f. He s a spy for the Other Side, OR
    g. He used to be a compulsive joke teller.

a somewhat different course of discourse development would be initiated -- one expressing some other sort of information about John. (e) *He has 100,000 white cells,* is too specific and too biological a fact about John to include in the same listing with his weight and place of employment, while (f) *He is a spy for the Other side* is too dramatic a piece of information; information asserted moreover from the viewpoint of an Omniscient Narrator who knows things about **John** that people who knew him in a casual sort of way probably would not know. The fact that John had been a compulsive joke teller in the past, the proposition encoded in (g), which fits the constraints on general knowability is a past rather than a present property of **John**. After (g) to continue with details of his current properties seems like a "return" to discuss issues which had appeared to have been completed earlier.

3.2.3 The Chronologically ordered Topic-chain dcu

The constraints on Topic-Chain dcu membership in (1) involve how each individual proposition relates to a more general, abstract proposition schema concerning the extension of **John**. In (2), a chronologically ordered topic-Chain dcu, the propositions are related to one another sequentially in addition to instantiating some more abstract (unexpressed) proposition schema concerning **John**. [25]

Chronologically ordered Topic-chain

a. Jim took all the home ec. courses in high school.
b. He was a cook in the army.
c. He took the Cordon Bleu course in France last year.

These three clauses describe **Jim's** culinary education. They relate to one another by each asserting a sequential step in this process. A next clause in this dcu must also give some detail of **Jim's** training as a cook -- specifically, some development which took place within the past year.

3.2.4 The Narrative

Narrative dcu's form one very important class of chronologically ordered sequential discourse List structure. Narrative dcu's are made up of *event clauses* which encode *event propositions* asserting the occurrence of a chronologically ordered list of discrete, non iterative or habitual occurrences in some world of discourse interpretation. [37] [21] [6] [35] [75] [53] [47] [54] Narrative dcu's are composed of main clauses which function to create a discourse *timeline*. Narrative Example 1 is a typical three clause narrative dcu.

Narrative Example 1

The bell rang. E1
John answered it. E2
Mary greeted John enthusiastically. E3

Narratives are discourse types composed of at least two event clauses -- which encode event propositions interpreted as true at one instant in a given world modelled by the narrative discourse unit.

In a narrative, the surface order placement of event clauses mirrors the order in which the events encoded by the clauses are to interpreted as having taken place.

These characteristics of narrative are presented in figure 1 below in which a set of event clauses c^1, c^2, c^n etc., arranged sequentially in a text -- c^1 at t_1, c^2 at t_2, c^r at t_n etc. are interpreted as encoding event propositions p^1, p^2, p^3, p^r -- expressing instantaneous states of affairs -- at discrete modelled instants t_1, t_2, t_3, and t_n respectively in the modelled world and t_1-t_n form a time line representing the forward motion of time in the modelled world so that t_1 necessarily precedes t_2 which necessarily precedes t_3 etc. This property of narratives is shown below:

<center>Narrative</center>

e = event clause (punctual, non-durative, etc.)

E = Event Proposition time then

$e_1...e_2...e_3...e_4...e_5$ (In Some Text)

$E_1...E_2...E_3...E_4...E_5$ (In World Modelled by Text)

$t_1...t_2...t_3...t_4...t_5$ (timeline of modelled world)

    time ------->
     o   n

Stories are the best known type of discourse unit built around a narrative line. However, they are not the only narrative discourse genre. The story is a severely constrained narrative type. a *positive specific realis past-time* narrative which makes a *point*. Note that in this definition we are distinguishing narrative genres from one another along several dimensions. *specific* versus *generic, realis* vs *irrealis negative* vs *positive*[10] and narratives in different time frames.

---

[10]Negative polarity narratives encoded event propositions asserted not to have occurred in the order in which they would have occurred had they occurred.

There are present-tense narratives (often termed *simultaneous reports* or *blow-by-blow descriptions*.), future time narratives (or *plans*) and past time narratives (*stories* and *reports*). There are also narrative genres -- such as stories -- which necessarily make a *point* and those which need not. Each narrative genre is built around one type of narrative dcus constituted by event clauses with the appropriate semantic properties. (See Appendix A for a detailed discussion of narrative genres.)

3.3 Discourse Subordination

So far the discourses we have seen have been "flat" -- consisting of clauses listing propositions with similar semantic relationships to one another. Discourse does not consist solely of such sequences of clauses, therefore, dcu's may also by *subordinated* to other dcu's.

Discourse subordination is possible in two cases: (1) where the subordinated element Elaborates on the higher level unit or (2) when there is no semantic congruence relationship obtaining at all between the two units, but the new unit interrupts the construction of an ongoing discourse units and is not a continuation of a unit interrupted earlier.[11] The first type of subordination is called *Expansion* and the second type is know as *Strictly Structural Subordination.* - strictly structural subordination allows us to deal uniformly with all cases of interruptions. Strictly Structural Subordination is a default operation resulting from the semantic unsuitability of the incoming unit for Coordination or Expansion unit formation.

---

[11]And still structurally accessible: See Section 5.5 below for a discussion of the implications of structural accessibility.

3.3.1 The Expansion dcu

In the present framework, an *Expansion dcu* is formed when the proposition
encoded in one dcu is expanded upon semantically by the propositional content of
clauses making up an immediately following dcu. An Expansion dcu consists of the
expanding dcu and a dcu which directly dominates the preceding dcu in the Tree
corresponding to the discourse. The Topic Chain below is a paradigmatic Expansion
dcu which clauses (b) (c) and (d) all expand on the propositional content of clause (a)
giving more information about the ways in which *Jim* is a *good cook*:

```
a. Jim is a great cook.
b. He took all the home ec. courses in high school.
c. He was a cook in the Army.
d. He took the cordon Bleu Course in France last year.
```

Hobbs formalization of the Elaboration relation is adopted here. [30]

```
"A segment of discourse S1 is an Elaboration of Segment S0
it the same proposition P can be inferred from both S0 and
S1, and one of the arguments of P is more fully specified
in S1 then in S0."
```

(Hobbs, 1983, p.31.) [30]

We call the semantic relationship obtaining between S1 and S0 an ISA relation.
The propositions corresponding to clauses (2b–d) explain how Jim came to be a good
cook. They expand our understanding of important aspects of the proposition which
asserts that he is a good cook. The LDM treats a dcu which expands on a proposition
encoded in the discourse in an immediately preceding clause as subordinated to the
clause on which it expands. Informally we can show this as follows:

```
                      Jim great cook

          home ec            cook           Cordon Bleu
          courses         in Army
```
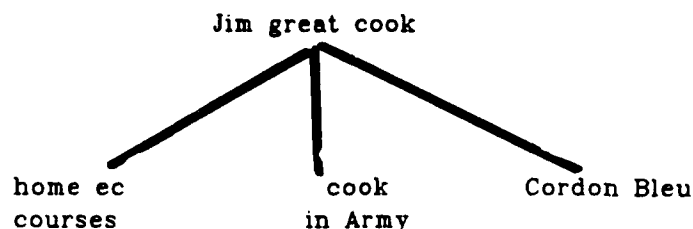
3.4 Combining dcu's to Form More Complex dcu's

Discourses are more complex, too, than merely list structures following semantically higher level proposition encoding clauses. Below, for example, a dcu describing **John** is conjoined to dcu's describing **Jim** and **Harry** into a three constituent List dcu suppleting the semantically more general requesting dcu.

```
a. Tell me about the young men in town.
   b. John is a blond.
   c. He weighs about 215.
   d. He's got a very nice disposition.
   e. He's a very good athlete, too.
   f. Jim is a great cook.
      g. He took all the home ec. courses in high school.
      h. He was a cook in the Army.
      i. He took the Cordon Bleu Course in France last year.
   j. and Harry is the scholar in the group. etc.
```

The List dcu consisting of a *John* −dcu, a *Jim* −dcu, and a *Harry* −dcu is an appropriate reply to (a) *Tell me about the young men in town.* because all three are members of the set of referred to in (a) as "the young men in town". A set/element or ISA Relation exists between the extension of the NP in the request dcu and the topics of the three constituents of the List dcu which suppletes the requested information. In an informal Tree which we can construct for this discourse, the three List dcu's are co−ordinated to one another in a List dcu and embedded relative to (3a). Each constituent dcu of the three element List has its own internal structure represented as well as shown below.

```
                              <young men>
                            /            \
                          /                _____
                        /                   \          \
                  <John>                  <Jim>       <Harry>
               /   |   \   \                |            |
             /     |    \    \              |            |
       <blond> <weighs <nice  \         <good cook>   <scholar>
               215> disposition> <good    /    |  \
                               athlete>  /     |   \
                                        /      |    \
                                  <home ec. <cook <Cordon
                                  courses>   in    Bleu>
                                            Army>
```
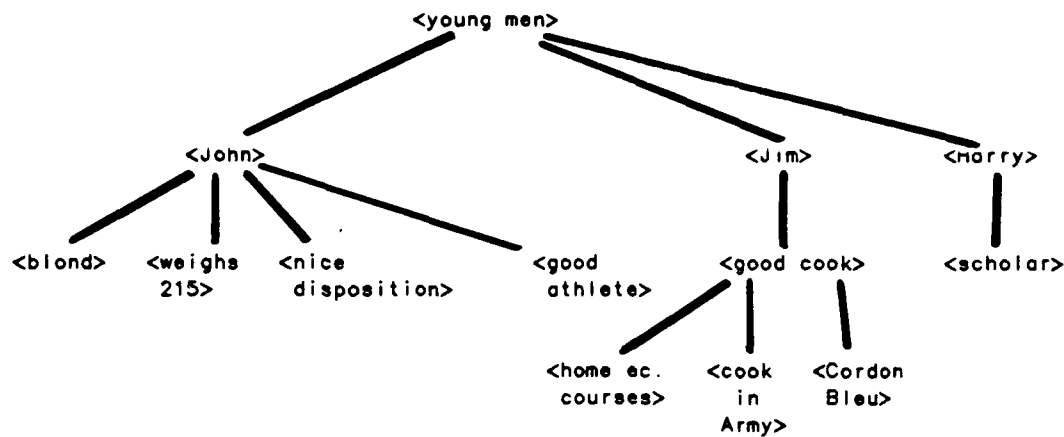
Thus far we have constructed structural descriptions of discourses by inspection.
We have taken the perspective of one with an overview of the entire discourse.
However, in processing discourse we cannot assume that we have the full text in front
of us. Discourse is processed incrementally as it occurs. Therefore, if we are to
model discourse formation and segmentation, we must have a theory of discourse
structure which will allow us to assign a structural description to discourse as it
unfolds, building up the Discourse History Tree from left to right, one clause at a
time. We shall now discuss how the Linguistic Discourse Model provides tools for
constructing such a left to right Parse Tree.

4. THE LDM — A DISCOURSE PARSER

The Linguistic Discourse Model, is a theory of the discourse structure conceptualized as a parser. The LDM Parser analyzes a discourse using grammars of constituents of possible units of various types which call each other recursively as needed. The Parser has two functions:

1. To segment the discourse into discourse constituent units according to strict criteria involving syntactic well–formedness and semantic compatibility.

2. To assign a structural description to the discourse on a left–to–right, clause–by–clause basis, specifying at any moment which discourse units have been completed, which are structurally accessible for completion, and which, left incomplete, are no longer available for completion.

4.0.1 Discourse Parse Trees

Discourse Parse Trees are formed by attaching incoming dcu's to suitable accessible nodes on the existing Tree. All nodes in the DPT are labelled with the information needed to allow proper attachment. The leaves of the DPT are the clauses themselves. In Discourse Parse Trees there are two types of nodes. The first, represents a co–ordination structure and is marked with a C. It reads: "A is coordinated with B" or "B is coordinated with A". A and B, thus, are sisters nodes in the tree at a node marked with a C.[12]

---

[12]The justification for using such a cumbersome notation is too complex to go into here. Suffice it to say that this allows us to create a tree with labelled nodes and terminal nodes which represent the clauses themselves while accommodating the tree building strategies necessary to account for discourse structure.

C

A   B   = A is coordinated with B
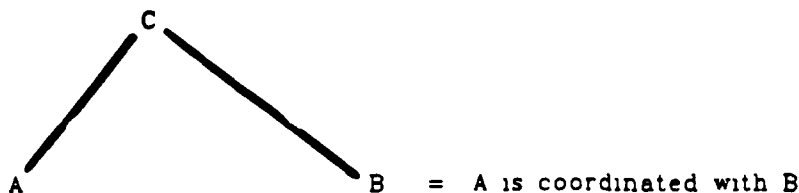
In the second case, the node marked with a S represents a subordination relation obtaining between the rightmost node and the left node. The right node is embedded relative to the left node.

S

A   B   = A dominates B
                  B is embedded relative to A
                  B is subordinated relative to A
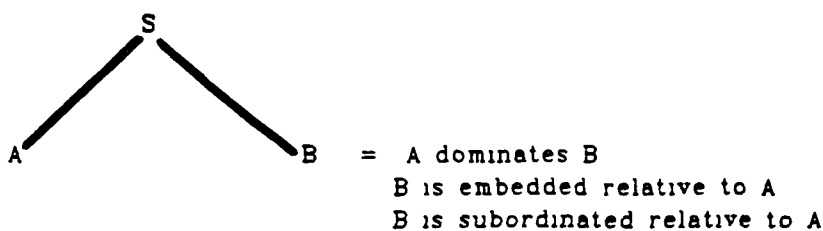
4.0.2 Constructing the Discourse Parse Tree

A new constituent is attached to the Discourse History Parse Tree as the rightmost constituent at a structurally accessible existing level in the Parse Tree.
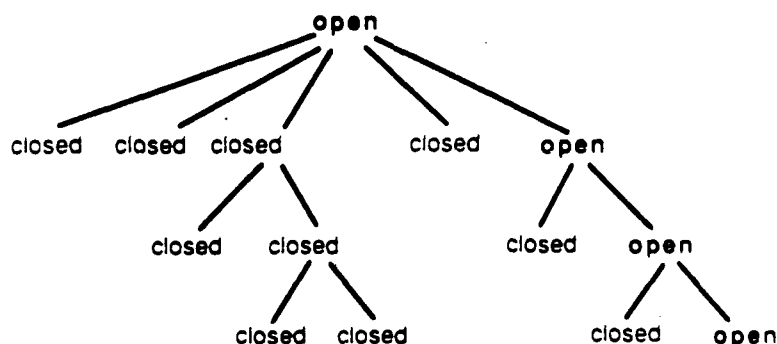
--attachment may be by coordinating it to the constituents already attached at a node directly dominating the previously attached constituent.
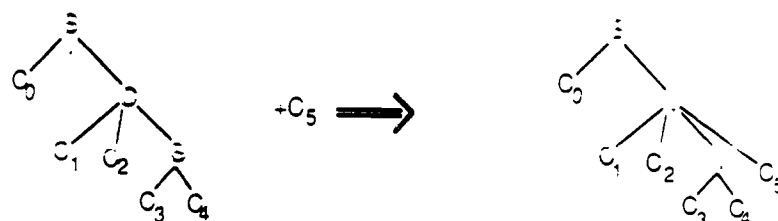
Alternatively, the new constituent may be attached as the right constituent of a new node inserted directly above a node dominating the preceding clause. In this latter case, the new constituent is embedded relative to the left constituent of the new node
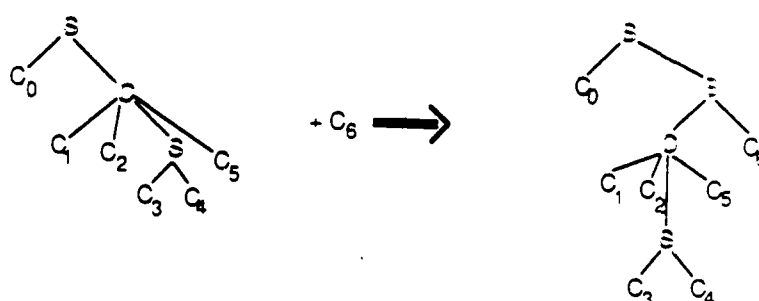
There is one additional case in which discourse coordination is possible: if a clause can be subordinated relative to a dcu at a structurally accessible position, but can not be coordinated to a unit dominated by that node because of a failure of semantic congruence, the new unit may be adjoined to the existing unit at a new coordination node immediately dominating the accessible constituent. This attachment process, called Discourse Adjoin, is illustrated below:
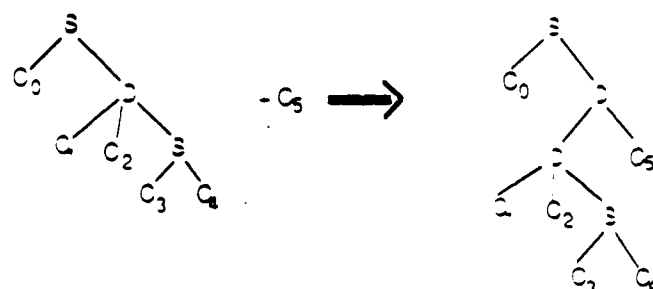
All other discourse constituents, whether or not semantically related to the last clause parsed will be subordinated with respect to that clause.
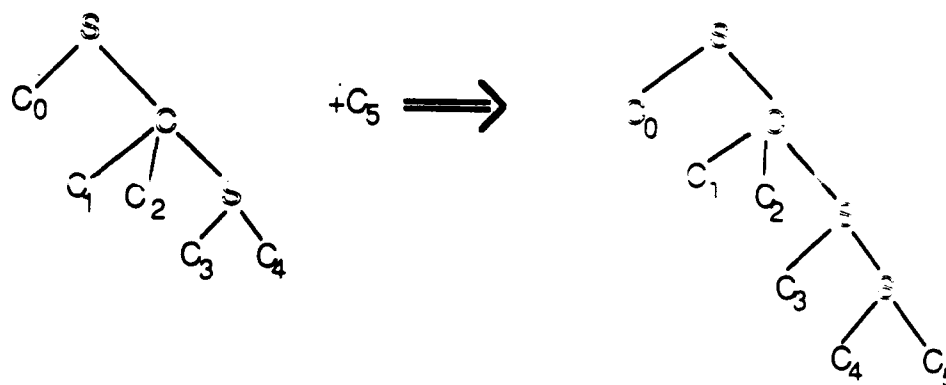
Discourse Pops

If while parsing a constituent of a given Type, the Parser encounters a clause which is not a legal next Move according to the Grammar of that Type of constituent, the Parser must try to find out if this new constituent is 1: the next Move of a constituent whose completion was interrupted but which is still accessible for completion; or, 2: if this new clause is the first constituent of some other unit all together.

In the first case of returning to complete parsing a previously interrupted unit, the system POPS up to the level of the previous unit rendering all intervening partially completed units structurally inaccessible.

In the second case, when a parse is interrupted by intervening material and no POP to a higher level is possible, the LDM parser embeds the interrupting material relative to the last clause parsed. In this case, both the embedding node and the nodes dominating it in the Parse Tree remain structurally accessible.

4.0.3 The role of World Knowledge and inference in discourse parsing

The decision of whether to subordinate or coordinate a given unit must be made using real world knowledge and inferential procedures.

For example, given the 2 clause discourse:

```
John is a very good athlete
He can run a four minute mile
```

Under an LDM analysis, *He can run a four minute mile* is subordinated to *John is a very good athlete* in the Discourse Parse Tree. To complete this subordination operation, one must know that *running a four minute mile* is an instantiation of *being a good athlete*. In addition, one must have the discourse structural knowledge that *he* is co—referential with *John* in the previous sentence and that the world in which John is a very good athlete has temporal and spatial properties which are related to the world in which he runs a four minute mile.[13]

4.0.4 Calculating dcu values

Semantic relations in any given text are often ad hoc. In the LDM , there is no fixed set of relationships among clauses or discourse units (unlike approaches to discourse "coherence" and "rhetorical structure" developed by Hobbs, Reichman, Mann, Longacre). [29] [27] [62] [44] [42] [43] Rather, the nodes of the DPT are labelled with the information necessary to compute the possible congruence relation obtaining between an incoming unit and a unit at a DPT open node.

---

[13]In order for a linguistically encoded text to communicates successfully — i.e. to be interpretable by the recipient(s) as the producer(s) intended — significant overlap of the store of relevant aspects of the world knowledge of producer(s) and recipient(s) is necessary. In the case of our present example, for instance, someone from another culture who did not understand how running a four minute mile was relevant to being considered to be a good athlete would be unable to do the appropriate computations on the values of the semantic parameters associated with each clause. To this person, this discourse might well seem incoherent — a mere concatenation of unrelated assertions.

How semantic congruence is ascertained is an important issue. This process of semantic analysis is a world-knowledge and inference-driven semantic matching process making use of extra-linguistic knowledge the meaning of the words and the structures encountered to perform an analytic and possible matching operation on the semantic values encoded at the various nodes.

Discourse Coordination and Discourse Subordination relations are computed as operations on vectors. Each individual vector corresponds to an individual slot in the context frame representation of the propositional content of a discourse unit. Taken together, the vectors define an n-dimensional semantic space corresponding to the defining characteristics of the unit.

The paradigmatic discourse coordinated unit is the List dcu. Lists have been characterized previously as a series of clauses $C^1,...,C^k$ which have a semantic structure of the form

$$F(a^1) = v^1,..., F(a^k) = v^k$$

where the clauses express propositions which convey the values one function has for a series of alternative arguments. Semantic congruence computations for discourse coordination are Generalized Union operations on the slot fillers of the participating discourse units. Given a series of vectors, the Generalized Union operates of them calculating for each corresponding vector pair the *most restrictive relevant natural set* which contains each vector viewed either as an element or as a sub-set.[14]

Informally speaking, if we have MEN in the Participant slot in the Context Frame

---

[14]The notion *most restrictive relevant natural set* is by no means yet a fully worked at formal construct. We shall deal with calculation on this strictly fuzzy notion in a moment.

associated with one unit and WOMEN in the corresponding Participant slot of a second unit, ADULTS would be the Most Restrictive Relevant Participant Slot filler which could accommodate both units. (Both units could also be accommodated in less restrictive categories such as "PEOPLE", "ANIMALS", "LIVING BEINGS", "OBJECTS", "MATTER" etc.)

In processing a discourse and computing dcu values, each new possible dcu-mate may force a reassessment of the *Most Restrictive Natural Category*. Given the two item list: *thunderstorms, tigers* one can ask what a next possible constituent might be. Some people may guess another item beginning with *t* while someone else might come up with *venus fly traps* or *the principal at school* suggesting three different higher level concepts respectively: <t words>, <jungle dangers> or <what Jimmy's afraid of>. It is clear that adding a next constituent to the list adds constraints on possible next items. A fourth list-mate would need minimally to meet those constraints and could add more constraints, if there were sufficient overlap between the formal, semantic, pragmatic and real world dimensions of the fourth item to narrow down the field of possible mates further.

In the following analyses, these Most Restrictive Relevant Natural Categories will usually be ad hoc abstract characterizations of the common constraints shared by the dcu-mates and created on the spot by the listing operation. They will not have the familiar appearance of neat lexicalizable pre-existing categories. These ad hoc, newly minted quality of the higher level predicates may seem suspicious to those used to working with the fairly crisp categories of Prototype Theory, for example. [64] [65] [66] [8] However, they seem to us to be fundamentally correct. Discourse is about the creation of new semantic structures using the resources of the existing common stock of lexical items and concepts to do so. A discourse representation scheme which parsed into existing categories and pre-defined notions would be unable to account for the fundamental creativity of language use.

4.1 Parsing a Simple Discourse

Let us now look briefly at how the Linguistic Discourse Model constructs a parse tree for a simple topic chain dcu.

For Text A:

Mary likes Bob.

She's attached to John.

She's madly in love with Harry.

the relationship between Clause A1 *Mary likes Bob* and Clause A2 *She's very attached to John* can be abstracted from their corresponding context frames: <Mary, NOW, has the property Like Bob>, <Mary, NOW, has the property Be Very Attached to John.> by comparing the two frames and calculating their Generalized Union:

```
PersonSlot A1=Mary,
PersonSlot A2=Mary
PersonSlot A GU 1/2 = MARY

TimeSlot A1 = NOW,
TimeSlot A2 = NOW
TimeSlot A GU 1/2 = NOW

 PropertySlot A2 = Like Bob
 PropertySlot A1 = Be very attached to John
 PropertySlot A GU 1/2 = Positive Feelings Toward
                    Male Friend_x
                    Conditions:
                    a. Degree of positive
                       feeling decreases
                    b. Male Friend_x =New
```

In the Tree of this discourse a and b will be coordinated under a node in the Tree labelled with the Generalized Union of their respective context frames:

GU A 1/2 =<Mary, NOW, Has the Property Positive Feelings Toward Male Friend ((Conditions: a. Degree of positive feeling increases b. Male friendx = New))>. as shown below:

DPT 1−1

C <Mary, NOW, has the Property Positive Feelings
Toward Male Friend ((Conditions:
a. Degree of positive feeling increases
b. Male Friendx = New))>

<Mary, NOW, has   <Mary, NOW, has the
the property Like Bob>,   property Be Very Attached
                                         to John.>.
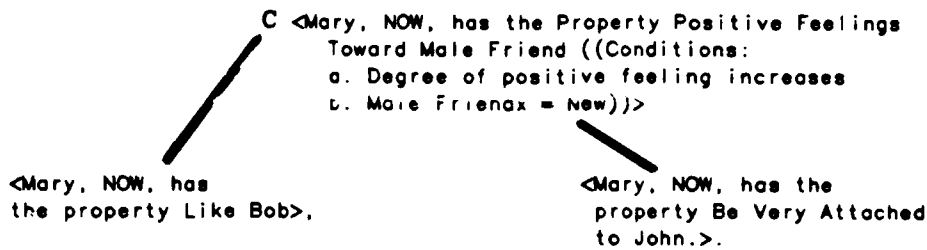
When the Context Frame of A3 *She's madly in love with Harry.* <Mary, NOW, has

the Property Madly in Love with Harry. is compared with the context frame for the

immediately preceding clause A2<Mary, NOW, has the property Be Very Attached to

John.> as follows:

```
PersonSlot A2=Mary,
PersonSlot A3=Mary
PersonSlot A GU 2/3 = MARY

TimeSlot A2 = NOW,
TimeSlot A3 = NOW
TimeSlot A GU 2/3 = NOW

PropertySlot A2 = Be very attached to John
PropertySlot A3 = Be very madly in love with Harry
PropertySlot A GU 2/3 = Positive Feelings Toward
                Male Friend_x
                Conditions:
                a. Degree of positive
                   feeling decreases
                b. Male Friend_x =New
```

the Context Frame for GU A 2/3 is assembled.

<Mary, NOW, Has the Property Positive Feelings Toward Male Friend ((Conditions:

a. Degree of positive feeling increases b. Male Friendx = New))>.

Since <GU 1/2> = < GU 2/3. Clause A3 relates to clause A2 as clause A2 relates

to clause A1. Clause A3 can be coordinated with Clause A1 and A2 under the existing

higher level coordination node as shown in Discourse Parse Tree 1−2.

DPT 1-2

C <Mary, NOW, has the Property Positive Feelings
Toward Male Friend ((Conditions:
a. Degree of positive feeling increases
b. Male Friendx = New))>

<Mary, NOW, has the property
Like Bob>,

<Mary, NOW, has the
Property Madly in
Love with Harry>

<Mary, NOW,
has the property
Be Very Attracted
to John.>.
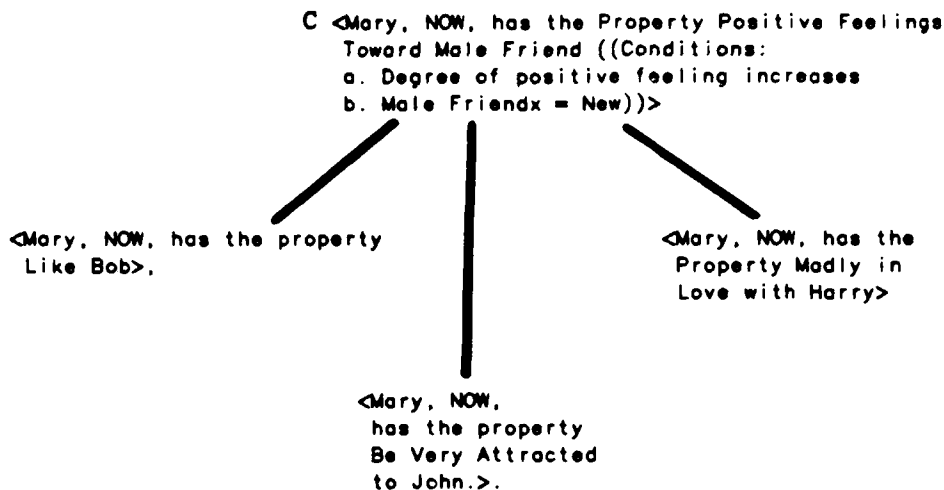
4.2 Summary of the The LDM Discourse Parsing Process

To sum up: the LDM segments a discourse by checking the Context frame of an
incoming against the frame of structurally accessible dcu's in the Discourse Context
Interpretation Tree beginning with the dcu corresponding to the immediately preceding
clause and continuing up the Parse Tree one level at a time. This parsing process is
summarized as follows:

Discourse Parsing Process

1. Get next clause dcu.

(2. Assign higher level contexts of interpretation to clause.
   (See Section X below))

3. Abstract context frame from the propositional content and
   syntactic form of the clause.

4. Compare the slot fillers of the Context Frame
   of new clause with the those of the
   immediately preceding clause dcu.

5. If a sub-set of the fillers of the new clause are in an IS A
   Relation with the Values at rightmost node, create an Elaboration
   dcu consisting of the dcu at that mode and the new clause.

Subordinate the Elaboration dcu to the old dcu. Otherwise,
continue to step 6.

6. Continue searching up the Discourse Context Interpretation Tree
   examining the Context Frames of the Mothers of the each
   successively higher Mother and her daughter.

   If congruence is established at a given level, coordinate the new
   unit in a newly created or existing dcu with the daughter at that
   level. The label at the node attachment will represent the Generalized
   Union of its constituent dcu context frames. All nodes to the
   left of the new daughter as well as all nodes below the new
   coordinate node in the discourse parse tree are now structurally
   closed off and inaccessible. No further subordination or
   coordination is possible at those nodes.

   If no suitable coordination point is possible, continue to step 7.

7. Embed the new clause to the last parsed clause in a semantically
   unrelated dcu.

8. Re-set new dcu as old dcu.

9. Stop if there is no more input. Otherwise, go to Step 1.

In considering examples of recursive dcu formation, we shall see that this

procedure, which may appear somewhat arbitrary as stated gives us the needed

structure to parse complex discourses on a right to left basis in an intuitively

acceptable manner. A uniform treatment of discourse subordination is one of the

central features of the LDM Framework. The right branching tree structure for

discourse is properly viewed as a hypothesis about discourse structure. We believe

that this hypothesis predicts for where the discourse can POP back to (within

cognitive processing limitations) and thus accounts for the behavior of discourse

particles and lexical items which return the discourse back to a point from which it

can continue the development of a discourse activity begun before intervening

semantically related or unrelated material was encountered.

5. PARSING WITH THE LDM

In order to show how the Linguistic Discourse Model processes a discourse by recursively forming increasingly complex dcu's, we shall analyze now some short Topic Chain and Narrative examples. In order to construct a Discourse Context Interpretation Tree (DPT) for the short texts reproduced below, we shall make use of both rules governing the formation of Coordination and Elaboration dcu's and of the information about the form and content of the various text clauses represented in discourse context frames.

5.1 Parsing a Simple Topic Chain with the LDM

TOPIC CHAIN EXAMPLE 1

a. John is a very good athlete.

b. He can run a four minute mile.

c. He throws a mean hardball, too.

d. And John is very·smart.

e. Won all the prizes at his graduation.

f. (f^1) Even I was surprised (f^2) that he won the Spanish prize.

g. He didn't even like Spanish.

h. Anyway, he's a disaster at parties.

i. He's too shy.

j. Last week, he went to a party at Bill's house etc.

The discourse begins with clause a: *"John is a very good athlete."* The propositional content of this clause **John is a very good athlete**, is analyzed into the dcu context frame **John, NOW, has the property very good athlete**., After attachment of dcu a, the DPT looks as follows:

DPT1

o<John, NOW, has the property very good athlete.>

Having begun construction of the DPT by attaching dcus to the Tree at a node with corresponding values, clause b, *He can run a four-minute mile*, must be processed. Making use of extra-linguistic World-Knowledge and general problem solving procedures, we know that being able to run a mile in four minutes qualifies someone as a very good athlete. In the LDM analysis as discussed above, we make use of this information to make the inference in computing the relation obtaining between the dcu a and b.

Because John's running a four-minute mile at time NOW gives us more information about the property John has NOW of being a very good athlete, when the context frame associated with the propositional value of the clause *He can run a four-minute mile* <John, NOW, has the property to run a four-minute mile>, are compared with the corresponding fillers for the context frame associated of its immediate predecessor, clause a, (< John, NOW, has the property very good athlete.>) an ISA relation is found to obtain. Under the rules of dcu attachment *"he can run a four-minute mile"*, clausal dcu b, is embedded to *John is a very good athlete*, dcu a, under, a dcu specifying that an elaboration relationship obtains between b and a. (The subordination node is indicated by an S.)

DPT 2

S<John, NOW, be very good athlete>

<John, NOW, be very good athlete>a   b<John, NOW, has the property to run a
.   four minute mile>
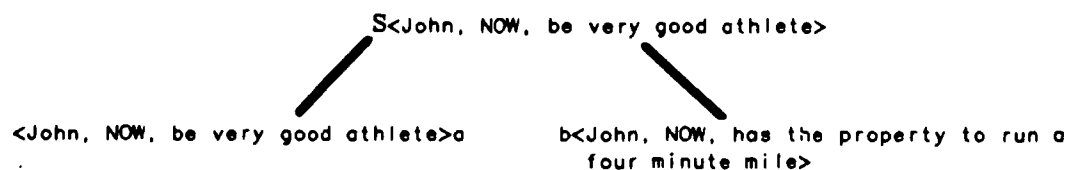
The context frame associated with this Elaboration dcu, <John, NOW, be a good athlete>, subsumes information from both dcu a and dcu b.

When the propositional content of clause c, *He throws a mean hard-ball*, represented by the dcu context frame **<John,NOW, has the property of throwing a mean hard-ball>** is compared to the information encoded in the context frame of dcu b, its immediate predecessor and with the frame associated with dcu a, b's mother, we see that: (1) dcu c elaborate on the way in which *John is a very good athlete* and, moreover (2) **<John, NOW, has the property of throwing a mean hard-ball>** elaborates on **<John, NOW, be a good athlete>**, in the same way as **<John, NOW, has the property to run a four minute mile>**, elaborates on **<John, NOW, be a good athlete>**. They both detail John's athletic prowess at the present time by giving an example of John's skills.

Because dcu c and dcu b relate to a higher level predicate in a similar manner, they may be co-ordinated with one another. In this case, a newly created coordination node, is inserted above the dcus c and b in the DPT and labelled with the semantic values specifying the common relationship they bear to the higher level predicate: **<Specification of John's athletic prowess NOW by enumeration of skills in a particular sports.>** as shown in DPT 3:

DPT3
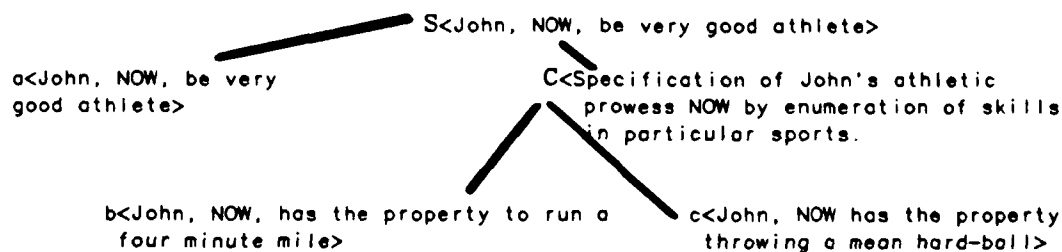
Construction of the rest of the DPT corresponding to this short topic chain text is accomplished in a similar fashion. In order to si   the development of the DPT in a readable fashion, we shall dispense with giving the full Context frame for every

terminal (clause) dcu, but shall give only the values calculated for the labels of new higher level S and C nodes, and the clause in question.

Clause d, *And John is very smart*, is associated with the Context Frame <John, **NOW, has the property of being very smart>**. As the *And* in this clause indicates, clausal dcu d is coordinated to clausal dcu a in the DPT, both d and a serving to give elaborations on the positive qualities of John [15]

After attachment of dcu d, the state of the DPT is as shown below

DPT4
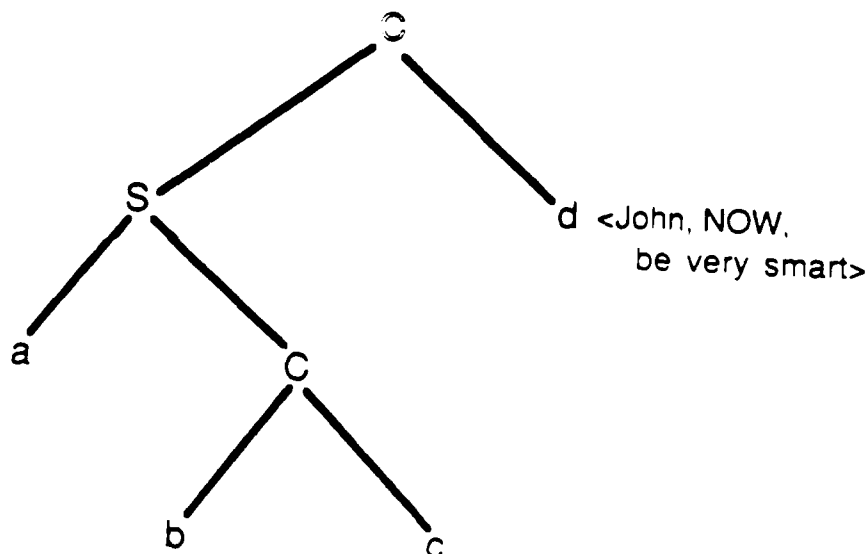
With the attachment of dcu d at the same level as dcu a in the DPT and to its right, dcu a is closed off for further development. Given the state of the DPT, it is no longer possible to continue the discussion of John's athletic prowess merely by listing

---

[15] As discussed earlier, this coordination is established by the procedure of Tree climbing during which the context frame values of the input dcu are compared to the values available at open nodes in the Tree. The dcu is attached as a sister at the most suitable node. Degree of suitability is determined by the similarity of the open node values to values of the incoming dcu.

another of John's sport competences.[16] The clause which follows d in the original

Topic Chain example, clause e, *Won all the prizes at graduation* does not raise these

displacement problems. Because winning all the prizes at graduation is an indication

of academic achievement and academic achievement may reasonably be considered an

indicator of intelligence, dcu e can be embedded relative to dcu d as an elaboration

specifying how John's smartness is manifest. After processing of dcu e, the DPT has

the form shown below:

---

[16]Thus, the LDM rules out the following discourse (unless the speaker intends that bowling
in the high 200's is an indication of intelligence):

**TOPIC CHAIN

a. John is a very good athlete.
b. He can run a four minute mile.
c. He throws a mean hard ball, too.
d. And John is very smart.
e. He bowls in the high 200's.

Of course speakers can not be precluded from uttering these clauses in this order, without
including a change in intonation to signal a "repair". However, we claim that if they do
so, they have created a discourse starred in precisely the same way as the familiar starred
sentence. The claim in starring a sentence is not that people cannot utter the string of
words in that order, but that the ordered string is not a *legal string* according to the
rules of the language. According to the LDM, the starred string of clauses is illegal. The
LDM predicts that this string would not occur without an indication of repair — perhaps
with the use of a "displacement marker" such as "*oh*" or "*and oh*" and distinct intonational
marking. We shall deal with the implication of this example in more detail below. Sec. 5.5

DPT 5
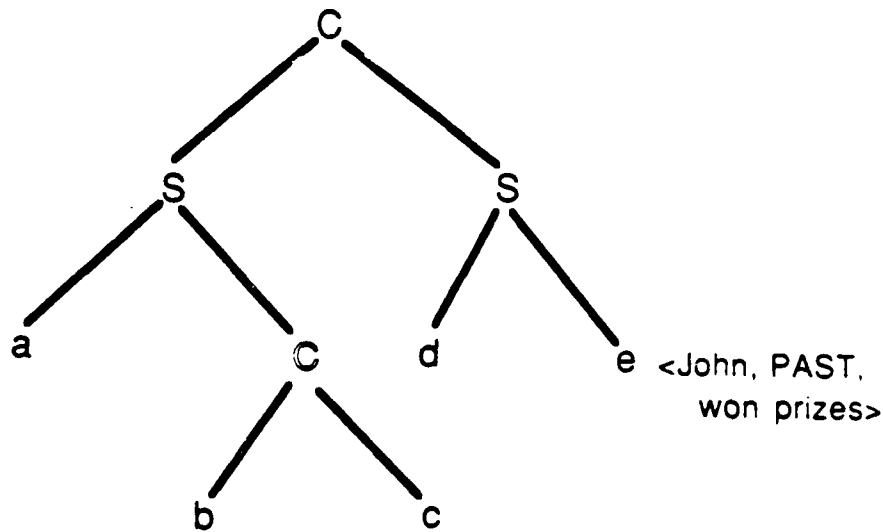
Dcu f, *Even I was surprised that he won the Spanish prize*, consists of two
clausal dcu's, f^1 and f^2. f^1 gives information not about *John*, but about the speaker.
f^1 comments on an item in the *John* Topic Chain from an external perspective. it is an
aside and is not part of the Topic Chain detailing *John*'s qualities. Therefore, dcu f^2
which does give information about *John*, according to the rules of sentential syntax
but which is structurally subordinated to f^1 can not participate in the mainline topic
chain either. Dcu f^2, while also discussing the properties of *John*, does so in a
separate dcu one embedded relative to its f^1 matrix as shown in DPT 6 below

DPT 6
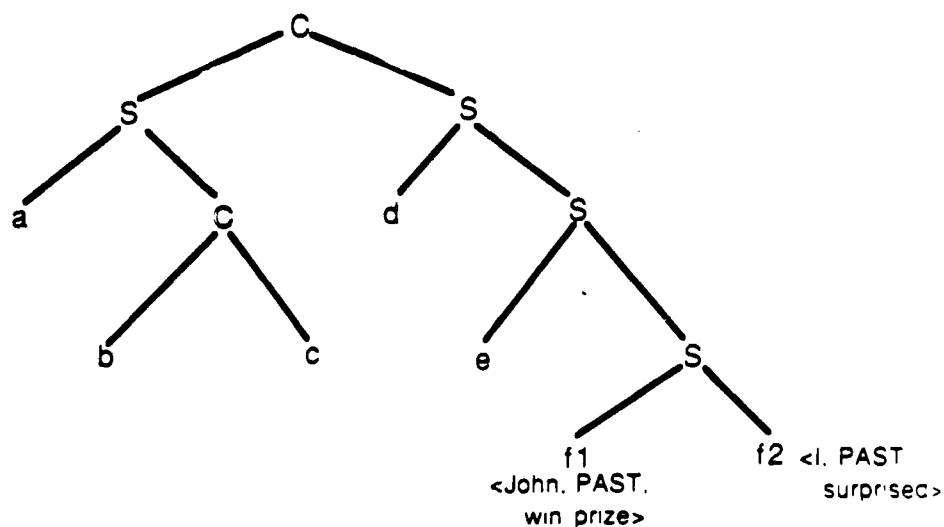
Clause g. *He didn't even like Spanish* elaborates on why it was surprising that John won the Spanish prize. It is therefore embedded relative to f^2 on the Parse Tree

DPT 7
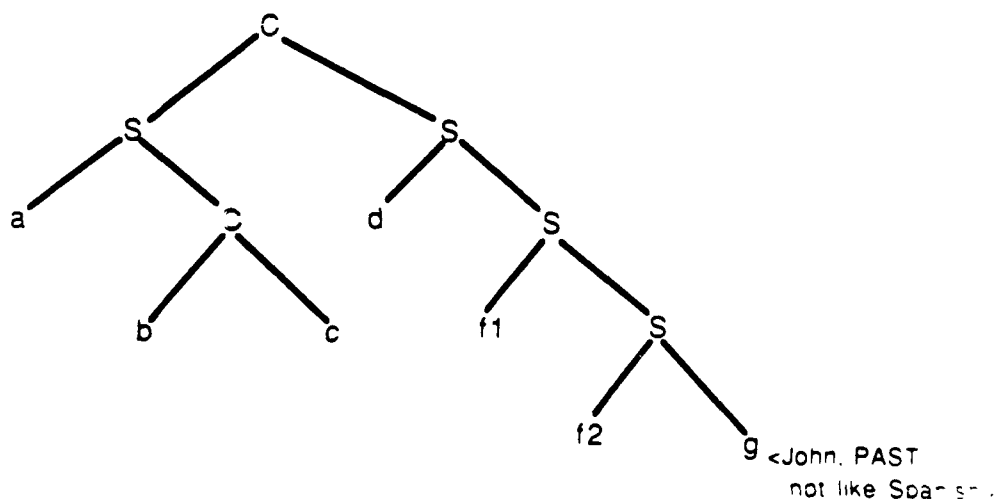
Clauses h–j present a different side of *John* Rather than detailing his best qualities. dcu h. *Anyway. he's a disaster at parties.* begins a listing of John's less

admirable properties in a List dcu to be coordinated with the List of John's admirable qualities under a newly created coordination node with the values <**John, NOW, qualities.**> which subsumes both his better and less admirable qualities. (*Anyway,* it should be pointed out, is a POP marker which signals a POP up the Tree to resume a higher level interrupted unit -- in this case the detailing of types of John's qualities.) The state of the DPT after attachment of dcu h is shown in DPT 8:

DPT 8
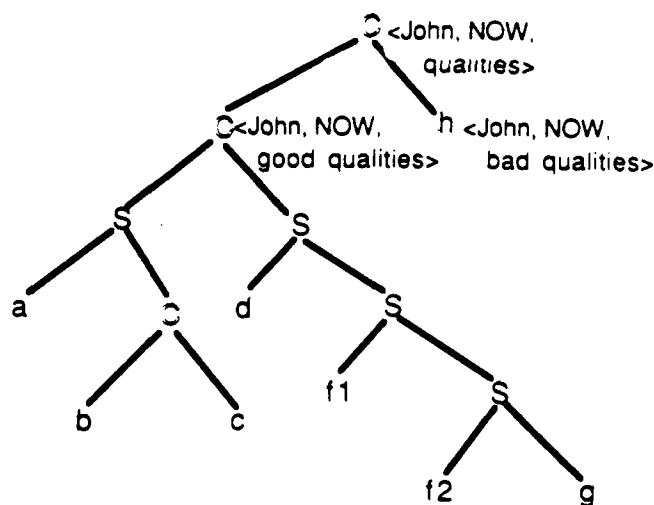
dcu 1. *He's too shy.* elaborates on why *John is a disaster at parties.* This is represented as expected in the DPT as illustrated in DPT 9.

DPT 9
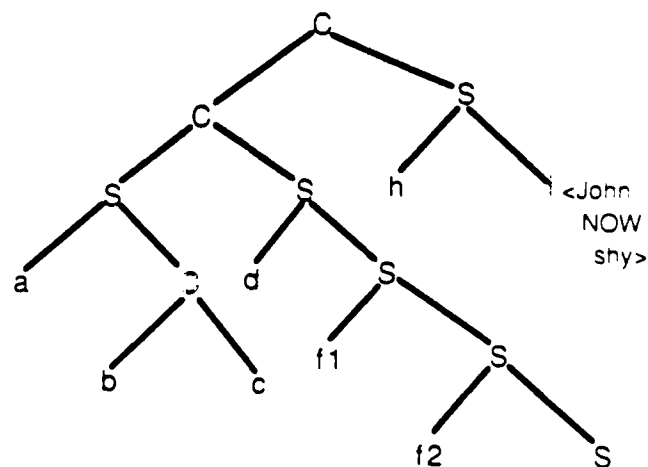
The final clause we shall consider in discussing this Topic Chain is clause j begins a story which we expect to (1) have a narrative structure and (2) make a poin·

illustrating John's disastrous shyness at Bill's party the week before. Clausal j dcu which corresponds to, *Last week, he went to a party at Bill's house,* is thus thus treated as embedded relative to dcu h because dcu j begins the development of an entire Discourse Unit which competent and well socialized speakers would expect to elaborate on the shyness of John. The state of the DPT after attachment of dcu j is shown in the figure below.

DPT 10
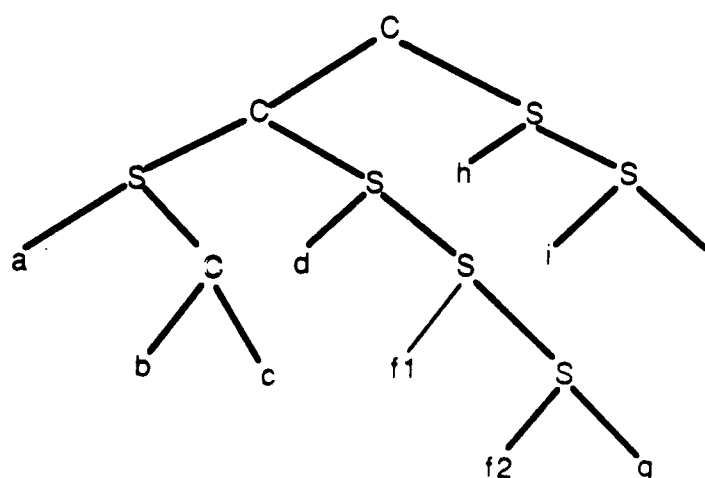
Having considered general principles of discourse formation as characterized in the Linguistic Discourse Model, we will now consider the special case of narrative dcus in more detail.

5.2 LDM Parsing of Narrative Discourse

We consider a Narrative, structurally, to be a Narrative DCU consisting of successive event clauses, specifying occurs at successive time-points in some world of interpretation described by the narrative

Following the rules for recursive DCU formation sketched in the previous section, we can now provide a slightly more exact characterization of the formation process of a Narrative dcu.

Structurally accessible event clause E(1) and structurally accessible successor event clause E(2), with temporal interpretation at discrete instant in time t(1) and t(2) in a narrative world W(n), respectively, form a Narrative dcu, consisting of sequentially ordered event clauses encoding propositions detailing the states of affairs obtaining at sequentially ordered discrete moments in W(n).

The following small narrative text, Narrative Example 2, consists of three ordered event clauses, $E(1)^1$, $E(2)^1$, $E(3)^1$ which express three instantaneous states of affairs which occurred at ordered discrete instants in W(1):

Narrative Example 2

```
The bell rang. E1
John answered it. E2
Mary greeted John enthusiastically. E3


The bell rang.      E1 asserted to have occurred at t(1) in W(1)
John answered it.     E(2) "  "  "  "  "  "      "  t(2) in W(1)
Mary greeted John enthusiastically.    E(3) "  "   t(3) in W(1)
```

When E(2), *John answered* it, is processed after E(1), *The bell rang* .. a coordination node is created to accommodate the two clausal dcu's. This new coordination dcu is an ordered listing of events asserted to have taken place in W(1). This coordination is accomplished by comparison of the information represented in the Context frames associated with the two clauses and the construction of a narrative dcu node appropriate to accommodate the fillers of the slots in the context frame.

<Bell, rang, t(1) in W(1)>
<John, answered bell, t(2) in W1>

The newly created node specifies:

1. the modality of the dcu (realis in this case)

2. the specificity of the dcu (specific not generic)

3. the polarity of the dcu (positive not negative)

4. the World of propositional interpretation (W1)

5. The narrative constraint that successive events are interpreted at
   successive time points and update a temporal index associated with the dcu
   indicated by **Event chain t = (left sister t =1 in W1)**

6. the specific constraints arising from the Generalized Union of the Context
   Frames of the clausal dcu's in question -- none in this case. After the
   attachment of E(2) the DPT for this discourse has the following structure:

DPT 1-1

```
                    C <realis<specific<positive<Event chain
                          t=(left sister t+1 in W1)>>>>


<realis<specific<positive<        <realis<specific<positive<
<Bell, rang, T(1) in W1>>>>        <John, answered bell, T(2)in W1>>>>
```
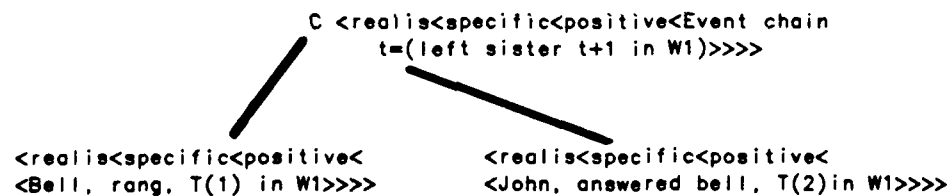
E(3), which encodes an event proposition with an interpretation at T(3) in W(1).

Mary greeted John enthusiastically, fulfills the constraints and is coordinated under

the existing dcu as shown:

DPT 2-1

```
            ⊃ <realis<specific<positive<Event chain
               t=(left sister t + 1 in W1)>>>>
```



```
<realis<specific<positive<        <realis<specific<positive<        <realis<specific<positive<
<Bell, rang, t1                   <John, answered bell t2           <Mary, greet John t3
in W1>>>>>                        in W1>>>>>                        in W1>>>>>
```
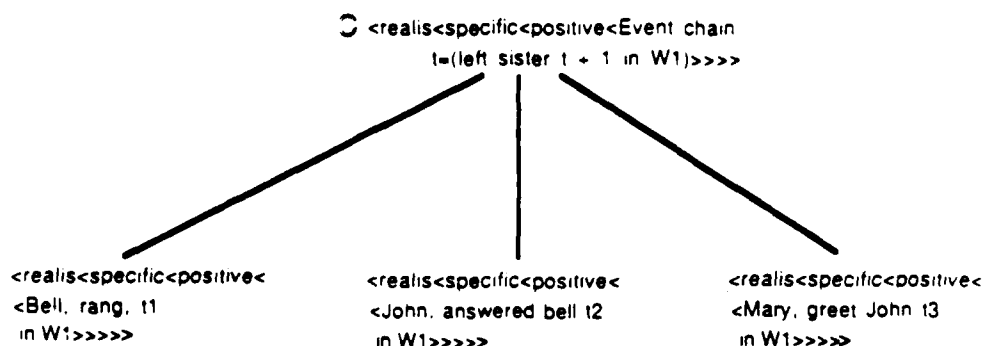
Due to the constraint on discourse unit co-membership, briefly mentioned above

which requires that all constituent clauses of a given discourse unit to encode

propositions which assert states of affairs in the same world of interpretation, should

a fourth event clause on the surface of the text encode a proposition with

interpretation at a time in any other world, World W(2), for example, E(4) would be a

constituent of a different dcu. Depending on the state of the Discourse Context

Interpretation Tree, this fourth clausal dcu will either:

1. initiate a new dcu, to be coordinated to the narrative dcu presently under
    construction *effectively closing off* that dcu for further development

2. initiate a new dcu, to be subordinated to the dcu presently under
    construction leaving the current narrative dcu in a "resumable" state or

3. continue development of a dcu interrupted earlier, closing off the current
    narrative dcu for further development.

We shall provide analyses of case 2 and case 3 in more detail.

Consider the following small discourse

Narrative Example 3

a. What did John and Sue do today?

b. John got up late. E1
c. He played tennis at four o'clock. E2

d. Sue ate lunch at the coffee shop. E3
e. She went to pick up her trophy later in the afternoon. E4
f. Then she met us at the tennis court. E5

In this case, *What did John and Sue do this afternoon*, is a question which is answered by first detailing John's activities as a topic chain narrative, and then presenting Sue's activities as a topic chained narrative.[17] Question/answer pairs are uniformly analyzed under the LDM as elaboration structures in which the *answer* elaborates on the *question* by suppleting the propositional information given in the question. (It may also be attractive to consider Question/Answer sequences as coordinate structures in which the Answer, the "second pair part" completes the unit begun by the Question the "first pair part". for the purpose of this discussion, these are not very relevant problems, however.)

The DPT after the attachment of *John got up late* has the form shown in DPT1-2:

DPT1-2

```
                              S
                        ╱           ╲
                      ╱               ╲
a<?<Activities/kids/              b<realis<specific<positive
 <realis<specific<positive        <John got up late
 <John, got up late in            in W(2)>>>>
 W(2)>> today>>
```
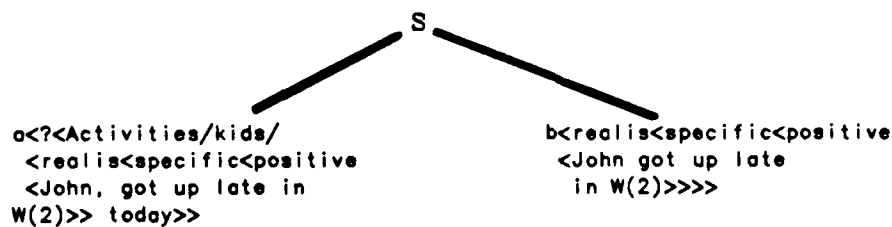

In order to make an attachment decision about the successor clause, it is

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[17]Question/answer pairs are examples of *adjacency structures*. See discussion Section XY below

necessary always to consider the entire state of the Tree and the specific nature of the semantic and syntactic constraints represented in the node labels at the structurally accessible right mode nodes In the present case, membership requirements for the narrative dcu detailing John's activities are more restrictive than the narrative dcu requirements in Narrative Example 1. The narrative List established by the Generalized Union of the values of the Context Frames of the chained clausal dcus (b) and (c) has initiated a topic chain dcu as well. The semantic implications of this syntactic situation is that the World of interpretation associated with the narrative dcu detailing John's activities has only one Participant -- **John**. Introduction of another Participant into the discourse initiates another dcu associated with an Interpretive World with either a set of participants necessarily including the new participant which may or may not include **John**. Coordination under the node established by the Generalized Union of clausal dcu's (b) and (c) is thus limited to clausal dcus which meet both the topic chain requirement (PARTICIPANT must be **John**), and the narrative requirement (proposition must assert an instantaneous state of affairs at $t(3)$ in $W(2)$.

The newly created node specifies therefore that a third constituent to be interpretable in World (W2) must have the following properties:

1. realis

2. specific

3. positive

4. be an event

5. an encoding of the referent of *John* must fill the dcu Participant slot.

In this case, the proposition encoded by clause c, **John PAST play tennis at 4 o'clock.** meets these constraints and is attached as a sister node to clausal dcu b

under a newly created narrative dcu with the context frame:

<realis<specific<positive<John, DO Event, yesterday>>>t=(left sister t+1 in W1)>>>>

DPT 2-2
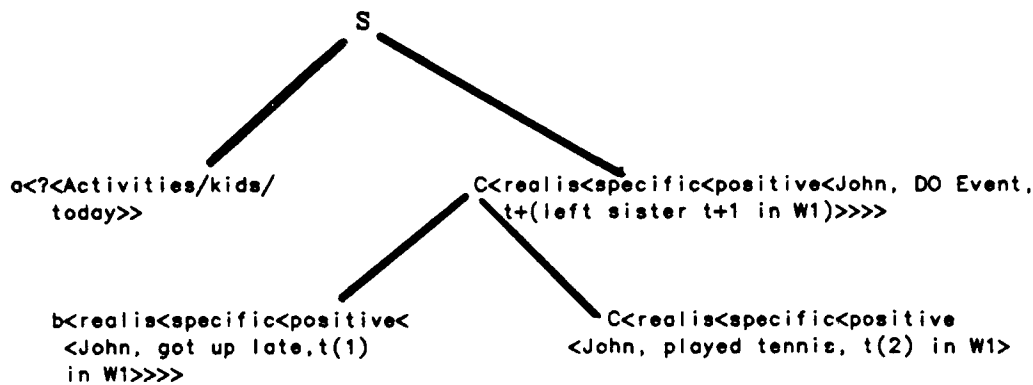
The proposition encoded by clause d, **Sue ate lunch at the coffee shop**, does not meet the criteria for inclusion under the developing narrative dcu, however. Although realis, specific, positive, and an event, *Sue ate lunch at the coffee shop*, has *Sue* as Participant in its associated Context Frame. Sue along with John are members of the set of kids available in World(1) and a dcu detailing the activities of another one of the kids is an appropriate Clause e therefore encodes a proposition which is interpreted in a different World than W(2), W(3) in which Sue is Participant. *Sue ate lunch at the coffee shop*, therefore initiates a new dcu which is coordinated to the narrative dcu detailing **John's** activities. This new dcu is associated with its own World, W(3) and propositions which assert states of affairs obtaining in that new World are interpreted relative to the timeline in that World.[18] .

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[18]While a newly established temporal reference point established in a dcu interpreted relative to one World _may_ be interpreted as subsequent to the last time point referred to in a previous unit associated with a different World, there is no necessity for this to be the case. The Strong Narrative Constraint is therefore not violated by the fact that the first event E3 detailing Sue's activities does not receive an interpretation at a time pint subsequent to be temporal interpretation point of E2. We shall discuss other counterexamples to the Strong Narrative Constraint below in the following section

Attaching *Sue ate lunch at the coffee shop*. involves the creation of a new

coordination node immediately dominated by the node corresponding to the initial

question. The narrative dcu detailing **John's** activities is the leftmost sister in this

new coordination unit and *Sue ate lunch at the coffee shop* is the rightmost sister

(In order to represent as much of this complex discourse as possible, we shall not

write out the full node label on each node but identify nodes not immediately relevant

in the analysis by their simple letter names).

DPT2-3
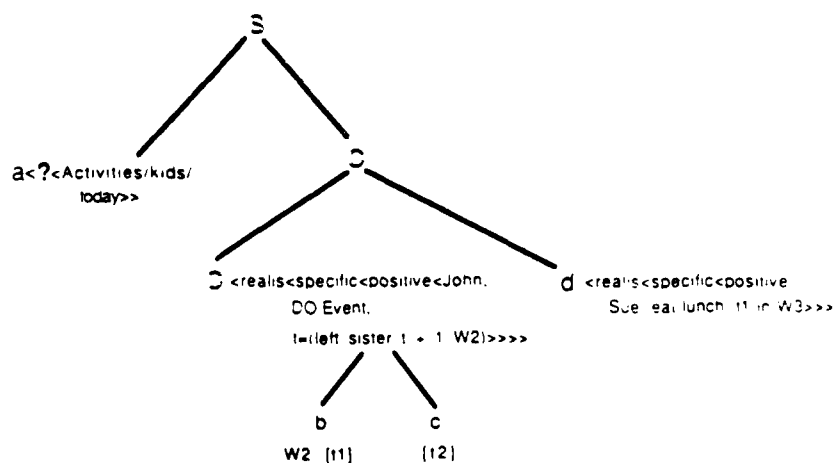
At this point, the dcu detailing **John's** activities is closed and is no longer

accessible for future clause attachment   Subsequent discussion of **John's** activities

must be attached to the DPT in terms of a different dcu   How that dcu will be

attached to the Tree will depend on the state of the Tree at the time the clause is

parsed

Adding clause e *She went to pick up her trophy later in the afternoon* and

clause g *Then she met us at the tennis court* to the developing Tree is unproblemat.

The final Tree for this discourse is as shown
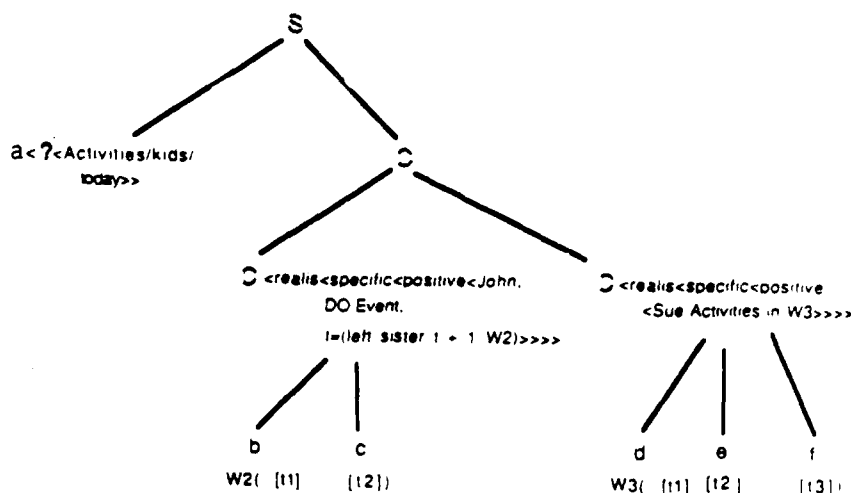
5.3 Narrative Complexities

Our experience of both literary and conversational story texts suggest that time marches resolutely ahead in narrative -- although we commonly encounter event clauses such as those in the previous example which can not be given an interpretation at the next instant following the previous event encounter int he text. This presents an apparent problem for the position. which we shall refer to as *the Strong Narrative Hypothesis* which asserts the inviolability of the *Strong Narrative Constraint* (SNC) in discourse structuring.

The *Strong Narrative Hypothesis* (SNH) predicts that the temporal reference point in narrative discourse is advanced forward along a time line by telic event clauses which encode. in syntactically main clauses. propositions whose instantiations are *noniterative. non-habitual* and *temporarily bounded*
[37] [75] [38] [31] [47] [55] [35] [20] [22] [6] etc   When the event clauses in narrative texts. such as conversational stories. planning sessions. or written novels

are abstracted out, however, it is clear that not all event clauses necessarily
participate in the narrative "main line" by advancing the temporal reference point of
the story or plan. Some event propositions may be interpreted at the same moment or
even at a time point previous to events which precede them in the text. [46] In
modelling discourse it is most important to remember that, theoretically, at least at
any time any speaker may utter any clause at any time and that event clauses are no
exception to this. The question then becomes which event propositions encoded in
precisely which event clauses on the surface structure of the discourse participate in
a given narrative unit?

As was the case with the topic-chain dcu, the structures of discourse get more
complicated when we deal with more complex, attenuated discourses. There are a
number of phenomena which present apparent counterexamples to the Strong Narrative
Hypothesis but which are resolvable after taking into account the hierarchical nature
of the source text, and the need to associate different semantic representations with
structurally different discourse units. We have dealt above with the case of a text
which consisted of two coordinate narrative dcu's in which the structurally "later"
than the event clauses participating in the first dcu. Now we shall deal with three
more apparent problems for the Strong Narrative Hypothesis: *flashed sequences*
(flashbacks and flashes ahead function identically), *governed main clauses*, and
narrative repairs. We will continue the development of the example of **Sue** and **John**
to illustrate how flash sequences are dealt with the LDM framework.

Narrative Example 4

a. What did John and Sue do today?

b. John got up late. E1
c. He played tennis at four o'clock. E2

d. Sue ate lunch at the coffee shop. E3
e. She went to pick up her trophy later in the afternoon. E4

f. Then she met us at the tennis court. E5
g. She had left her car in the parking lot at school. E6
h. She picked it up. E7
i. She drove home first. E8
j. Then she met us at the tennis court. E9
k. Then we all went to get a soda. E10

DPT NARRATIVE 3-1
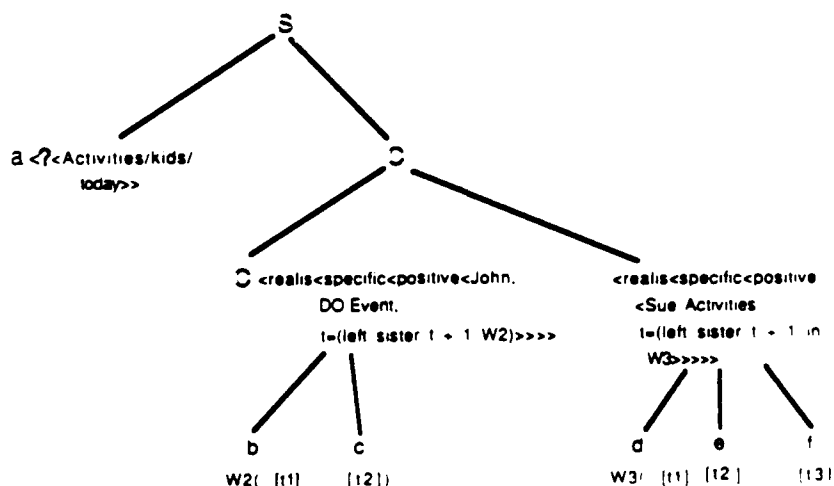
We shall treat clauses g-j.

g. She had left her car in the parking lot at school. E6
h. She picked it up. E7
i. She drove home first. E8
j. Then she met us at the tennis court. E9

as an embedded flashed back unit. a separate narrative dcu, asserting the states

of affairs in World W(4) with its own timeline initiated by the first flashed clause. g.

She had left her car in the parking lot at school, which is signalled by the use of the

pluperfect tense.

We embed the flashed unit to the narrative mainline because under a LDM

analysis, the flash is interpreted as interrupting the development on the ongoing

narrative List structure   Because a search of the DPT does not reveal any suitable

attachment point for g above the mainline narrative. the flashed dcu is embedded

relative to the mainline narrative dcu detailing Sue's activities as shown (since the coordination of the narrative dcu presents no new information about the parser's operation, we will just give one DPT for the entire flash unit attachment process)

DPT NARRATIVE 3-2
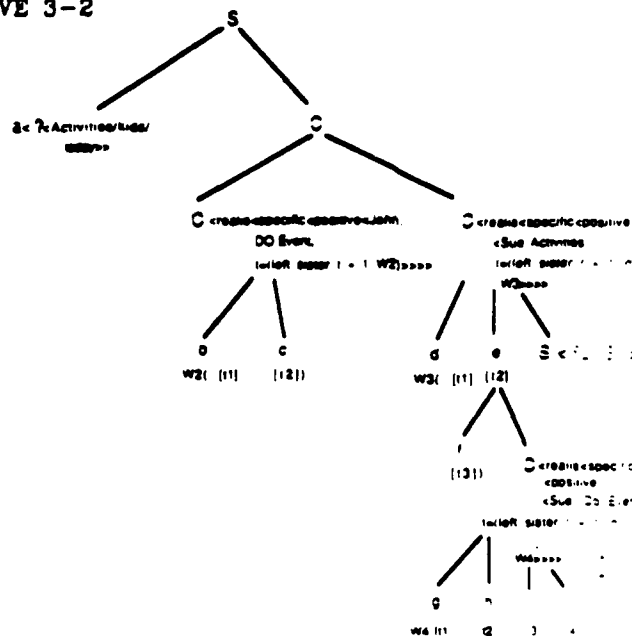
Structurally, the state of the Tree expects a POP or return to the mainline narrative after completion of the flashed unit. When this return occurs, the correct temporal interpretation information for the clause is available at the node immediately dominating the last mainline clause parsed [19]

The next clause in the discourse, J *Then she met us at the tennis court* is structurally interesting. Although it is encoded as a full proposition carrying clause J functions in the discourse as a POP marker -- signalling a return to the mainline from the PUSHed flashed constituent. It does not signal a <u>second</u> meeting to have

---

[19] The information at that node requires updating of a temporal register in the context frame associated with the narrative list dcu by one when a next event clause in the World associated with the dcu is parsed

taken place at the tennis court after the first meeting (at t^3 in W(3)) but merely
signals the re-union of the timelines of the two units. the flashed dcu and its
embedding mainline dcu. (The use of repetitions for discourse structural marking is
widespread. See discussion of *the True Start Construction* below.) Then *She met us at
the tennis court.* does not advance the timeline in W(3) and it is not represented in
the DPT as an independent element because it is functioning only as a *well, so,
anyway* might function -- to indicate specific structural aspects of the discourse.

Clause (k). *then we all went to get a soda.* is evaluated at t(4) in World(3)
resuming the interrupted narrative mainline dcu as shown in DPT 3-3.

DPT NARRATIVE 3-3
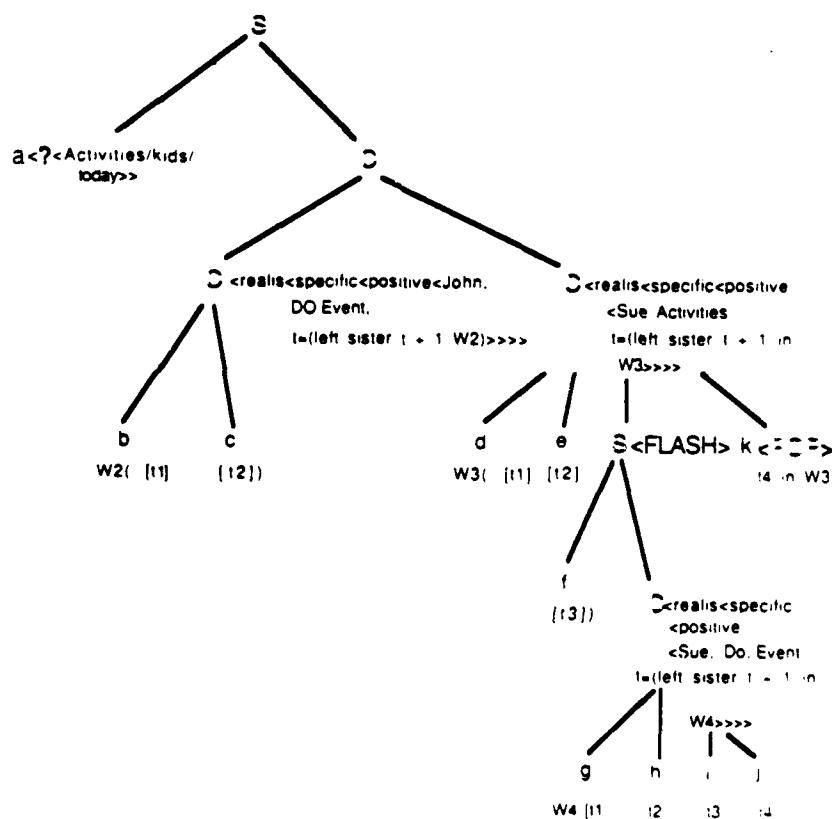
5:4   Governed Main Clause

A less well known and more serious challenge to the Strong Narrative Hypothesis than the flash sequence, comes from event clauses in *Governed Main Clause* (GMC) [57] constructions. Governed main clause constructions consist structurally of a semantically underdefined clause which is expanded upon by one or more immediately following syntactically main clauses which semantically supplete the underdefined proposition.

Since a Governed Main Clause is an expansive unit which only gives more information about what was meant by a preceding clause, but does not push the narrative forward at all, the Governed Main Clause unit is treated as off the main time line -- structurally embedded relative to the higher order object which it is expanding upon. The three events encoded in the Governed Main Clause construction -- although syntactically main clauses -- are semantically subordinate structures in the discourse context in which they occur. They do not stand alone but merely clarify and elaborate upon a state of affairs expressed in an earlier clause. They are thus to be considered a separate discourse chunk -- embedded relative to the main storyline. Like other embedded units which interrupt the forward progression of a discourse structure under development, they are separate from the embedding unit, are interpreted relative to their own world W(2) and participate in the temporal structure of that world.

5.4.1   Governed Main Clause: An example parse

The following discourse modified from a complex oral story provides an example of this discourse phenomena which all of the clauses in this text are event clauses, attempting to interpret them in strict chronological order will lead to the wrong semantic interpretation. The governed main clauses (e-h) are underlined:

Governed Main Clause

a. He told us, (E1)
b. "Stop someone on the street. (E2)
c. Ask him if the apartment a good price." (E3)
d. So that's what we did. (E4)

e. We went to the street corner. (E5)
f. We stopped a married couple. (E6)
g. We asked them if we should take the apartment. (E7)
h. And they said "yes". (E8)

i. So we went back and rented it. (E9)

In this discourse, clause (a), matrix of the reported speech segment, *He told us.*
Stop someone on the street. Ask him if the apartment is a good price. is an event
clause with interpretation time t1 (W1). Because reported speech dcu's are uniformly
treated as embedded relative to mainline dcu's in the LDM framework −− the narrative
grammar expects another event clause which moves the time line ahead and not a
digression a semantic space called into being by the reported speech −− clauses b
and c, encoding events E2 and E3 are embedded relative to clause a and are
interpreted at timepoints t1 and t2 in W(2) respectively. Clause (d), the semantically
underdefined clause, *So that's what we did.* which encodes event proposition E4,
resumes the narrative mainline and is interpreted at t2 in W(1).[20]

Governed main clauses (e), (f), (g).

e. We went to the street corner. (E5)
f. We stopped a married couple. (E6)
g. We asked them if we should take the apartment. (E7)

appear to encode the same information as clause (b). Since e−g are also event
clauses, we appear to have a violation of the Strong Narrative Constraint which
requires that events to be interpreted at distinct *unique* moments in time and that

---

[20]Note the use of *So* functioning as a POP marker signalling the return to the mainline
from the embedded reported speech dcu.

sequential events obtain at ordered instants along the time line. However, upon closer examination, it is clear that *So that's what we did.* encodes a semantically underdefined event proposition. Without the gloss provided by the events e-h

    e. We went to the street corner.
    f. We stopped a married couple.
    g. We asked them if we should take the apartment.
    h. and they said "yes"

we would not know exactly what had occurred. Clauses (e), (f), and (g) provide an elaboration of what was meant by *did* —semantically expanding on it. (Clause h continues the development of the event chain initiated in (g).)

5.4.2 Constructing the Discourse Parse Tree for the Governed Main Clause

Clause e begins the semantic expansion. The LDM requires an elaboration to be embedded relative to the dcu encoding the proposition(s) suppleted if the elaborating clause immediately follows the suppleted proposition. Therefore, an elaboration dcu is created. Clausal dcu e is embedded relative to clausal dcu d under the new elaborative unit.

DPT 4-1
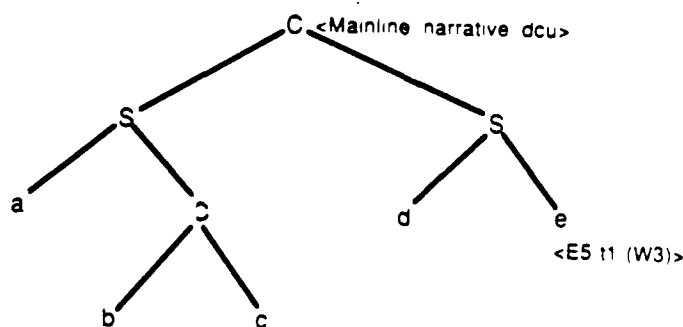
An elaboration dcu is associated with its own interpretive World with its own timeline. Event (e) is interpreted at T(1) in this newly invoked World, W(3).

DPT 4-2
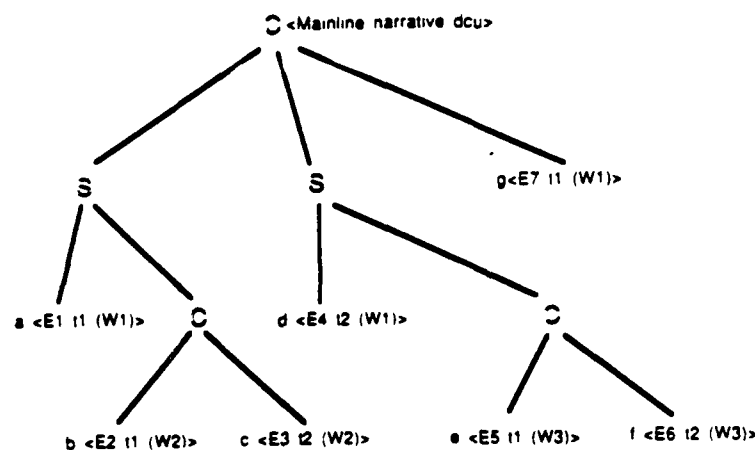
Clausal dcu (f) develops the elaboration of what was done, encoding Event 6 at T3 in W(3). Dcu f is coordinated with dcu e under a newly created coordination dcu which subsequently accommodates successor clauses (g) and (h).

DPT 4-3
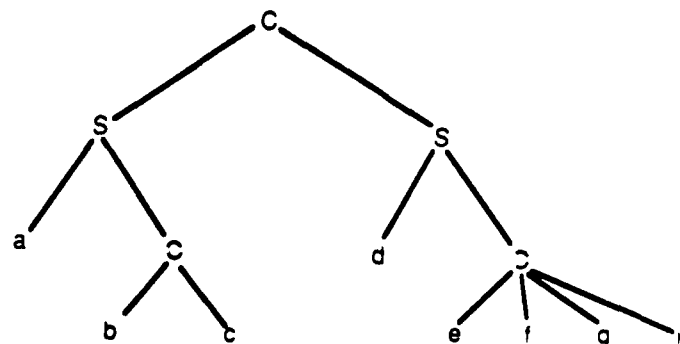
Clause (i) resumes the narrative mainline

DPT 4-4
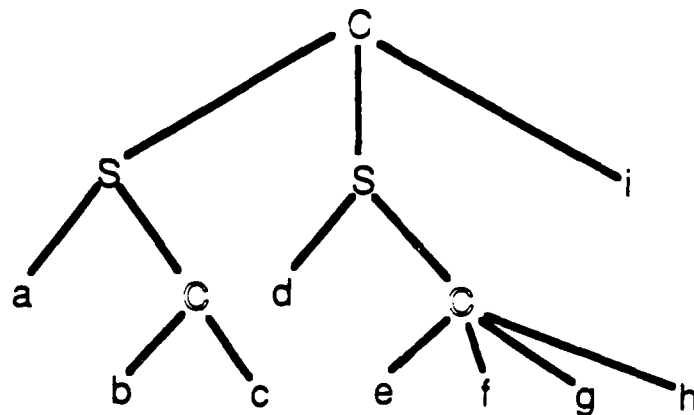
5.5 Hearable Repairs

The LDM predicts that the discourse.

HEARABLE REPAIR EXAMPLE

a. John went to school. E1
b. He played tennis at four. E2
c. He had lost his racquet last week. E3
d. He had found it before his lesson. E4
e. Then he watched T.V. E5
f. He was glad he found it. (it=racquet) E6

would not be said with an even intonation   E6 *he was glad he found it.* would be made

hearable as a repair, by the use of some kind of marker on the surface structure of

the text, which would signal that (f) *He was glad he found it.* does not follow the

normal ordering   *Boy, was he ever glad he found it?* said in a marked intonation

would be one way to signal the deviant nature of the discourse.

While, this argument may seem somewhat arbitrary and unconvincing very simple

cases are looked at as the discourses get longer and more complex, it is easier to see why "returnability" is a very real issue.

Consider the following string of event clauses:

a.   John went to school. E1

b.   He played tennis at four. E2

c.   He had lost his racquet last week. E3

d.   He had looked for it. E4

e.   He turned on the T.V. at 7. E5

f.   He found it at just when the courts filled up. E6

g.   He went to bed at 10. E7

h.   He called his mother from the tennis court. E8

i.   He woke up at eleven. E9

j.   And asked for a glass of milk. E10

k.   When he told her, he pretended it was gone for good. 11

This discourse consists of two narrative lines interleaved with one another.

Despite differences in subject matter clearly recoverable in each sentence, we can not parse this text easily.

E1, E2, E5, E7, E9, E10 form one narrative line:

John went to school. E1

He played tennis at four. E2

He turned on the TV at seven. E5

He went to bed at ten. E7

He woke up at eleven. E9

And asked for a glass of milk. E10

while clauses E3, E4, E6, E8, and E11 form a separate narrative which concerns events
which took place before the recital of John's day and concern his problems with a lost
tennis racquet.

He had lost his racquet last week. E3

He had looked for it. E4

He found it just when the courts filled up. E6

He called his mother from the tennis court. E8

When he told her, he pretended it was gone for good. E11

The structure of the DPT does not allow coordination at a closed off node - The
rules of discourse formation are violated by the attachment of new constituents at
nodes in the Discourse Tree rendered inaccessible by discourse POPping. Thus event
clauses E3, E4, E6, E8 and E11 can not be coordinated into one unit after the POP at
E5.

Under the LDM analysis the DPT for this discourse has the following structure
IS:

and not

$\bigcirc$<MAINLINE NARRATIVE, (W1)>

e1<t1 in W1>   S<FLASH>   e5<d3 (W1)>

e2<t2 (W1)> $\bigcirc$<NARRATIVE(W2)>

e3<t1 (W2)>   e4<t2 (W2)>   e<t1 (W3)>
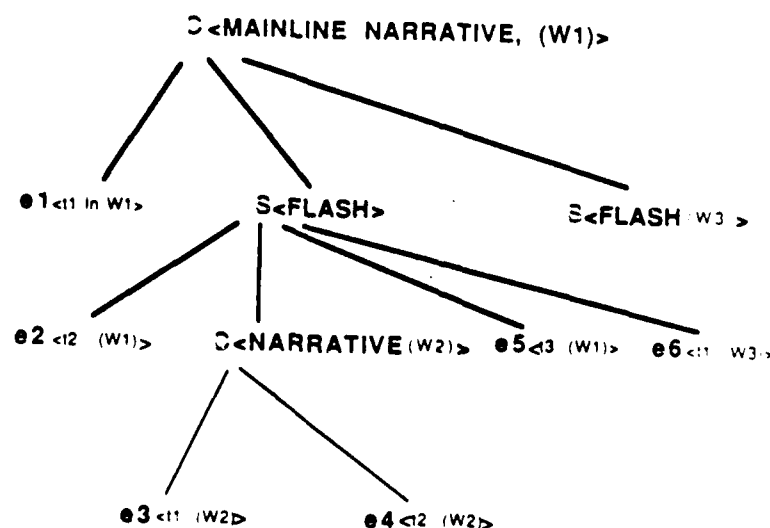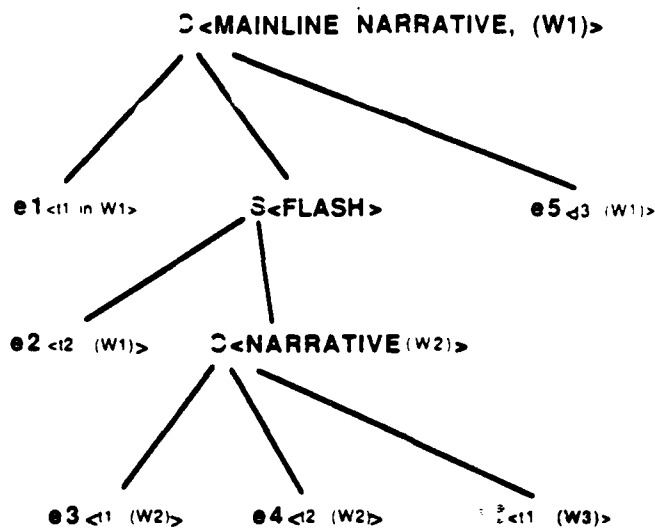
Our analysis suggests that the difficulty in understanding this text has its origin in processing difficulties. we believe that attempts to "force" coordination semantically causes confusion and comprehension breakdown. Discourse may have the properties we are suggesting simply because of the cognitive overload resulting from trying to keep track of several "lines of thought" at once.

6. HIGHER LEVELS OF THE DISCOURSE CONSTITUENT HIERARCHY

6.0.1 Introduction

Thus far, in our discussion of the operation of the LDM, we have focused our attention on the construction and organization of dcu's, the linguistic unit of discourse construction in this theory.

However, in accomplishing our interactional and communicative purposes through language we make use of discourse constituent units in order to further higher-level communicative aims. No one has the intention of uttering a dcu just as no one intends to accomplish the exchange of well-formed linguistic strings by uttering sentences. In our interactions with one another we have goals and purposes which we try to accomplish through the use of language. With the LDM, our goal is to explain how speakers achieve their goals and purposes by exploiting the discourse structuring conventions of language, constructing discourse surface structure by means of dcu formation rules and strategies.

The kinds of activities which we are engaged in with one another, can involve the construction of such units as answering a question, telling a story, giving a description, registering a complaint or communicating a reaction to a stimulus. These kinds of genre units are in themselves uttered relative to interactional contexts in which real world speakers engage in meaningful activities with one another, transacted through the exchange of information which they choose to encode using one of these genre forms.

Discourse Units, are structured, linguistically-encoded objects in which some conventional organization of information is used to encode semantic context of known

types in order to build a coherent picture of the states of affairs obtaining in some

world of interpretation. *Stories, reports, arguments* and *proposals,* are Discourse Units

often encountered Discourse Units such as stories or reports are responses to

external phenomena, while the Discourse Units themselves are constructed relative to

real or modelled communicational contexts in which speakers are engaged in

meaningful activities with one another. Therefore, the Linguistic Discourse Model's

Discourse Constituent Hierarchy recognizes two further levels of structure: the

Speech Event and the Interaction. We shall discuss these levels of discourse structure

after discussing the Discourse Unit in some detail.

7. DISCOURSE UNITS: INTRODUCTION

On the surface, Discourse Units are constructed of one or more dcus. The constraints on a dcu participating in a DU of a particular sort is that the context values of any dcu must be subsumable under the context values of the Discourse Unit at large. Thus, the participants' time and spatial indices of all dcus that participate in a given Discourse Unit must be subset of the objects accessible by the indices established by the context parameters of the higher-level unit. A narrative dcu for example, may form the main structural element of a story or planning session. All constituent elements of the narrative dcu must encode propositions with temporal interpretation in the mainline narrative world as we have proposed earlier. Therefore, if a narrative dcu clause (x) participates in the structure of a story Story (y), all temporal indices of World (x) must obtain in the World of Interpretation associated with Story World (y).

We shall provide an examinative of Discourse Units through a discussion of the most widely studied discourse genre structure — the *story*. We shall present first a discussion of the *Canonical Story* and develop a *Canonical Story Grammar*. Then we shall go on to describe a violation of Canonical Story Ordering which can be explained .n terms of embedded discourse units interrupting the construction of the story DU. We shall find however, that we can not explain all interruptions with reference only to the dcu and DU levels of structure and we shall then return to the discussion of the

    .rse Constituent Hierarchy to discuss the role in discourse structure played by

      ;ee n Event and Interaction — socially salient units which impact linguistic

    ‘.   ‘r, ‘ure in important ways.

7.1   Stories: Specific Past Time Narrations Which Make A Point

7.1.1   The Story Structure

Stories are *Specific Past Time Narratives which make a point*. Linguistically,
stories exhibit a relatively conventional structure. Event clauses which encode event
propositions true at one instant in the past–time world form the "mainline" or
"backbone" of the story. Stories commonly contain "flashed sequences" as well in
which the presentation of information about the states of affairs in the storyworld
through time does not mirror the order in which those states of affairs obtained.
Story texts also consist of durative–descriptive clauses, however, which encode
durative–descriptive or state propositions describing states of affairs true for more
than one instant in the same past–time story world. Syntactically, state clauses
exhibit properties distinct from those of the event clauses —— they occur in all these
and modalities, and may be iterative, or habitual. They are always non–punctual.

Stories are built around *a plot* structure. Beginning with Propp a great deal of
work was done within literary theory on identifying the ingredients of a "minimal plot".
[60] Eventually, the minimal plot was characterized of consisting of an initial "lack"
state obtaining in a storyworld which is "liquidated" through the action of the
story. [5], [19], [58]

Put more simply, a minimal plot requires a state change: a state of affairs
obtaining in the storyworld is altered by an event which occurs during the course of
the story irrevocably changing the world in a way deemed significant. Structurally,
the "peak" of the story occurs at this moment —— when a crucial state is changed by
a crucial event.

Once the peak is reached, inferring the point of telling the story is a process in the part of the story recipient of generalizing to the actual world facts of the specific storyworld which identify who has been rewarded or punished and what occurred to bring about the deserved or cruelly unfair fates of the central protagonists and other characters in the modelled world. The nature of the change itself and the way in which it comes in the story states a truth about point the nature of the storyworld and, by extension, about the nature of the world in which teller and recipients both live.

To mark that some states and some events are more important than others, speakers create an evaluative meta−structure, making use of evaluative devices −− encoding forms which differ from the local norm of the text −− to mark the degree of saliency to be accorded each proposition −− the more salient a proposition to the point of the story being made by the telling, the more highly it will be evaluated. [38] [48] [49] [50] [54]

The most highly salient event −− as determined from the degree of evaluation it was accorded −− taken together with the most highly evaluated state normally constitutes the *core* or *minimal plot* of the story.

7.1.2 The Temporal Structure of Stories

General rhetorical strategies −− which need not be universal −− guide the organization of discourse units. The unmarked linguistic realization of story organization calls for us to encode the propositions with wide temporal scope first. This is a generalization of what we could think of as unmarked discourse organization strategies of English:

All thing being equal, order:

```
Known before Unknown
General Before Specific
Here, before There
Now, before Then
Real before Hypothetical.
```

In short, **Close before things Remote**.

This implies that for the unmarked linguistic realization of stories is that a storyteller should encode propositions with scope outside the storyworld before propositions with scope exclusively internal to the storyworld.

Universally True propositions -- those with the interpretation always true at all times and places, within the story world and outside of it are encoded first; followed by those *Generally True* propositions which are interpreted as true, both in the storyworld and in some sort of limited context beyond it though not necessarily in times and places removed from the currently relevant.

Following Generally True propositions, *Storyworld Universal* states which are universally true at all times in the story world are asserted, and then those propositions which give information about states obtaining initially in the story world. Finally the first specific past time state of affairs -- or *event* -- with an interpretation of true at only one moment in the Storyworld is asserted followed by other Storyworld internal events -- interleaved if necessary with states of affairs whose duration is bounded by the discrete instants demarcated by the events. -- The narrative line itself culminates with the last state or event with scope entirely within the story world.

We can summarize the encoding strategy of the temporal structure of the Canonical

Story as follows:

```
Always happens in all worlds;
Always happens in the story world and in its surrounding context.
Always happens in the story world.
Circumstances in the story world just before the first event.
First event.
Events and states delimited by events.
Last event.
Circumstances in the story world just after the last event.
Always happens in the story world.
Always happens in the story world and in its surrounding context.
Always happens in all worlds.
```

Moving perceptual from the **Universally True**, through the **Generally True**, to the

Storyworld Universally True, to the **Storyworld Initially** obtaining states to the

Storyworld Here and Now has been termed the *funnel effect* [12].

Entry into the Storyworld from the world which includes both the Now and Here

of the Telling World and Past and There of the Storyworld is through the "backdoor"

at the past timepoint most remote in time from the perspective of the Teller's World.

By funneling through States with scope more and more confined to the Storyworld a

transition is made in the text from the Here of the Telling to the There of the

Storyworld. Once There, marked by Storyworld Initial states which are only Storyworld

True, time normally moves from the past forward into the present. Eventually the

Storyworld approaches the Telling World in time -- the moment of the last Past Time

Storyworld event is necessarily closest in Time to the telling World and allows for a

smooth transition out of the Storyworld by the optional Coda. [76] The Coda initiates a

reverse funnel structure. Narrow scopes states which obtain partially in the

Storyworld and partially in the Telling World are followed by clauses encoding states

with increasingly wider scopes, until a final exit from the Storyworld is accomplished

through the Generally True and finally Universally True propositions. These last,

equally True in both worlds, may serve as a moral commentary on what has transpired

in the Storyworld -- making explicit the applicability of the generalization to be

drawn from the Storyworld course of events to the Telling World -- and thus to the

recipients' own concerns.

In the following section, we shall express these constraints on temporal scope

propositions in more formal and conventional terms -- incorporating them into a

Story Grammar for the Canonical Story.

7.1.3   Story Grammar, Story Grammars, and a Story Grammar

Stories have long been described as having some sort of global structure. In our

version of the Classic Aristotelian Story Grammar, *the Abstract*, which is optional, tells

about the story which is going to be told while the *Orientation* section gives

information about the world in which the story takes place. This is followed by *a Plot*

involving a possible complicating actions and necessarily includes critical change of

state at the peak, which results in the resolution of some storyworld imbalance. The

Story telling ends with a *Coda* in which the events of the story world are tied to the

events of the world of the telling. [37]

In graphic representation of this structure, we show the Abstract and Coda as

peripheral to the story proper which consists of propositions describing states of

affairs obtaining in the storyworld. The Story consists of an orientation section

providing background information followed by the plot.

Global Story Structure

```
┌─────────────────────────────────────────────────────┐
│  ABSTRACT                                             │
│   ┌─────────────────────────────────────────────┐    │
│   │  ORIENTATION                                  │    │
│   │   ┌──────────────────────┐                    │    │
│   │   │ COMPLICATION         │                    │    │
│   │   │                      │                    │    │
│   │   │ PEAK                 │                    │    │
│   │   │          PLOT  STORY    PERPHERY  TELLING  │    │
│   │   │ RESOLUTION           │                    │    │
│   │   └──────────────────────┘                    │    │
│   │                                               │    │
│   │  CODA                                         │    │
│   └─────────────────────────────────────────────┘    │
│                                                       │
└─────────────────────────────────────────────────────┘
```
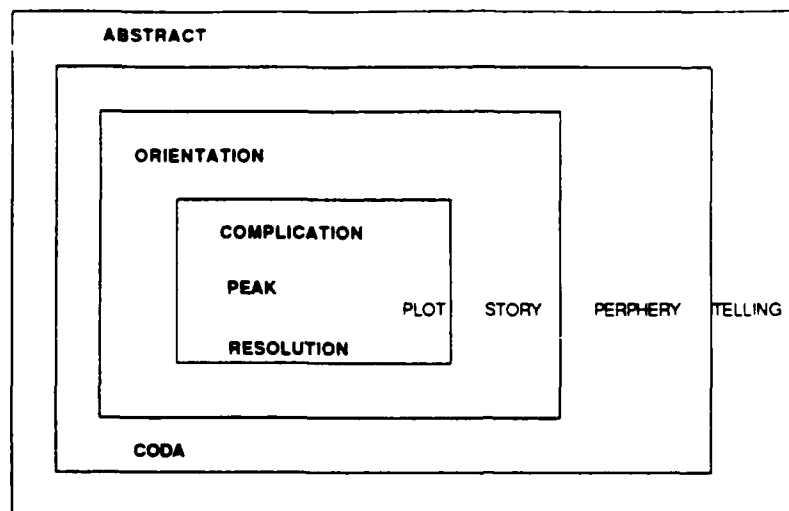
This allows us to build the following story grammar.

STORY GRAMMAR 1

$$\text{STORY} \longrightarrow (\text{ABSTRACT})(\text{ORIENTATION})(\text{EPISODE}^{+})\text{PEAK}(\text{EPISODE})^{+}(\text{CODA})$$

$$\text{EPISODE} \longrightarrow (\text{STATE})^{+} \text{ EVENT}(((\text{EVENT})^{+})(\text{STATE})^{+}))^{+}$$

in which a story can be rewritten as an optional **Abstract** followed by an optional orientation, followed by one or more optional **episodes, a Peak Episode**, one or more optional **Episodes** and an optional **Coda**. Each episode can be seen as consisting of one or more events and optional states. Semantic interpretations rules specify that the **Story** takes place in some sort of space/time character frame, while any **Episode** of that same **Story** will necessarily occupy some subset of that same frame.

This Story Grammar -- a stripped down model -- is not significantly different from other story grammars which have been proposed and is similarly unsatisfactory

Combining the insights into clausal scope ordering and encoding form constraints from the above discussions with the Story Grammar presented above results in the following Grammar of the Canonical Story.

GRAMMAR OF THE CANONICAL STORY

$DU_{Canonical\ Story} \longrightarrow$ (ABSTRACT) STORY

$ABSTRACT_x \longrightarrow STORY_x$

STORY $\longrightarrow$ (ORIENTATION) EPISODES$^+$ (CODA)

ORIENTATION $\longrightarrow (dcu_{generic})*(dcu_{limited\ scope})*$

EPISODE $\longrightarrow$ (ORIENTATION) $dcu_{narrative\ line}$ (CODA) $(dcu_{event})+$

$dcu_{narrative\ line} \longrightarrow dcu_{event} \{(dcu_{state})*dcu_{event}\}+$

$dcu_{narrative\ line} \longrightarrow dcu_{event} \{(dcu_{state})*dcu_{event}\}+$

CODA $\longrightarrow (dcu_{bounded\ state})* (dcu_{janus\ state})*$ (dcu generic)

The story grammar is a set of re-write rules which describes a Canonical Story as consisting of an optional **Abstract** followed by the **Story**.

$$DU_{Canonical\ Story} \text{ ---> (ABSTRACT) STORY}$$

The Abstract must be an Abstract of the Story which is told.

$$ABSTRACT_x \text{ ---> } STORY_x$$

The story itself consists of an optional **Orientation** section, followed by one or more **Episodes**, followed by an optional **Coda**.

$$STORY \text{ ---> (ORIENTATION) EPISODES}^+ \text{ (CODA)}$$

Orientation consists of an optional set of clauses encoding generic propositions, followed by an optional set of clauses encoding propositions of limited scope with the operant scope of the states of affairs describing becoming increasingly restricted.

ORIENTATION $--->(dcu_{generic})^*(dcu_{limited\ scope})^*$

Orientation to the Story is followed by one or more **Episodes**. Each Episode consists of an optional **Orientation**, followed by a **Narrative Line**, followed by an optional **Coda**.

EPISODE $---> (ORIENTATION)dcu_{narrative\ line}\ (CODA)\ (dcu_{event})+$

The **Narrative Line** consists recursively of one or more **Narrative Lines**, one or more **Events**, or, of an **Event** followed by one or more **States**, followed by one or more **Events**.

$$dcu_{narrative\ line} ---> dcu_{event}\ (dcu_{state})^*dcu_{event}\}+$$

The **Coda**, following the last event of the **Story** is expressed through zero or more state clauses which obtain only in the storyworld for a limited period beginning with X including the time point of the last event. These *bounded state clauses* are followed by one or more clauses encoding states of affairs which are true both in the story world and in the world of the telling *Janus states*, followed by clauses which encode states of affairs with increasingly wide scope. **Coda** final propositions are Universally True.

CODA $--->(dcu_{bounded\ state})^*\ (dcu_{janus\ state})^*\ (dcu_{generic})$

7.2 Narrative Order Despite Seeming Disorder

Serious consideration of the transcription of a story told in an everyday conversation may seriously call into question the usefulness of the Canonical Story Grammar described above. The analyst may be faced with apparently pervasive counterexamples to the generalization captured by the Grammar. *Asides,*

question/answer sequences, flashbacks and *flashaheads, corrections* and *true interruptions* disturb the recital of states of affairs in the storyworld while those assertions about the storyworld which are uttered may appear hopelessly out of order. generic orientation information, for example, may appear well after the beginning of the narrative proper. We shall argue the LDM provides a useful theoretical perspective for understanding how storyworld order can be recovered from storytelling disorder.

It is important to point out, that as treating all disruptions uniformly as embedded relative to the narrative main line provides an account of the forward movement of narrative time in stories despite surface disturbance, the detailing of scope ordering constraints for stories captured by the Grammar accounts for why generic or state information is structurally *foregrounded* when it precedes propositions with more limited scope, while the identical information encoded in an identical clause further along in the story might well be embedded relative to the ' story mainline. The embedding is purely structural, resulting from its placement in the text and not from its inherent properties as providing general information about the world.

This feature of the LDM captures our intuitive feelings about stories: background information should be given first. If given first, it does not inhibit the development of our understanding of the storyworld but is exactly what is needed. Orientation information which follows the start of the narration proper has a different status, seemingly slowing down the forward progression of a tale.

A full discussion of story deviators and an account of their treatment under an LDM analysis lies beyond the scope of the present paper. We shall confine ourselves, therefore, to a brief presentation of one reasonably pervasive storytelling deviation phenomenon. the True Start analyzed informally elsewhere. [48] [55]

7.2.1 True Starts

Like the Governed Main Clause, the True Start Construction is not uncommon in

conversational story texts. In a classical True Start construction, a speaker has

begun presenting Storyworld Events and then switches back to wider scope stative

clauses -- Universally True or Storyworld Initial state propositions, for example --

inserting background information which interrupts the man line of the telling. Having

completed the wide scope propositions, the teller resumes the main line of the

interrupted story by the simple and expedient device of repeating the propositional

content of the clause which immediately preceded the inserted material as in this very

slightly modified except from a short conversational story. In the following excerpt

taken from a short conversational story the repeated first event clause is underlined

while the "background" – Universally True and Storyworld the initial state clauses are

in italics.

<p align="center">"Eating on the New York Thruway"</p>

E. (29) I mean ... (30) I mean ... (31) Did I ever tell you the story
about the water (32) I mean (33) the coke? (34) <u>I went in</u> ... *(35) I
always drink coke, (36) right* [L. *(37) Right*] <u>*(38) so L. is thr ...*</u>
*(39)walking around with this gallon of spring water (40) and I can't
understand (41) why she's walking around with this gallon of spring water
(42) and she keeps talk ... (43) she keeps telling me these vague ...
(44) making these vague comments about the restaurants on the New York
Thruway (45) and at least we have this spring water (46) and I don't ..
(47) you know (48) I don't know what she's talking about* (49) <u>so we go
to this restaurant</u> ... (50) and I order a coke ... (51) and I ordered
some sort of sandwich

In the LDM analysis, the segment of text which constitutes a deviation from the

information ordering required by the canonical story grammar is *embedded* relative to

the mainline story events.

In a true start construction, the repetition of the propositional content of the

clause immediately preceding an "interruption" in another clause signals the end of

the interruption and a POP from the embedded talk to the higher level constituent

<p align="center">85</p>

dominating it. In "Eating In the New York Thruway", it is asserted that E and L enter the restaurant only once despite the repetition of the encoding of the entering proposition in two clauses (34) *I went i..* and (49) *so we go to this restaurant.*

Structurally viewed, a "True Start" is a repair at the level of global structure: because of a violation of the Wide Scope Before Narrow Scope Constraint, in "orientation"/"background" material placed after first event: a repair is necessary to re-establish the lines of narrative structure:

> (34) I went i ... [EVENT]
>
>> (35) I always drink coke, [UNIVERSAL] (36) right.
>> (37) Right. (38) so L. is thr... (39) walking around
>> with this gallon of spring water (40) and I can't
>> understand (41) why she's walking around with this
>> gallon of spring water (42) and she keeps talk ...
>> etc. [DURATIVE/WIDE SCOPE]
>
> (49) so we go to this restaurant.

In this text the event clause are:

EVENT CLAUSES

```
(34)  I went i = (49) so we go to this restaurant E1
(50)  and I order a coke E2
(51)  and I ordered some sort of sandwich E3
```

The semantic event structure can be represented graphically as shown:

EVENT STRUCTURE

```
                 (34)    (49)   (50)    (51)

   CLAUSE        e1      e2     e3      e4
                  \     /        |       |
                   \   /         |       |
   PROPOSITION      E1          E2      E3
                     |           |       |
                     |           |       |
                     |           |       |
   TIME POINT       t1          t2      t3


                      t0 —> n
```
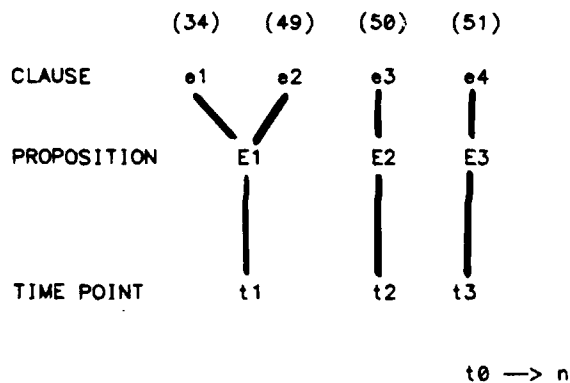
Although, this small excerpt the embedded constituent signalled by the true start may include event clauses, like flashbacks, event clauses located within "true starts" may encode event propositions which describe states of affairs in the storyworld which occurred previous to a last mainline event, just as events in flashed sequences do not participate in the time line of the interrupted story mainline, true start events do not cause any disturbance to the narrative time line of the story proper. We interpret these events relative to an embedded context –– the true start context –– which has its own spatial and temporal indices.

So far, we have concentrated our attention on the linguistic units of structures –– the dcu and DU particular. All clauses, however, are uttered relative to some sort of social context in which one person functions as hearer and another as speaker. We will now turn our attention briefly to *adjacency structures*, discourse units, which are an important resource in the creation and maintenance of interactive talk.

7.3 Adjacency Structures

Adjacency structures such as *greetings, question/answer pairs* and
compliment/response sequences are used in interactive talk to accomplish specific
tasks: to signal mutual engagement in the Interaction, to accomplish the exchange of
requested information or permit the complimenter and recipient to negotiate the
complimenter's making explicit his positive evaluation of some aspect pertaining to the
recipient. One feature of these *Discourse Adjacency Units* is that one speaker's
utterance of the first constituent of an Adjacency Structure, a *greeting, questioning,
compliment,* or *greeting,* to use our examples, implicates the recipient to produce the
next constituent. Not to do so is conversationally inappropriate and may require
repair at a later point in the talk. [70] We may find examples as follows:

A. Hello

B. What a nice dress

A. Thank you

B. Oh. Hello! by the way

In which the conventional "Hello" − "Hello" structure of greeting is interrupted
by a "Compliment/Response" sequence. The inappropriateness of the failure to
respond according to the socially salient greeting grammar which calls for a greeting
to be countered immediately with a second greeting is acknowledged by the *Oh'* and *by
the way* which accompany the repairing greeting.

We also find embedded question/answers sequences quite commonly s . : as
Have you seen Jim?
Why do you want to know?
Because he's late for his appointment.
He's in the kitchen talking to Mary.
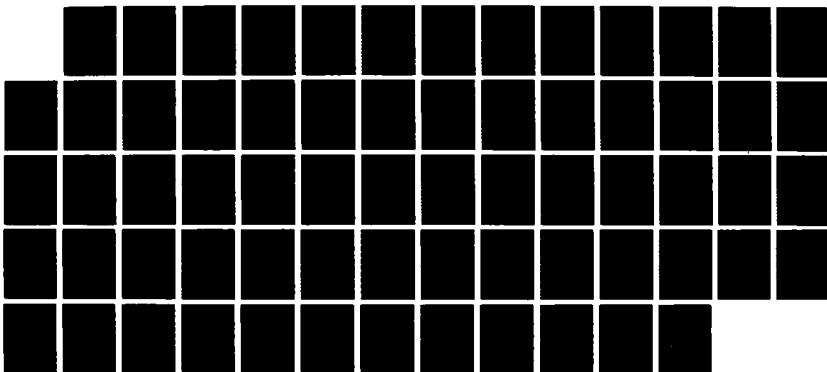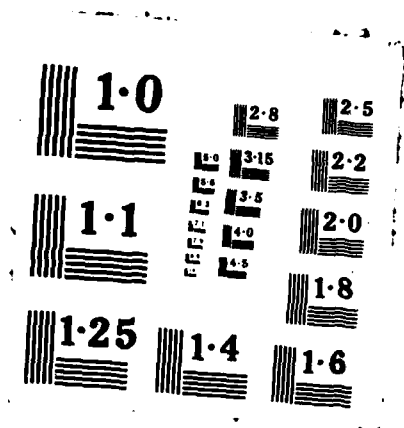
The DPT of this discourse has the form:

DPT
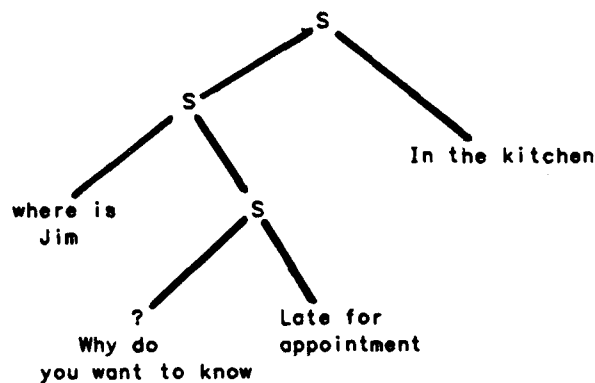
We build it by treating the question–answer sequence *Why do you want to know?/Because he's late for his appointment* as interrupting the completion of the *where's Jim/in the kitchen* sequence.

8. INTRODUCTION: REFERENCE AT THE INTERACTION AND SPEECH EVENT LEVELS

To begin this discussion of the socially relevant dimensions of language use. we will characterize interactively constructed discourse as consisting most globally of a series of co-ordinated and sub-ordinated Interactions, each of which is defined in terms of the participants who are present and feel themselves to be involved with one another in a particular place and time. [10] Thus, if we were to put a microphone down in a room and tape record whatever goes on in it for an entire day, we would expect to segment the talk on the tape into a number of Interactions taking place among those in the room. Some of those Interactions would relate to one another as sister-nodes on a DPT of the talk as a whole, while others, viewed from the perspective of one on-going Interaction as "interruptions" would be daughter-nodes embedded within the "on-going" talk.[21]

To make this a bit more lifelike, let's assume that the "room" which we are taping is a small "examining room" in a medical clinic. During the day, a number of people come into the room, talk with one another there and depart. All the talk which takes place there must be contextualized relative to one or another Interaction among those persons.

If we want to recover the reference for an *I* or *you* spoken in that room during that day, we would have to segment the discourse into Interaction units specifying who the candidates for *I* or *you* were at any given time. Likewise, *now* and *just then* would be interpreted relative to ongoing Interaction time. Spatial deixis would be set relative to the place of the room and placement of the Participants in the room.

---

[21]We will deal briefly with the multiple DPT to reflect different participants' different perspectives in Section 11 below.

In the LDM system, each discourse unit is associated with a Context Frame as was discussed earlier in connection with the dcu. The Context Frames of Interactions and Speech Events are serve as indices on the lower level dcu structures, locating them uniquely in time, space and contextualizing activity. The context frame values for each Interaction correspond to Kaplan contexts of the real world situation in which the Interaction took place. [36] [68] A change at the level of Time, Place, or Participants which is of relevance to the participants involved initiates a new Interaction unit. The temporal index is constantly updated to reflect change in "realworld" time. Should an Interaction be ongoing and a new person arrive in the room, the ongoing Interaction will be redefined to add the new arrival to the Participant set, as would be the case should a *nurse* enter to assist the *doctor* with a *patient*. A separate embedded Interaction may occur, if the *nurse* enters to give the *doctor* a message and then leaves again, for example.

It is important to point out that the persons referred to as *doctor, nurse* and *patient* receive these role titles from the Speech Event, the medical examination, which the participants are carrying out in the Interaction. From the point of view of the Interaction there are three people in the room, let's call them **Allan, Brown** and **Carr**. These three people may be referred to as *you* (singular or plural)by one another while, *we* if uttered by one of them may properly include one or both of the others in an inclusive reading. *I* would be reserved to reflexively refer to one of the three serving as speaker. These three persons carrying out their roles in the Medical Examination Speech Event relate to one another not as three undifferentiated individuals but as three persons with specific duties, responsibilities, and situationally appropriate relationship to one another: *Patient Allen, Nurse Brown* and *Doctor Carr.*

8.1 Speech Events

Speech Events specify the type of activity which in ongoing in terms of the activities which the participants believe themselves to be engaged in. Speech Events constrain appropriateness of behavior, define the roles which the interactants are playing and define the nature of the time and place in which the interacting takes place. [33] As Interactions, dcu's and other discourse constituents, Speech Events may be syntactically related to one another through co—ordination or subordination.

In a given Interaction, one might have more than one Speech Event among the Participants. To return to our three interactants: **Allan, Brown** and **Carr**. These three together in the room we imagine ourselves to be taping may well be *Patient Allen, Nurse Brown and Doctor Carr* at one time in an Interaction — — a Medical Examination Speech Event — — and *Expert Allen, Helpless Client Brown,* and *Helpless Client Carr* in a plumbing emergency — — a Repair Speech Event — — if the radiator were to burst and **Allan**, a plumber by profession, rushed over to deal with the problem. The one Speech Event, the Repair, would then be embedded in the Medical Examination, and one would expect a return to the Examination when the emergency were dealt with. One could also imagine a case in which the two Speech Events were co—ordinate, for example, if **Allan** entered the room to deal with the emergency and *Plumber Allan,* having burned himself, became *Patient Allan* in a subsequent, conjoined Medical Examination in which the burn were dealt with. These two cases are shown graphically below.

SPEECH EVENT EMBEDDED IN SPEECH EVENT   CO-ORDINATED SPEECH EVENTS
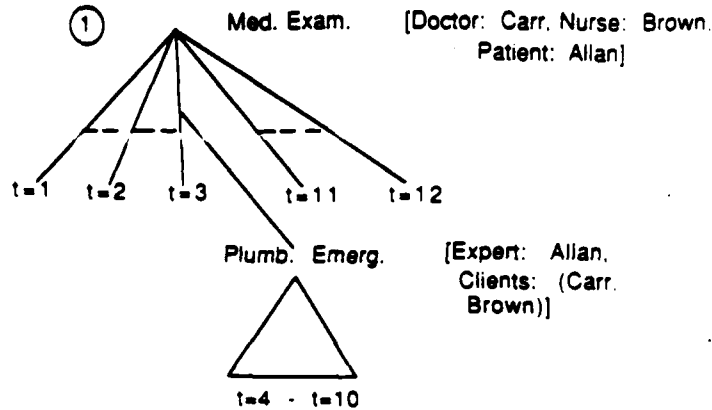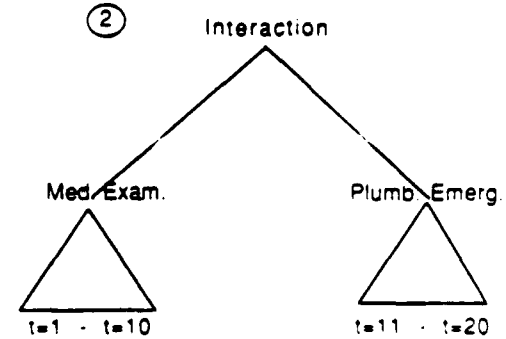
t = Time
Time o ———▶ ‒

Speech Events and the relationships among persons which they entail, constrain talk by restricting the class of utterances appropriate to an individual to those utterances permitted by the role being played by that individual. Any clause encoding an utterance not congruent with the ongoing Speech Event is assumed to initiate a new dcu belonging to a different Speech Event -- one which is either subordinate, co-ordinate or unrelated to the previous context given Event.

8.1.1 Moves and Topics: Constituents of Speech Events

In addition to constraining appropriateness of utterance in roles played by persons. Speech Events also exert constraints on appropriateness of utterance relative to the stage of proceedings reached in the Speech Event itself. It is not appropriate to say hello and inquire about someone's health in the "middle" of a "conversation". Likewise, it is not appropriate for a "question" to be asked in the middle of a talk in a formal conference.

Speech Events thus proceed segmented into *Moves* -- a notion which allows us

to understand many uses of *now, then, later* and *a minute ago*. Within the Moves in
Speech Events activities may further sub—divide into *sub—moves* while the talk itself
proceeds segmented into *Topics*. Postulating <u>Topics</u> as a level of structure with social
significance allows us to account for the familiar phenomenon experienced by speakers
in which a given contribution to a discussion, for instance, seems no longer relevant
or appropriate because the talk has moved beyond the point at which it seems
relevant. (A formalization of the notion of Discourse Topic will be left for a later
paper.)

8.1.2 A Grammar for Speech Events

The structure of talk is exchanged in order to perform a task will follow the
structure of some goal/subgoal analysis of this task [14]. In Speech Event types
which involve a more or less fixed goal, this often leads to a fixed grammar of
subsequent steps taken to attain it. Not all Speech Events are equally determined,
however. [45] Some Speech Events, like the Service Encounter are relatively fixed and
rigid.[22] Merritt (1978) suggests that Service Encounters have a four part structure:

> SERVICE ENCOUNTER STRUCTURE
>> Access phrase
>> selection decision phase
>> exchange
>> closure

However, even in less formal and pre—determined types of Speech Events, an

---

[22]In order to capture what actually goes on in real Service Encounters the full recursive
discourse grammar formalized by the LDM must be brought into play to account for digression,
interruptions, repairs, simultaneous activities etc.

initiate knows how to behave and how to produce an appropriate next utterance. It is

this "members' knowledge" that the higher level structures of the LDM Discourse

constituent hierarchy attempts to capture in a Speech Event Grammar.

Across cultural groups, the grammar of even rigidly determined and established

Speech Events, such as Service Encounters, can differ remarkably . Let us look for a

moment at the following sequential structure which represents how transactions take

place in a Dutch butcher shop.

Dutch Butcher Shop Service Encounter

Move 1   Establishing that it is this customer's turn.

Move 2   The first desired item is ordered, and the order is dealt
         with,....., the n-th desired item is ordered and the order is
         dealt with.

Move 3   It is established that the sequence of orders is finished.

Move 4   The bill is dealt with.

Move 5   The interaction is closed off.

Someone unfamiliar with the grammar -- an American, for example, -- might

have considerable difficulty in handling this Speech Event, this difficulty can be

explained in LDM terms by claiming that Americans have a different discourse grammar

specifying how butcher shop transactions in America take place.

This American Butcher Shop Grammar is shown below:

American Butcher Shop Service Encounter

Move 1   Establish that it is a given customer's turn.

Move 2   Items 1-n are listed.

Move 3   Items 1-n are dealt with.

Move 4   It is established that the order has been satisfactorily dealt with.

Move 5   The bill is dealt with.

Move 6   The Interaction is terminated.

Because Americans have a different discourse grammar specifying how butcher shop transactions should go, the American grammar calls for the entire order to be given at once, an American butcher would become quite impatient if every time he or she thought that the customer had completed the order, more requests were forthcoming. Intercultural disfluencies, sometimes referred to rather dramatically as "communication breakdowns" sometimes occur in the circumstances of grammatical conflict at the Speech Event level when the participants are unable to produce appropriate utterances and behavior having very different expectations about what must be said and done when.

9. PARSING COMPLEX INTERACTIVE DISCOURSE WITH THE LDM

In order to determine whether an incoming clause is to coordinated, subordinated or superordinated on the DPT, the first step is to assign a set of indices corresponding to *Contexts of Interpretation* to the clause which specify to which Interaction, Speech Event and Discourse Unit (if any) to which it belongs. The propositional content of the clause is then parsed into the *semantic frame* with slots for recording the temporal, spatial and participant parameters of the clause's interpretation as well as other important information, if any. At this point the "clause" is a set of semantic information located in a context of interpretation. It is a dcu.

9.1 Semantically Interpreting Gesturally Suppleted, Verbally Incomplete Propositions

[23] In order to demonstrate how the LDM parses interactive discourse we shall consider the example below taken from a corpus of spatial planning protocols.[24]

(1)   A: we have two points left.
        B: OKAY.
             So [we can go to
               [We might as well use them
                  to go. {{B's finger at Genoa}}
                        {{B's finger moves from
                           piece at Genoa to Zurich.}}

---

[23]This section is taken in its entirety from Hinrichs and Polanyi, 1986. [23]

[24]The protocol collection sessions involved playing a game called "Travelling through Europe". Two subjects playing together against a researcher were given a set of nine European cities and a game board which consists of a map of Europe marked with over on‧ hundred city names joined together by lines representing legal routes. The task of the subjects was to plan the most efficient route — one which would allow them to visit all nine cities on their itinerary in the smallest number of steps. "Playing the game" involved planning an itinerary and then taking turns throwing a die and moving a marker on the board the number of city steps corresponding to the number shown on the die. Updating and changing plans was allowed at any time.

<blockquote>
We could go to ...
h::m = {{hand off Zurich}}
A: We could go to Lyons and be on our way
to Orleans.
</blockquote>

We shall also treat B's gesture as expressing propositional information because a reasonably correct analysis of this data is only possible when the non−verbal information is taken into account.[25][26] In the context in which is occurs, B's gesture is interpreted as making a *PROPOSAL* to travel from Genoa to Zurich. A's utterance *We could go to Lyons and be on our way to Orleans* then functions in this discourse as a counter−proposal.

Before beginning the LDM analysis, let us first consider briefly some of the factors which we intuitively take into account in interpreting B's proposition as a proposal that a route from Genoa to Zurich be taken in the game which they are playing.

o A and B are engaged in an interaction, with each other.

o They constitute a team playing the "Game Travelling through Europe" as part of an experiment.

o A and B play this game cooperatively. They agree together to moves which are acceptable to both and which they believe to be permitted by the rules of the game.

o It is A and B's turn in the game.

o After the die is thrown and it is clear how many points are available to them, A and B have to agree upon a course of action.

---

[25] Without the accompanying pointing gestures made by B, which in ?? are set off in bold-face and by curly brackets, we might well characterize B's functioning in this piece of discourse as inarticulate and indecisive. When B's gestures are considered part of the signifying mechanism he is employing, it becomes clear that B, far from producing "incomplete" proposition carrying units and adding little to the planning process, is actively suggesting a very definite course of action . He is proposing that the players should choose a route which takes them from *Genoa* to *Zurich*.

[26] See [23] for a full treatment of this issue.

o Agreeing upon a course of action involves a *negotiation* in which *proposals* and *counterproposals* are made.

o Putting some course of action on the table, is a possible first step in a negotiation sequence.

o The presence of the modal *might* in the verbally encoded *We might as well use them to go to* signals' proposal to perform the action specified in the embedded phrase.

o The verbally encoded phrase is suppleted by B's use of his finger to connect two dots on the gameboard construed in the game as representing" cities".

o The beginning point of B's tracing motion is at the dot marked *Genoa* and the trace ends at the dot marked *Zurich*. A&B's playing token is located at *Genoa* as the turn begins. The number of steps to *Zurich* is two, which is the number thrown on the die a moment earlier.

The LDM provides a formal mechanism for capturing these intuitive conceptions of what is happening at the time of B's gesturally suppleted utterance.

9.1.1 Analyzing The Discourse Context Of B'S Utterance

When B's utterance is encountered by the parser, it has just finished dealing with the previous utterance and has assigned to *We have two points left* a set of interpretive contexts reflecting its current state. These contexts, shown in Figure X below, are occasioned by the throw of the die during one of A&B's turns at Play in the Speech Event$_{\text{Playing the game "Travelling Through Europe"}}$ which is itself part of a Speech Event$_{\text{Experiment}}$ taking place during a unique spatio/temporal/social Interaction$_{\text{Kaplan Contexts}_{\text{a}}}$.

INTERPRETIVE CONTEXTS FOR B'S UTTERANCE

<Interaction_{Kaplan Contexts}

$<$Interaction$_{Kaplan\ Contexts_a}$

$<$Speech Event$_{Experiment}$

$<$Speech Event$_{Playing\ Travelling\ through\ Europe}$

$<$Move$_{Take\ turns}$

$<$Sub-Move$_{Turn\ A\&B}$

$<$Sub-Move$_{Throw\ die}>>>>>>$

According to the Grammar of A&B's Turn:

TURN GRAMMAR

Move$_{Turn\ Team\ A\&B}$ ----> Throw Die + <u>Negotiate Action</u> + Move Counter

the parser now expects A and B to <u>Negotiate</u> a course of action to take in deciding what "route" to use in accomplishing the part of their Game World Journey which would advance them towards their goal. According to the grammar of Negotiation shown in, the first part of any <u>Negotiation Sequence</u> in this game is a <u>Proposal</u>, for what to do relative to the position of the players' piece on the map game board:

NEGOTIATION GRAMMAR

Move$_{Negotiation}$ ----> <u>Make Proposal</u> + (Discussion of Proposal)
+ [Counter Proposal
+ (Discussion of Counter Proposal)]*
+ One Proposal Accepted

Expecting a Route Proposal, the parser processes B's gesturally suppleted utterance as such a Proposal since it conveys appropriate propositional information, and is encoded according to the syntactic conventions appropriate for signalling possibility. The parser assigns the interpretive contexts:

```
<Interaction_Kaplan Contexts_0
  <Speech Event_Experiment
   <Speech Event_Playing Travelling through Europe
    <Move_Take Turns
      <Sub-Move Turn_A&B
        <Discourse Unit_Negotiation of route to take
          <dcu_Proposal>>>>>>>>
```

These contexts localize B's gesturally suppleted clause as a unique utterance relative to unique circumstances of utterance and are used to compute how the encoding clause participates in the DPT of the emerging discourse.

In order to assign, *We could go to*, or any other incoming clause a position in the Discourse Context Interpretation Tree, the contexts of the present utterance are compared with those of the immediately preceding utterance *We have two points left* (shown above).

These contexts are available in the tree of the developing discourse as the label at the node immediately dominating the terminal clause node as shown:

```
          <1<2<3<4<TURN>>>>>
                  |
          <1<2<3<4<5<THROW DICE>>>>>>

          "We have two points left"
```

In the present case, therefore, the first five contexts match.

o   Interaction_Kaplan Context_0

o   Speech Event_Experiment

o   Speech Event_Playing Travelling Through Europe

o   Move_Complete Turns

o Sub-Move$_{Turn\ A\&B}$.

However, when processing Context 6 of *We could go to*, the indices do not match.
Context 6 of the preceding unit -- <Throw die> -- does not match Context 6 of the
present clause which is <Negotiation of Route>. At this point, with reference to the
state of the discourse as reflected in the parse tree, the grammars of the discourse
units currently under construction and and the context information encoded at open
nodes are used to decide whether to subordinate, coordinate, or superordinate the
incoming unit at the node corresponding to Context 5 in the tree.

The decision process, in this case, is not complicated. Because the higher level
interpretation contexts match and because "Negotiating a route to take" is an
appropriate next constituent to follow "Throw Die" according to the Grammar of A &
B's Turn, *We could go to* is coordinated with *We have two points left* under a
coordination node carrying the values of the five matched contexts as illustrated:
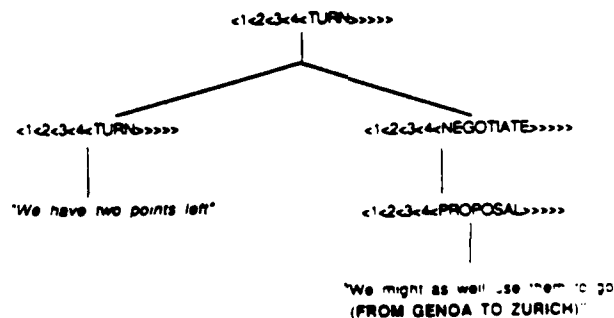
Carrying the analysis one step further, we can now account for the relevance of
A's next remark. *why not just go to Lyons and we'd be on our way to Orleans?* In the
context where it occurs, A's comment is commonplace and fully coherent "*Lyons*" is
seen as a counterproposal to B's gesturally communicated proposal to follow a route
from *Genoa* to *Zurich*.

Viewed in terms of the LDM framework. A's behavior is predictable from the *Grammar of Negotiation*. Following B's Proposal. A makes the next Move allowed by that Grammar and utters a complex clausal construction which functions in the ongoing context as a counter-proposal to B. Since contexts 1-6 of the two utterances are the same, as is shown in Figure 0, the LDM when processing *Why no just go to Lyons and we'll be on our way to Orleans.*, will eventually coordinate it to *We can go to [Zurich from Genoa]* under a node with values <1-6> on the Discourse Context Interpretation Tree.
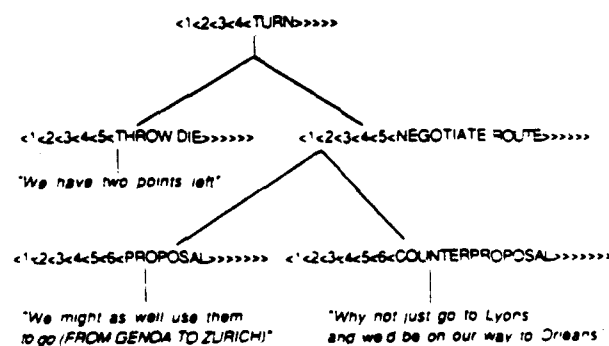
9.1.2 Establishing The Contextually Constrained Interpretation Of B'S Utterance

The Participant Set (Player 1, Player 2, Player 3) of the Speech Event$_{Playing\ Travelling\ Through\ Europe}$ is related systematically to a subset of the participants playing roles in the higher level Speech Event$_{Experiment}$ (Experimenter 1, Experimenter 2, Research Subject 1, Research Subject 2). The role playing participants of the Experiment Speech Event are similarly related to a proper subset of the participants of the Interaction $_{Kaplan\ Context_0}$. (A, B, E.H., L.P.) The individual A in the real world of the Interaction is defined relative to his Speech Event$_{Experiment}$ role as Research Subject$_1$ and to his role in Speech Event$_{Playing\ Travelling\ Through\ Europe}$ as Player 1.

Space and Time in the lower level units are established with reference to the spatial and temporal parameters of higher level contexts. The Spatial parameter associated with the *A&B's Turn*, for example, is set relative to the Spatial parameters of the contextualizing higher level unit -- the *Complete Turn*. The Spatial parameters of the Complete Turn include all possible routes for both teams while the spatial parameters for *Turn$_{A\&B}$* include only possible routes for A&B's Gameworld surrogate.

For the example in question, therefore, the possible interpretation of the spatial locations referred to in *We could go from "Zurich" from "Genoa"* is restricted by context computations to the *Genoa* and *Zurich* on the game board and cannot refer to the Genoa and Zurich in the real world, on any other map or relevant to any other world of discourse. *We* is similarly interpreted as We the surrogates associated with We the Players associated with We A&B in the Real World in which the Interaction took place.

10. INTERRUPTIONS AND THE PROPER PARSING OF COMPLEX TALK

Parsers. human and otherwise. have more difficulty with processing unexpected constituents which they perceive to be unrelated to the units under development. Genuine interruptions, unmarked digressions, "semantic returns" to discuss some topic not presently accessible in the Discourse Context Interpretation Tree etc. may present interpretation difficulties.

In these circumstances, the human parser often adopts a "wait and see" attitude towards the input, delaying interpretation until he gets enough information from the content of what is being said to build up a hypothesis about the unit being constructed.

In order to assign interpretations to such utterances, therefore, high level interpretation strategies much be brought into play which start from the assumptions that (1) the speaker is "doing something" with his talk--either carrying out some task or reacting to some stimulus in the environment and (2) that he believes his utterance to be interpretable given the content of the utterance and what may be knowable about the speaker and the general context in which the utterance was encoded.

Working with these high level strategies, the parser will look beyond the linguistic context to try to determine what the speaker might reasonably be trying to do with his talk. This may involve searching the environment in which the talk takes place for a stimulus to which the speaker may be reacting or may involve an analysis of the task the speaker may be carring out. This is often a conscious cognitive process involving an attempt to figure out what is going on [74]

In terms of building the Discourse Context Interpretation Tree, then, a human parser must decide whether the new constituent is to be coordinated or subordinated on the tree.[27] Although we initially presented discourse parsing with this model as an unambiguous and definitive process, in actually processing, complexities such as structurally ambiguous utterances (one which can attach legally at more than one place on the tree) and true confusions force a relaxation of this view.[28]

10.1 Parsing Complex Talk: An Example

In order to demonstrate how the LDM deals with complex discourse, let us return to the example which was used to demonstrate the complexity of the problem. We have shortened and simplified the example considerably, but it gives a fair impression of how this parsing is accomplished.

PLANNING DISCOURSE C

A: let's go to France next

      I love France

B: You had a great time there

C: *Move closer to the camera*

A: I like Italy too

A: and then Spain

In this vignette, A and B, are the *Research Subjects* doing the planning; C is an

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[27]This "decision process" is unconscious and exactly analogous to deciding between two possible structural descriptions to be assigned to a sentence under current approaches to syntactic theory.

[28]We shall leave discussions of the complexities of ambiguous tree attachments to a subsequent paper where we shall suggest that each participant may, in fact, be associated with an individual Tree.

Experimenter. They are engaged in an Interaction A with one another.[29] There are

two Speech Events ongoing within Interaction A. The **Experiment Speech Event**, and

the **Game Playing Planning Speech Event** -- these Speech Event 2 and Speech Event 1

respectively. Within Speech Event 1, there are several discourse units of various

sorts-- including a developing **Future Time Narrative Itinerary Plan**, **Elaborations on**

Comments and a **Command** etc.[30] In this example, all of the utterances belong to

Interaction Context A, and except for C's Command to *move closer*, all are uttered

relative to the **Game Playing Speech Event**. We assign all clauses a set of

Interpretation Contexts specifying which Interaction and Speech Event they belong to

as we did in the spatial planning example and then parse the propositions into the

semantic frame formalism assigning the contexts of interpretation to them. We will

trace the parsing of PLANNING DISCOURSE C in some detail.

10.1.1 Building The DPT For A Complex Discourse

The first dcu, <A<1<WE GO France at future time point 1>>, is the first element

on the Tree At this point in segmenting this discourse, this dcu is the only node.

```
< 1<We GO France at
  future time point 1>
```

The next dcu, <A<1<I LOVE France>>, elaborates on *"why we should go to France."*

---

[29] In the original more extended planning example we looked at earlier, there were two Interactions, one involving A, B, C, and the other involving C, and D, a *Secretary*. We could label these Interactions, Interaction Context A and Interaction Context B.

[30] A command in the imperative mood such as *Mover closer to the camera* coming in the midst of assertives or questions institutes a *modality* shift. Modality, along with point of view, "empathy", must be held held constant across dcu's. A shift in modality is a shift in dcu.

and follows immediately in the text. <A<1<We Go France at future time point 1>> is in an accessible position in the Tree at that point, and <a<1<I LOVE France>> is embedded relative to it in an Elaboration dcu

```
┌──────────────────────┐
│ < 1<We GO France at  │
│ future time point 1> │
└──────────────────────┘
            │
            │
    ┌─────────────────┐
    │ <1<I LOVE FRANCE>│
    └─────────────────┘
```
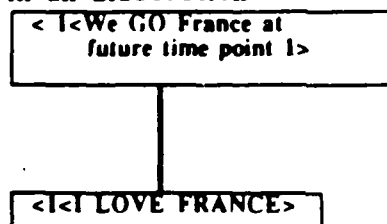
The third clause, *"We had a great time there last year,"* elaborates on why we love France, <A<1<We ENJOY France last year>>, and is embedded relative to <A<1<I LOVE France>> as shown.

```
┌──────────────────────┐
│ < 1<We GO France at  │
│ future time point 1> │
└──────────────────────┘
            │
            │
     ┌──────────────────┐
     │ <1<I LOVE FRANCE> │
     └──────────────────┘
            │
            │
   ┌───────────────────────────┐
   │ <1<We ENJOY France last year> │
   └───────────────────────────┘
```
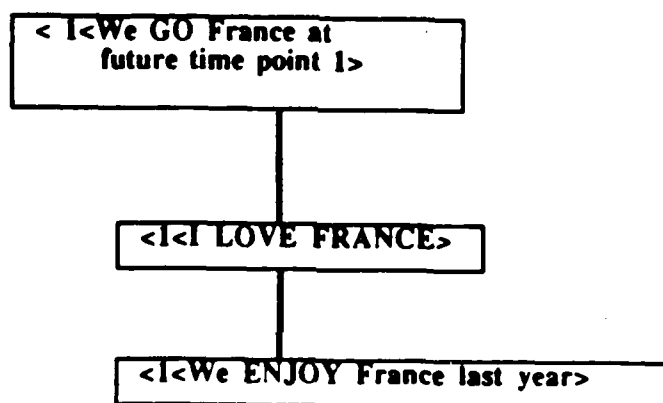
The ongoing Speech Event at this point is "interrupted" by an intrusion from another world. One in which the social construction of the situation assigns A and B the roles **Experimental subjects** and C the role **Experimenter**, rather than A and B's Game Playing Speech Event Roles as two **Gameplayers**. There is (1) no semantic connection between *Move closer to the camera* with its dcu, <A<2<You Future/**IMPERATIVE** closer to camera>> and any other dcu available in the Tree[31] and (2) by uttering *"Move closer to the camera"* C does not move the Experiment Speech Event on to a new phase according to its grammar (shown below) Speech Event,

_____

[31]This lack of relationship can be read off of the Context indices which show that <You Future/IMPERATIVE closer to camera> was uttered relative to context 2, while all of the previous clauses were uttered relative to Context A.

<A<2<You Future/IMPERATIVE closer to camera>> is embedded relative to the last clause parsed as a true interruption.
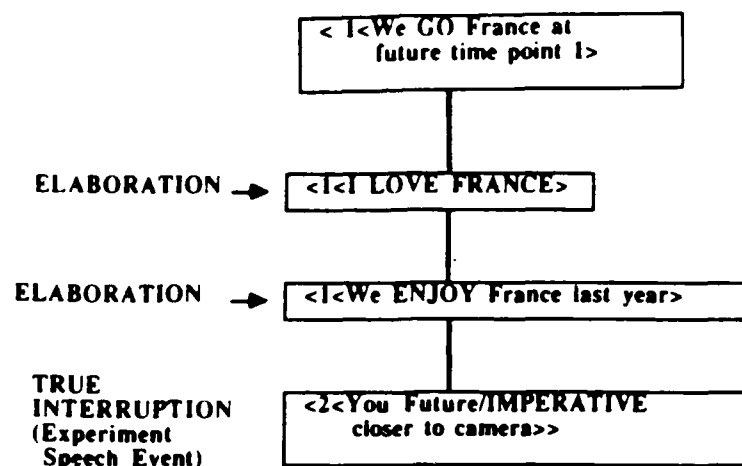
The next clause, *"I like Spain,too"*. <A<1<I LIKE Spain>>, continues a line of thought begun earlier and still accessible in the tree: an enumeration of the countries which the speaker likes. There is no node present in the tree which corresponds to the speaker's positive feelings towards countries, but once the semantic relationship is computed, <A<1<I LIKE Italy> is coordinated with <A<1<I LOVE France>, under the node <1<1<positive feelings towards countries>> effectively closing off what is now to the left and below it in the Tree for further coordination. Pronouns and deictics like *nou* or *there* could not be used to refer to France, for example, without reintroducing France in its full nominal from. [73][32]

---

[32]This constraint on coordination allows us to distinguish between those cases when returr to a previous topic is possible by a simple continuation perhaps marked by a "POP" marker such as "go", "well", anyway", "as I was saying" etc. and when other cases when such a simple return is not possible and it is necessary to "reintroduce" the topic once again [56] [52] [16] [73]

PLAN STRUCTURE → < 1<We GO France at future time point 1>

CONSTRUCTED COORDINATION NODE → <1<1 Positive feelings towards countries>

ELABORATION → <1<I LOVE FRANCE>   <1<I LIKE Spain>

ELABORATION → <1<We ENJOY France last year>

TRUE INTERRUPTION (Experiment Speech Event) <2<You Future/IMPERATIVE closer to camera>>
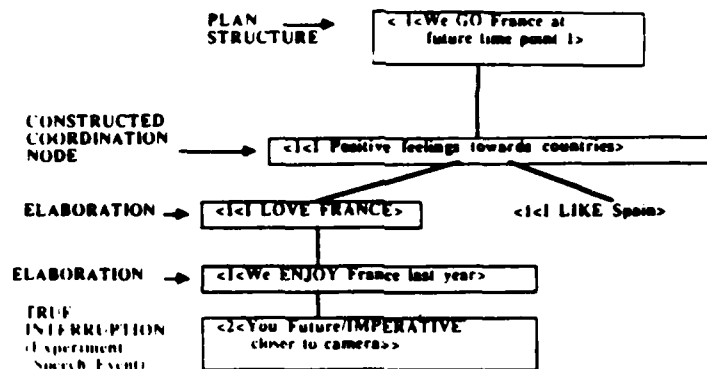
Once a POP to resume a higher level activity has occurred, the discourse has "moved on" from the embedded constituent and it is structurally "off the floor".[33] In the present example, the next clause also causes a POP in the state of the Discourse Context Interpretation Tree and the creating of a higher level node to accommodate the new input. This clause, *then Italy*, corresponding to dcu <A<1<We GO Italy at future time point 2> is the next item in the Plan Unit being constructed

<A<1<We GO Italy at future time point 2> is coordinated to <A<1<We Go France at future time point 1>> under a narrative dcu which specifies that all constituent dcu's are to be interpreted as taking place in a future time world.

In following the development of the emerging plan in the rest of the Planing Example given in the introduction to this paper, we would continue tracking the development of this Plan structure through observing closely how this future time narrative is constructed and seeing how alternatives are offered, accepted or rejected

---

[33] Re-establishing the closed off discourse activity is always possible, but socially quite constrained. Utterances must appear "Locally occasioned" by the immediately previous utterances in so far as is possible. [67]

CONSTRUCTED
NARRATIVE → o<Future time Narrative dcu/WE GO x at time t>
NODE

PLAN → < I<We GO France at   < I<We GO Italy at
STRUCTURE   future time point 1>   future time point 2>

CONSTRUCTED
COORDINATION →   <I<I Positive feelings towards countries>
NODE

ELABORATION →   <I<I LOVE FRANCE>   <I<I LIKE Spain>

ELABORATION →   <I<We ENJOY France last year>

TRUE
INTERRUPTION   <2<You Future/IMPERATIVE
(Experiment   closer to camera>>
 Speech Event)
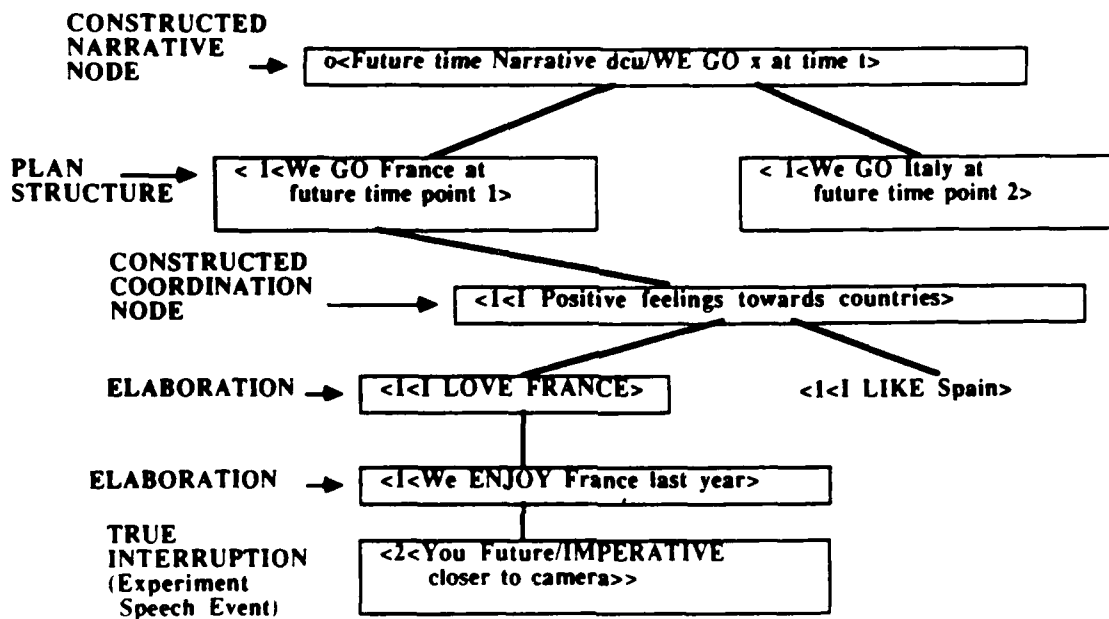
11. AMBIGUITY AND INTERPRETATION IN DISCOURSE UNDERSTANDING: THE CASE FOR MULTIPLE TREES

It is important to emphasize that in deciding upon the relationship obtaining among units in the Discourse Parse Tree built up through the analyses, we make no claim about the exact structure of reasoning used by the individual planners who in fact created the discourse. We take the position that neither analysts nor speakers have access either to anyone else's intentions in carrying out an action nor do we reliably interpret an utterance other than our own. Such precise "understanding" of the inner states of others is not necessary for creating and maintaining smooth flowing interaction. We operate in a social context where we need to demonstrate reasonableness and appropriateness in our responses — but not correctness. As long as our interlocutors believe that we have assigned a plausible interpretation to their remarks they are not disappointed if that interpretation does not reflect the true analysis they intend.

In creating a discourse we evaluate our own internally available inference processes and the impact of an utterance or potential utterance on ourselves, then assuming our interpretation process to be not different in kind from those of other social actors with whom we engage in social action, we decide on an interpretation of the clause. The choice of clausal attachment point on the DPT, whether by analyst or conversational partner, which results from our interpretation on the clause may also be ambiguous. In creating the Discourse History Parse Tree therefore we create one of a possibly large set of such trees.

In order to account for complex cases in which different speakers using the same general discourse processing strategies may believe themselves to be "in different places", the Singleton DPT tree is replaced by Multiple Trees: one tree is

associated with each participant. The degree to which participants are "in the same place" is then seen as resulting from the degree to which the rightmost node configuration of their trees are similar.

Misunderstandings in discourse often occur because the same input may update participants' understanding differently. Problems can arise because different people may interpret the same words or phrases in various ways depending on their understandings of their meanings or because they may have built up different DPT's due to clause attachment ambiguities earlier in the discourse. The different participants may then have different ideas of what is "on the floor" and of how objects and concepts discussed earlier may be accessed. In addition to misunderstanding one another due to ambiguous clause placement, however, speakers may also use discourse placement ambiguity as a resource in assuring smooth social interaction.

11.1 A Misunderstanding

The following excerpt from a transcript of a service encounter collected by Merritt is, for the most part, easily segmented into a -- **Request for Information** -- **Selection/Decision** -- **Exchange** -- **Closure** structure typical for a Service Encounter [45].

A MISUNDERSTANDING

S: (1) Whattoya lookin' for Miss? COUGH (2) ((maybe)) I can help you?

C: (3) Uh Yeah   (4) Christmas wrapping paper.

S: (5) All right.   (6) We'll show you.   [CASH REGISTER SLAM] (7) Here you are.

    (8) Right around here Miss, (9) look.

C: (10) Oh.   (11) O.K.

S: (12) Around here.

C. (13) Oh (14) I see.

S: (15) Here's this ((inaudible)) and then we got uh different boxes here.

C: (16) ((You don't carry)) the individual sheets.

S: (17) All right.

C: (18) Hmm.

S: (19) And if you don't see anything individual we'll sell

    these rolls, (20) we'll break // a box for you.

C: (21) Oh   (22) really?

S: (23) We'll sell you one—(24) you know what I mean.   (25) In other words

    (26) that is a dollar and a quarter for three, forty-five cents for one.

    (27) Of course this is the Christmas wrap individual.

C: (28) Yeah. (29) O.K. (30) Good.

S: (31) You can buy any of these individually.   (32) In other words

    (33) like (34)—like one of these rolls you can have //

C: (35) Un Hunh.

S: (36) for forty-five cents a roll.

C: (37) O.K. (38) Thank you.

(S goes back to serving post; C looks at paper)

S: You can break any of those boxes [O.K. just take one roll out

    you want it.]

C: ((O.K.))

Most of the talk flows smoothly and both *Serving Person* and *Customer* are "in the same place". However, there is one "problem area" -- clauses 31-38 (underlined in the text above) -- which displays a structural difficulty between the two participants.

C: (28) Yeah. (29) O.K. (30) Good.

S: (31) You can buy any of these individually. (32) In other words

    (33) like (34)—like one of these rolls you can have //

C: (35) Un Hunh.

S: (36) for forty-five cents a roll.

C: (37) O.K. (38) Thank you.

After the Serving Person made his point about the price of the *Christmas wrap individual*, the Customer signalled her understanding of the information with the agreement markers (28) *Yeah* (29) *O.K.* (30) *Good.* She was thus fully informed and ready to proceed onto the decision phase. In we were to draw a tree of her understanding of the. state of the discourse, she would be ready to accept next utterances as coordinate to the *information* phase. *She would be busy making her selection.* The Serving Person, however, is clearly "in a different place". He continues to clarify for her the pricing of the three roles of Christmas wrap:

S: (31) You can buy any of these individually. (32) In other words

    (33) like (34)—like one of these rolls you can have //

C: (35) Un Hunh.

S: (36) for forty-five cents a roll.

He believes that they are still engaged in a discussion of the pricing that -- they remain in the information Move of the transaction. When the Customer finally stops him with her emphatic (37) *O.K.* (38) *Thank You,* their two different views of what they saw happening are reconciled. However, in producing a structural description of the discourse so far in the form of a Discourse History Parse Tree, we must assign a

different Tree structure to each participant reflecting his or her understanding of the
state of the discourse as that understanding developed:

THE CUSTOMER'S TREE
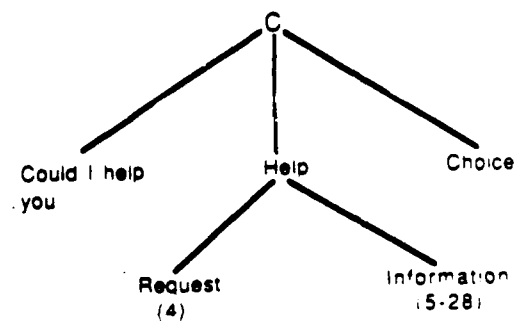
THE SERVER'S TREE
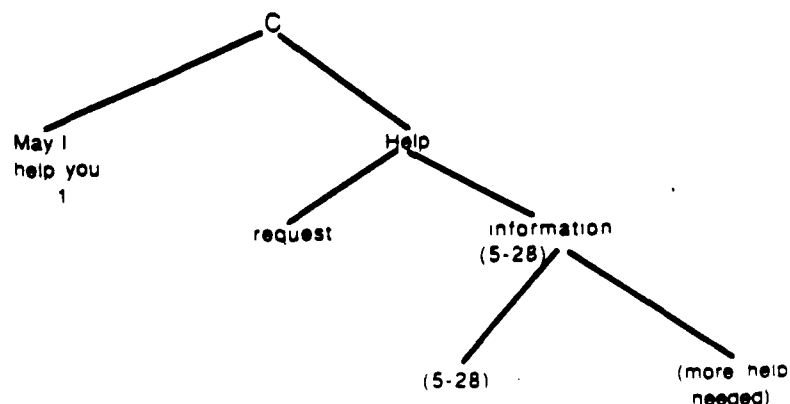
In the following example of the Discourse Pivot. we have a more complex of multiple Tree structures the two participants involved entertain an ambiguous tree structure as a way of allowing them to accomplish a complex interactional task -- in this case. moving from a painful topic of talk to one much easier to deal with.

11.2 Discourse Pivots

In a recent paper. *Jefferson* has suggested that managing the transition to talking about cheerful matters of a general nature from discussing deeply personal and difficult matters (*trouble talk*) presents a serious interactional problem for interactants An abrupt cessation of interest on the past of the trouble talk recipient

would be signalled by merely stopping the trouble talk and continuing the conversation with another topic. While for the teller to abandon a tale of woe to explore more cheerful topics is potentially threatening both to the face of the recipient who is thereby implicitly characterized as someone who would not wish to remain in a situation of presenting a comforting listening post to the troubled individual and to the face of the teller whose willingness to abandon the trouble signals a lack of involvement with his or her own problem. Since trouble talk is unpleasant to deal with, and fraught with the potential for interpersonal difficulties and misunderstandings, a too quick abandonment of one's own trouble raises the question of why the trouble was brought up in the first place. Clearly some subtle conversational footwork is necessary to accomplish the interactional task of extricating the conversation from the topic of the trouble. [34]

Jefferson argues that speakers follow a 4-step routine in moving from *talk about trouble* to *inappropriately next-positioned matters* -- i.e. talk about non-problem related issues. [34]

This "routine" which we could describe as a grammar has the following structure:

GRAMMAR OF MOVING FROM TALK ABOUT TROUBLE

1. Sum—up of heart of the trouble

2. Teller turns to related but ancillary matters

3. Troubles recipient topically stabilizes the ancillary matters which

    a. continues the discussion of the ancillary topic

    b. "potentiates" further talk by the recipient

4. The trouble recipient produces a pivotal utterance which
    is recognizably on topic and has independent topical potential

In exploring how speakers use ambiguous time attachment as an interaction
resource we will make use of a complex example in this analysis from G. Jefferson
(1984) *On Stepwise Transition from talk about a trouble to inappropriately next-
positioned matters*. In this excerpt, the speaker who complains bitterly about not
being able to "go typing last night" due to serious family problems (clauses 1a—10c)
within a very few minutes is chattering away happily about the movie she has seen.
([34])

In undertaking an investigation into Jefferson's findings with the LDM, we re-
analyzed her data by segmenting the text into clause and cleaning up the segmented
text a bit. While in principle, the raw text could have been processed, removing
spelling idiosyncrasies from the transcription along with eliminating repetitions and
false starts make the text easier to handle. We have indicated the key clause in each
section with an arrow.

DISCOURSE PIVOT

TROUBLE TALK

```
    G: 1a. and Danny didn't get in last night
->     1b. so I didn't go typing last night

    L: 2a. Didn't you?

    G: 3a.             no
    L:     oh...
       3c. I thought
       3d. well
->     3e. I can't leave him for two hours
->     3f. if I'm
->     3g. if he's crying
->     3h. when I've left him for on

    L: 4a. oh
       4b. dear me

    G: 5a. so
       5e. as I say
       5f. I didn't get to typing

    L: 6a.        oh
       6b. you are will tied down
       6c. aren't you?

    G: 7a.     well

       7b. I am
       7c. really
```

TELLER SUMS UP HEART OF THE TROUBLE

```
       8c. cause he doesn't
->     8d. he hates being in
->     8e. on his own
       8f. for some peculiar reason
     G:         yeah
       8g. and
->     8i. he always knows
->     8j. (where I am going
       8k. and
     G: 10a. you know
->     10b. approximately what time
       10c. ((I'll be
     L: 11a. yes
```

TELLER TURNS TO RELATED BUT ANCILLARY MATTERS

```
->G:   2a. cause Norman said n the morning
       12b. (would I take him to Saltbern
       12c. and I said
       12d. well
       12g.  hI don't know
```

```
12h.  the roads are so bad
12i.  I might not (.)
12j.  make it
```

TROUBLE RECIPIENT TOPICALLY STABILIZES ANCILLARY MATTER

```
->  L: 13a.  No
        13c.  Were they very bad
        13d.  Gwennie

        14b.  no
        14c.  it wasn't
        14d.  it's just
        14e.  (that you can't go so fast
        14f.  you know
        14i.   you just have to be that little bit more careful
```

TROUBLE RECIPIENT PRODUCES PIVOTAL UTTERANCE

```
->  L: 15a.   I think
->      15b.   it's that little bit warmer tonight
        15c.   isn't it
```

DISCUSSION OF PIVOTAL CONCERN

```
    G: 16a.  Oh
        16c.  it's not so bad

    L: 17a.      it's not quite as severe tonight

    G: 20a.  No
        20b.  but it's
        20c.  it's
        20e.  melted
        20f.  but I th-
        20g.   if it freezes tonight
        20h.   it'll be worse tomorrow morning

    L:                 tomorrow
        20i.   I think

    L: 21a.  that's the only thing
        21b.  yes

    L: 22a.  well
        22b.  I think
        22c.  I'll stay in bed in the morning

    G: 23a.              hah
        23b.  I don't blame you
```

DISCUSSION OF INAPPROPRIATELY NEXT POSITIONED MATTER

```
    G: 24b.  hey
        24c.  listen
->      24e.  you should have come on Tuesday

    L: 25a.  was it good?

    G: 26b.   it was marvelous
```

```
L: 27a.   oh
   27b.   was it

G: 28a.   I thoroughly enjoyed it.

(c. 12 lines omitted dealing with the movie)

G: 29a.   I jumped (.)
   29b.   shot about three feet in the air
   29c.   I think
```

                         NEXT TOPIC

```
   L: 30a.   Yes
->    30d.   we didn't go to have our hair done
      30e.   by the way

   G: 31b.   no
      31c.   well
      31d.   I gathered not
```

Clause (15b) *it's that little bit warmer tonight* identified by Jefferson as the "pivotal utterance" in the conversational fragment has interesting properties, semantically and structurally. Following the normal rules of discourse formation we have outlined, a legitimate case could be made for treating the utterance either as (1) a short digressive comment on the weather which, once completed, would permit the return to a discussion of the problems teller has with getting away or, alternatively, as (2) an initiation of a new topic of talk occasioned by the discussion of the weather in the previous problem-talk unit, now complete. We claim that the discourse participants exploit this ambiguity in effecting transitions in talk.

11.2.1 Structural Analysis of the Discourse Pivot

The unit immediately preceding Clause 15 the pivotal utterance consists of the clauses (12a-14i) and concerns <the state of the roads last night>.

```
L.   13c   Were they [the roads last night] very bad

     13d   Gwennie
     ..............

G.   14d   it's just
     14e   (that you can't go so fast
     ..............
     14i   you just have to be that little bit
     more careful
```

While, the new unit, initiated with clause (15b) concerns <the state of the roads today>

```
L:   15b      it's that little bit warmer
     15c          isn't it

G:   16a      Oh
     16b      it is
     16c      it's not so bad

L:   17a            it's not quite as severe
        tonight

        mmhm
```

G: 18   it's really not

Semantically, following the normal rules, (15b) *It's that little bit warmer tonight*
could be analyzed as somewhat off the point of <last night's driving conditions> but
related to it and thus structurally could be attached to the developing discourse tree
as a subordination to the ongoing constituent dealing with <last night's weather
conditions>.

Tree A

```
                    S
                  /   \
                /       \
              /           \
            /               \
  <last night's        15b<tonight's
   driving               driving
   conditions>           conditions>
```
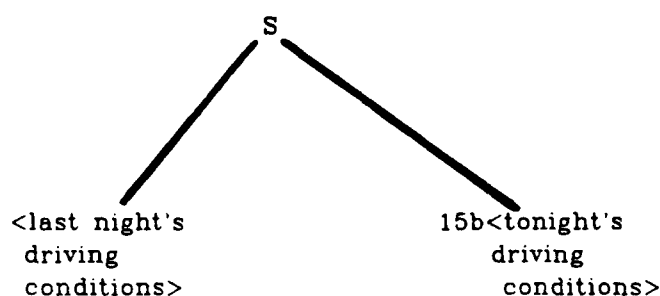
Alternatively, one could view (15b) as a possible topic of talk under a general higher
level topic <recent driving conditions>. In this latter case, since <last night's driving
conditions> is also subsumable under <recent driving conditions>, (15b) which begins
a new phase of development of the higher level topic could be coordinated higher up
the existing discourse parse tree -- exactly where on the tree being left
indeterminate and a matter of negotiation to be settled finally through the subsequent
behavior of the participants. The most likely point of attachment being at a
coordination node <driving conditions in recent weather> directly dominated by (12b)
[Tree B]

Tree B

```
                      S
                    /   \
                  /       \
               12g       S<recent driving
                        /    conditions>
                      /         \
                    /            \
              <last night's      <tonight's
               driving            driving
               conditions>        conditions>
```
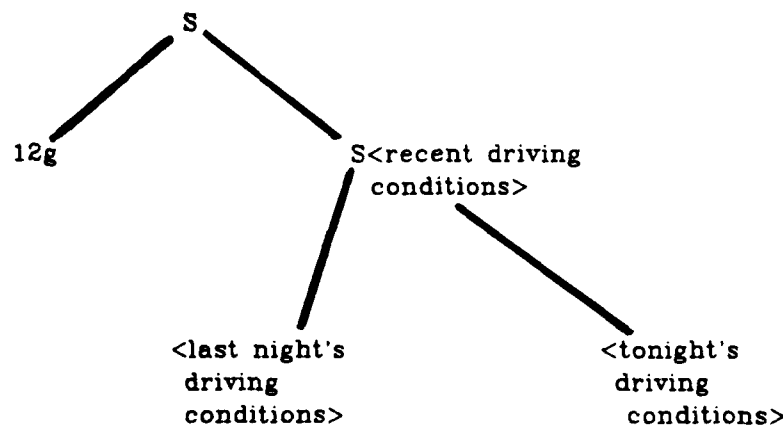
Thus (15A) is "pivotal" because it can reasonably support two conflicting structural analyses of what is going on. In both cases while the trouble talk is still fully accessible in the tree, in the co-ordination case, the trouble talk is beginning to become structurally inaccessible -- the anecdote about perhaps driving to Saltbern has trailed off into a complex increasingly murky structure and functions as a coda to what would then be considered to be the finished trouble talk. Since a Topic unit has been completed, a new Topic is expected. This new Topic, introduced by *(30d) We didn't get our hair done* which is semantically and structurally analogous *(1b) I didn't go typing last night* and is easily subsumed under a higher level node in the Tree detailing <What did not get done last night>.

```
            S
          /   \
        /       \
  <What did not   C
   get done      /  \
   last night>  /    \
             /        \
        <G. didn't    <L. didn't
         go typing>    get hair done>
```
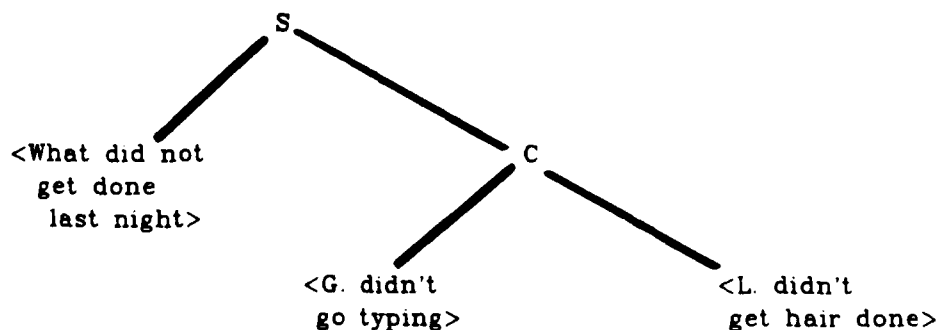
Analysis of other texts suggest that what Jefferson has identified as the "pivotal" utterance device in trouble talk should be seen as a more general resource which speakers may make use of in changing topics in situations other than trouble talk. In the context of trouble talk, the recognition of possible termination of trouble talk is not made explicit when the pivotal utterance occurs but is effectively delayed until the teller has declined subsequent opportunities to resume the sad recital. After a few such refusals to resume, both participants act as if the configuration of the tree is one in which the trouble talk is no longer accessible -- implicitly opting for the coordination interpretation over the subordination analysis. Any attempt to talk again about the original troubles can now be hearable as "talking about again" rather then "continuing to talk about an interrupted topic still structurally incompleted". "Participant face" is not threatened by the move away from trouble talk because neither teller nor recipient instigate the shift — thereby calling the worthiness of the trouble telling into question. Rather, they develop mutually an interactively constructed interpretation of the state of the discourse parse tree. Eventually, they find themselves talking about other topics with the trouble talk safely behind them -- "safely" being construable in terms of the now established structural inaccessibility of the trouble talk in the discourse history tree.

12. CONNECTION WITH OTHER FORMAL MODELS OF DISCOURSE STRUCTURE

Recent advances in understanding the structure of natural language discourse make it possible to segment complex talk and recover the integrity of "discourse units" despite the complexity of the actual talk in which they occur. An important research focus within the past five years has been to capture the semantic, or "coherence" relations among clauses and segments making up a text in which all of the constituent elements function together to communicate a set of mutually interconnected ideas. [18] [29] [27] [44] [55]. A second research focus has been to understand the structural relations obtaining even in discourses which are not coherent but which are characterized by interruptions and resumptions, and even by hesitations and other types of complex phenomena arising from the social and processing constraints on actual talk [62] [52] [15] [23].

We shall review below proposals for dealing with coherence relations in discourse and the proceed to discuss two alternatives to the present frameworks which attempt to characterize the structure of discourse -- accounting for coherence while also allowing for digressions and interruptions

12.1 Discourse Coherence

It has been observed many times that not every sequence of sentences makes up a "text". In a well-formed text, the sentences are perceived as working together to build up a unified whole, by expressing propositions which are related to each other in a limited number of specific ways.

A number of coherence relations which may obtain among the constituents of a well formed text have been identified by Hobbs [29] [27]. He describes how a semantic

structure for a whole discourse may be built up recursively by recognizing coherence relations obtaining between adjacent *segments* (i.e. dcu's) of a text. He addresses himself initially to why it is that we find discourses coherent at all — what are the sources of discourse coherence? According to Hobbs, not surprisingly, one source of discourse coherence lies in the coherence of the world or object described. We can find a text coherent if it tells us about a set of objects or states or events which we know to be coherent. Thus even a gasped out, highly interrupted narrative of a disaster may appear "coherent" and be "understandable" when we bring to the text our belief that the disaster formed a coherent set of events, related causally to one another and affecting in various ways the people, objects and situations described. This relates closely to another source of discourse coherence: when we find that one assertion details the cause for the situation described by the next assertion, we view the sequence as coherent. We will also find a sequence of two sentences, two stories, or, generally speaking, two discourse constituents to be coherently related to one another if one tells us more detail about the other, offers an explanation, or otherwise gives more information about the proposition expressed by the other.

Hobbs provides a method for allowing the coherence relations in a discourse to emerge. He suggests segmenting the discourse "intuitively" and then labelling the various naturally occurring segments with the coherence relation(s) which tie them to immediately preceding constituents. There will be two types of relations: *coordination* and *subordination* relations. Coordinate coherence relations include *parallel* constructions and *elaborations* in which one discovers a common proposition as the assertion of the composite segment. *Subordination* relations obtain when one constituent provides background or explanatory information with respect to another. Hobbs' ideas of "coherence" allow us to see how even the subsequent moves in a conversation, which may appear incoherent to an outside observer, may be appropriate

conversational moves for the participants -- entirely coherent and describable with the relations which he has outlined. [26] [28] Mann and Thompson's work on *rhetorical relations* focuses exclusively on the relations which obtain within a coherent text. [44]They assign a phrase structure analysis to texts, in which two subsequent constituents can be related through each of a number of specific relations. Their inventory of coherence relations is more detailed than that provided by Hobbs. The relations they list are *solutionhood, evidence, justification, motivation, reason, sequence, enablement, elaboration, restatement, condition, circumstance, cause, concession, background, and thesis-antithesis.*

12.2 Context Space Theory

Reichman's *context space theory* deals with the structure of conversation [62] It associates with each topic of discussion a *context space* -- a schematic structure with a number of slots. These slots hold the following information:

- a propositional representation of the set of
  functionally related utterances said to lie in
  this context space;

- the communicative function served by the utterances in
  this context space;

- a marker reflecting the foreground-background status of
  this context space at any given point in the
  conversation;

- focus level assignments to the discourse elements in
  this context space;

- links to preceding context spaces in relation to
  which this context space was developed; and

- specification of the relations involved.

The utterances that constitute the discourse are analyzed as "conversational moves" which affect the content of the various context spaces. Reichman paid special attention to the conversational structures involved in arguments. Among the conversational moves she identifies, for instance, are assertion of a claim, explanation, illustration, support, challenge, interruption, and further development.

While Reichman's work provided much important insight into the functioning of discourse, her Context Space formalism fails to distinguish between those cases in which one can return to a previous topic by use of a simple POP, for example, and those cases in which such a simple purely structural return is not possible and one must re-introduce the topic in order to continue talking about it. Reichman's Context Spaces are never "closed off" and inaccessible because one can always say anything one wishes and continuing to talk about a matter dropped earlier is certainly possible. Discourse structural relations, in her account, are thus finally obscured by discourse semantic relations obtaining among the topics of talk in the various units.

The work of both Grosz and Sidner [15] the LDM here [51] [52], [55], [56] [23], [57] incorporates elements of Reichman's work -- particularly her treatment of clue words -- while separating structural and semantic relations between clauses. This separation allows for a treatment of "interruptions" and "resumptions" which is based on structural properties of the discourse rather than being dependent on semantic relationships among topics of talk. These two frameworks generalize upon Grosz' early work by providing an account of discourse structure which is not task dependent.

12.3 The Discourse Structures Theory

In early work on the structure of Task Oriented Dialogs, Grosz [13] provided an important demonstration of the hierarchical structure of natural texts as discussed earlier.

Following up on Grosz's work, Sidner [74] showed that a structurally analogous account of anaphora resolution also applies at a linguistic level of discourse structure which is independent of task structure. In her model the candidates for anaphoric reference are stored in a *stack*. An incoming discourse constituent which is treated as embedded *PUSHes* new *focused elements* into this list, while the resumption of a suspended discourse constituent *POPs* the intervening focus elements off the stack.

In the view of Grosz and Sidner [15], the structure of a discourse results from three interacting components: a *linguistic structure*, an *intentional structure*, and an *attentional state*. These three components deal with different aspects of the utterances in a discourse. Grosz and Sidner have particularly focused on the intentional and the attentional aspects of discourse.

The intentional structure is a hierarchical structure which describes relations between the purpose of the discourse and the purpose of discourse segments. These purposes (such as "Intend that a particular agent perform a particular talk", or "Intend that a particular agent believe a particular fact.") are linked by relations of *dominance* (between a goal and a subgoal) or *ordering* (between two goals which must be achieved in a specific order).

The attentional state is an abstraction of the participants' focus of attention as their discourse unfolds. The attention state is a property of discourse, not of

discourse participants. It is inherently dynamic, recording the object, properties, and relations that are salient at each point in the discourse. The attentional state is represented by a stack of *focus spaces*. Changes in attentional state are modeled by a set of transition rules that specify the conditions for adding and deleting spaces.

A focus space is associated with each discourse segment; this space contains those entities that are salient -- either because they have been mentioned explicitly in the segment or because they became salient in the process of producing or comprehending the utterances in the segment (as in Grosz' original work on focusing [16]). The focus space also includes *the discourse segment purpose*; this reflects the fact that the discourse participants are *focused not only on what they are talking about but also on why they are talking about it*.

Discourse Structures Theory provides a unified account of both the intentional and attentional dimensions of discourse understanding and makes explicit important links between the two. The Dynamic Discourse Model, on the other hand, while more limited in its scope, provides an account of the discourse segmentation process on an utterance by utterance basis and is thus a more developed computational theory of the strictly linguistic aspects of the discourse understanding process.

13. THE LINGUISTIC DISCOURSE MODEL: CONCLUSIONS, CLAIMS AND FUTURE DIRECTIONS

The Linguistic Discourse Model presented in this paper provides a theoretical framework for the formal analysis of naturally occurring discourse. The Model captures many of the insights into discourse structure which have emerged over the past decade and provides a coherent account of both well behaved, maximally cohesive written discourse and highly attenuated social constructed oral talk. While we believe that we have demonstrated the usefulness of this Model in permitting the assignment of a structural description to a discourse on a left to right, clause by clause basis, a great deal of work remains to be done.

We expect to turn our attention next to refining and formalizing further the structural relationships which obtain among clauses and beginning the difficult task of providing an adequate discourse semantics.

A well worked out principled discourse semantics is necessary to provide an account of how a complex description of an entire rich world may be constructed through language by the sequencing and embedding of simple propositional clausal units. Detailed analyses of the role of discourse structure in constraining sentential syntactic and intonational structure remains for the future as well. Preliminary investigation indicates that recognition of the dcu boundary is accomplished by surface level structural cues in clause encoding form as well as by the semantic and pragmatic criteria discussed above. [59] [7] Intonational variation also correlates with syntactically and semantically recognizable dcu boundaries. Although work on discourse intonation is still in its infancy, the re-examination of preliminary findings of discourse unit breaks discovered through measurement of pitch and frequency contours [24] indicates that acoustic signal variation occurs where predicted by the

LDM on structural and semantic and contextual grounds. We shall leave further discussion of these intriguing possibilities to a subsequent paper.

APPENDIX A
NARRATIVE GENRES

Generic Narratives

Generic narratives are often used to encoded descriptions of *procedures*. [42]

Present time generic narrative dcu's consist of a listing of events in the order in which they are considered to have occurred in *a generic world* (GW_1) which has scope over the modelled moment of speaking. In GW_1 event E1 always occurs at time t_1,... event E2 always occurs at a next instantaneous time point t_2, and event E3 always occurs at time point t^3 etc. Time points $t_1 - t_3$ are ordered in GW_1 on a time line with t_1 preceding t_2 which precedes t_3.

Similarly, in a generic past-time narrative, the events do not encode a happening which occurred once, but a set of events which are asserted as always having occurred in a modelled discourse World GW_2 which is past relative to the present modelled moment of speaking. If a generic present narrative can be glossed as asserting: "in GW_1 event[1] always happens at $time_1$, followed by event[2] at $time_2$, and then event[3] at $time_3$. Then a generic past-time narrative, can be glossed as asserting in GW_2 Event 1 always took place at $time_1$, then Event 2 took place at $time_2$, and Event 3 always occurred at $time_3$. One can imagine, for example, encoding what one's grandfather always did every day in the past as a past time generic narrative, as in the following Generic Narrative Example.

Generic Narrative Example

```
Grandpa always woke up at 5 o'clock sharp. E1
He ate breakfast. E2
Washed quickly E3
and left for the office at 6:30. E4
He came home promptly at 6 E5
Ate dinner at 7 E6
```

and turned out the light E7
promptly at 11 o'clock. E8   ·

Simultaneous Narrative

Simultaneous Narratives are often produced in reporting situations where one person is acting "as the eyes" of another, recreating through language the unfolding of events in some (real or imaginary) shared context.

The convention of present specific time narration device permits event clauses on the surface structure of the text to be assigned the interpretation of asserting that events in the actual world of speaking are occurring at precisely the same moment as the event clause reporting their occurrence.: *Event1 is happening at time$_1$ which is now$_1$; Event 2 is happening at time$_2$, which is now$_2$ subsequent in time to now$_1$; while Event 3 is happening now$_3$ subsequent to the now$_2$ in which Event 2 just took place.*[34] Simultaneous narration is a feature of radio and television sports commentary and reporting of highly serialized happenings such as pageants and processions where "something new" is constantly taking place. The following is a short excerpt adopted from a report of an imaginary soccer game.

<div align="center">SIMULTANEOUS NARRATIVE EXAMPLE</div>

```
Angel picks the ball up midfield for Real Madrid. E1
floats it out to the far side E2
Santillo leads it short to Juanito E3
but Liverpool wins the ball back midway inside
their own green.E4
```

---

[34]Hypothetical narratives detail events which might or even must have occurred in a give order of specific instants in some hypothetical world

Irrealis Narrative

Plans are built around future-time narrative dcu's. Future-time narratives, differ from subjunctural narratives, because they assert that a series of events will take place and in a certain order -- *At $time_1$ Event 1 will take place; at $time_2$, Event 2 will take place; and at $time_3$, Event 3.* -- rather than asserting that events might happen at some time in the future.

<div align="center">Irrealis Narrative Example</div>

```
Let's wash the dishes E1
Pick up the kids E2
then
buy the tickets E3
and show up at your folks at 9. E4
```

Reports and Stories

Now in addition to past and future, past and present narratives, there are also past time specific positive realis narratives. Narratives meeting these constraints which do not necessarily make a *point* are commonly known as *reports*. A report asserts that *Event 1 took place at $time_1$ in a specific realis world A; followed by Event 2 at $time_2$ but preceding Event 3 which took place at $time_3$*. However, why these events are important, or why they are being reported is not necessarily marked on the surface structure of the text. Because reports are often produced in response to a request from he interlocutor who is assumed to know why the information should be given, a report is often a bare string series of events and states whose relevance must be determined by the report recipient independent of any explicit determination of relative salience by the report maker.

APPENDIX B
THE DISCOURSE CONSTITUENT HIERARCHY

DISCOURSE CONSTITUENT HIERARCHY

The Interaction

INTERACTION may be defined as "a mutually acknowledged state obtaining between participants in which semantic objects produced form part of an evolving Discourse History".

Grammar

Interaction--->Engagement + Speech Event* + Disengagement

Context Parameters (Kaplan Contexts) <(Interactants). Real World Time, Real Place, doing Activity specified at the Speech Event Level.>

The Speech Event

A **Speech Event** is a Constituent Unit of an **Interaction** in which a proper sub-set of the Interactants are engaged in some Activity with one another. The Activity engaged in brings with it a set of roles, expected sequences of events, admissible topics of talk and behavior.

Grammar

Speech Event ---> Move$^+$

Context Parameters

<(Role^1, Role^2, Role^{n-1}, Role^n), Activity defined Space, Activity defined time, Do Move>

THE MOVE and sub-move

A **MOVE**, a unit of Activity, is a Constituent Unit of a Speech Event.

Grammar

Move $--->$Move$^+$

THE DISCOURSE UNIT (DU)

Discourse Units are structured linguistically encoded objects in which come conventional organization of information is used to encode semantic content of known types in order to build up a coherent picture of the states of affairs obtaining in some world of interpretation. Stories, reports, arguments and proposals are DU types often encountered.

Grammar

DU$--->$dcu$^+$

Context Parameters

<Participants in World Modelled by Discourse, Temporal World Index, Temporal Spatial Index, (DO)>

DISCOURSE CONSTITUENT UNIT (dcu)

Discourse Constituent Units are the linguistic unit of discourse organization. Discourses, as linguistic objects, are composed of sequences and recursive embeddings of dcu's. The primitive dcu is the clause.

Grammar

dcu--->dcu$^+$
dcu<W> ---> dcu<W_1> COORD dcu<W_2>
    <W> = of the intersection of <W1>, <W2>
dcu--->dcu <W> EMBEDS dcu<W^1>
    <W> = generalized case of <W> or dcu<W> unrelated to <W>
    unrelated to any other open Node in Parse Tree.
dcu---> dcu BINARY LOGICAL OPERATOR dcu

Context Parameters

{<polarity, degree of genericity, point of view, "sympathy" monotonicity, <established structuring relation <Topic*, Time*, Place*, Circumstances, Activity>>>}

Topic* -- subset of Participants (animate or abstract) in World*
Time* -- Time index in World*
Place* -- Spatial Index in World*

APPENDIX C
CONTEXTUAL PARAMETERS

CONTEXTUAL PARAMETERS

Topic* –– subset of Participants (animate or abstract) in World*
Time* –– Time index in World*
Place* –– Spatial index in World*

THE INTERACTION

<(Interactants), Real World Time, Real Place doing Activity specified a the Speech

Event Level.>

THE SPEECH EVENT

<(Role^1, Role^2, Role^{n-1}, Role^n), Activity defined Space, Activity defined time, DO

Moves>

THE DISCOURSE UNIT

<Participants in World Modelled by Discourse, Temporal World INdex, Temporal

Spatial Index, (DO)>

DISCOURSE CONSTITUENT UNIT (dcu)

{<polarity, degree of genericity, point of view, "sympathy" monotonicity, <established

structuring relation <Topic*, Time*, Place*, Circumstances, Activity>>>{

Topic* –– subset of Participants (animate or abstract) in World*
Time* –– Time index in World*
Place* –– Spatial Index in World*

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