MODELING INFORMAL DEBATES*

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ABSTRACT

Many rules of formal debate are well documented, of common knowledge, and "looked-up" in preparation for planned debating. Informal debates, on the other hand, are highly dynamic, are complex, and are spontaneously generated with no prior rule-book preparation. They too, however, are rule-governed. In this paper I present an abstract process model capable of modeling "well" formed" argument structures that occur in ordinary conversations. The formalization rests on a general theoretical framework for discourse engagement encapsulated in a disoourse ATN grammar. A major feature of the system is its segmentation of disoourse utterances Into functionally related oontext spaoes.

A, Introduction

A close analysis of spontaneous conversation reveals that it is highly rule-governed, and that its underlying structure is a hierarohical **organization of distinct, but related and linked, disoourse units [6, 3, 11]. I shall illustrate that a hierarohical view of disoourse facilitates the design of an abstract process model that** simultaneously (1) accounts for many surfaoe linguistics phenomena found in conversational speech; (2) identifies the relevant discourse oontext in which subsequent utterances are generated/interpreted; (3) explains the semantic coherent flow of a conversation; and (4) specifies options available to oonversants at discrete points in the disoourse. These elements are fundamental in modeling informal debate structures.

B. The Context Spaoe Theory of DIsoourse

1. Conversational moves

In the discourse theory proposed here, a conversation is seen as a sequence of converzational moves wherein each move corresponds to a speaker's nnmnnlfiitilYft *MSMI* vls-a-vis a particular ᵨ precedingsection of discourse. •Support,* "Challenge,■ and "Interrupt," are of the communicative goals Identified in this. The goals are specific to "maxim-abiding thematio development of a disoourse, and do not refer to underlying speaker emotive intentions.

All conversational moves have a set of (1) preconditions which speolfles the requisite

discourse environment for the move's appropriate performance; (2) different nodes of fulfillment; and (3) varied effects on a discourse context. Effective communication is enabled by oonversants being aware of such a standardisation of conversational moves.

2. A relevant dIsoourse oontext

Discourse structuring and segmentation Provides a mechanism by whioh to delineate that limited portion of preceding discourse directly relevant to the ongoing exchange. For example, when development of a oontext spaoe is interrupted, the interrupted space is not of direct relevanoe to the ensuing conversation until the digression is oompleted and the interrupted spaoe is resumed from its point of interruption.

Different forms of topic suspension and resumption is a typical feature of extended discourse. By associating different levels of influential Status with a context spaoe, a space's various suspension states during the coourse of an exchange oan be captured.

The influential status of a space reflects its foreground-background disoourse role. Only oontext spaces in a foreground role are directly related to current discussion, and only they are considered to be in the current relevant dlaoourse context. In general, the relevant oontext is limited to the context space under ourrent development (called the $^{M}_{th}$% and the one other space called the spaoe) vis-A-vis which the goal of the active space applies.

In the oontext spaoe framework, relevant context identification is enabled by recording the standardised effects of taken conversational moves. These effects include reassigning the influential status of preoeding spaces and creating and deleting outstanding dlsoourse expectations of moves to follow.

3. Context spaoes

Context spaoes enoode information both explicit and implicit in the dialogue. The spaces are characterised in muoh the same way as elements of s "Systemic Grammar" [4] via attributes represented as "slots" A la MInsky [8]. Some slots are standard for all context spaoes. Other slots are specific to the communicative goal served by the space - they reflect the implioit inferential elaborations needed for a constituent type to serve a given disoourse role.

For example, substantive supports usually involve expression of some etate-of-affairs, F, such that there exists some generic support-principle, P (A la Toulmln'a notion of a *baoking" [15]), of the form "A Implies B," such thst F is an instanoe of A (or Not B). C is an Instance of B (or Not A), and using some Inference

rule like Modus-Ponens (or Modus-Tollens), C follows from F.

In illustration, consider R's utterances on Lines 1-16 below. The excerpt is taken from an informal debate between friends, where the "nature-nurture" controversy is under current contention. R's utterances are in response to D's preceding claim that most criminal behavior is not genetically determined.

Excerpt 1

```
R:  1.  Except however, John and I just saw this
    2.  two hour TV show,
M:  3.  Uh hum,
R:  4.  where they showed - it was an excellent
    5.  French TV documentary - and they showed
    6.  that, in fact, the aggressive nature of
    7.  the child is not really that much
    8.  influenced by his environment.
M:  9.  How did they show that?
R: 10.  They showed that by filming kids in
   11.  kindergarten,
M: 12.  Uh hum,
R: 13.  showing his behavior among other children,
M: 14.  And then?
R: 15.  and showed him ten years later acting the
   16.  same way, towards, um,
D: 17.  Well, of course, that's where he learns
   18.  his behavior, in kindergarten.
M: 19.  Oh, sure,
R: 20.  Oh, and it was twins. The important thing
   21.  was that there were two children from the
   22.  same environment, whereas only one of the
   23.  brothers acted that way.
   24.  So you couldn't blame it on the child's
   25.  home.
D: 26.  It has nothing to do with the child's home.
   27.  It has to do with the child's environment.
R: 28.  Right, but the two brothers have the same
   29.  environment.
D: 30.  They do not have the same environment.
R: 31.  Why not?
D: 32.  Because you and I are very close in this
   33.  room right now but we don't have the same
   34.  environment.
   35.  Because I'm looking at you, I'm seeing
   36.  that window behind you, you're not seeing
   37.  that window behind you. You are not
   38.  looking at you, I am doing it.
   39.  Two people can't be in exactly the same
   40.  place at the same time, otherwise, they'd
   41.  occupy the same space.
   42.  They do not have the same environment.
   43.  They don't have the same friends.
M: 44.  And, I mean, they don't even - You know, to
   45.  say that two kids come from the same
   46.  family is really meaningless, because when
   47.  you think of the difference in treatment
   48.  that two kids can get in exactly the same
   49.  family, it's incredible. You know, it's
   50.  the difference between night and day.
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On Lines 1 -16, R performs two conversational moves: (1) the assertion of a claim (Lines 5-6); and (2) citation of a support for this claim. The support move involves both an authority citation (Lines 1-5) and a substantive support analyzed as follows (using the abbreviations, C (Claim), F(Fact of Support), P (Principle), M (Mappings between P and C), M' (Mappings between P and F), and LR (Logic Rule)):

C = Not(The aggressive nature of the child is influenced by his environment) - Not(A)

F = Not(A child's aggressive behavior in kindergarten changed over ten years) - Not(B)

P = IF (A) a person's social interactive behavior is environmentally influenced Then (B) that person's social interactive behavior will change over time

M = ((person's social interactive behavior, child's aggressive behavior))

M' = ((person's social interactive behavior, child's aggressive behavior), over time, ten year duration period from kindergarten))

LR = Modus-Tollens

All supportive context spaces are characterized by slots to hold a Source, Method, Credentials, Access, F, P, M, and M' components of a support move.

4. Surface linguistic phenomena

Effective conversational engagement rests on listeners being able to identify the functional relation of a speaker's utterances to the preceding discourse. A speaker's surface linguistic forms often signal the relation involved.

Clue words:

Speakers often preface their substantive utterances with linguistic connectives whose sole (major) import seems to be conversational move marking [7, 11, 14]. For example, when directly attacking an opponent, a speaker will say something like, "No, but," whereas, when indirectly attacking, the speaker will say "Right/Yes, but" (e.g., Line 29, Excerpt 1). The "right/yes" of the indirect challenge indicates that while the opponent's claim may be true, it is basically irrelevant or overly weak to be of major import to the argument. The "no" of the direct challenge explicitly undermines the very validity of the opponent's claim.

(Non)Pronominalization:

Traditional theories of pronominalization based on "recency" and "semantic ambiguity" criteria cannot account for the many cases of nonpronominalization that one finds in spontaneous discourse. An effective model of discourse (non)pronominalization must be based on recognizing a discourse's underlying structural, thematic organization, and the interrelationship between this structure and the discourse "focus". The predominant pronominalization rule encoded in the context space theory is that only elements in high focus in a current relevant discourse context will be pronominalized.

The nonpronominalization phenomenon highlighted here, I believe, exhibits the high level of subconscious rule-governed processing involved in discourse engagement. For example, in all probability, most readers, consciously analyzing Excerpt 1, will assume that the nonpronominal cases cited could all be replaced with pronominals without any so called grammatical violation or obscurity of intended referent. Yes, the intended referent would probably be retrievable without undo difficulty. However, in the course of the exchange, such pronominals would convey subtle conflicting messages to a listener about the speaker's underlying structural representation of the discourse. In addition, these cases are but prototypical of the repeated nonpronominalization found in discourse. The phenomena warrants explanation.

For example, consider the contrasting cases of (non)pronominalization on Lines 24, 29, and 43 of Excerpt 1.

Line 24: Line 24 is supported by Lines 20-23

and is used by R to modify and supersede her initial claim of Lines 6-8. After acceptance of D's Lines 17-18 challenge, only a child's environment before kindergarten is relevant. R therefore equates "environment before kindergarten" with "child's home" and addresses herself to this residual issue.

The antecedent of "It" on Line 24 is "the aggressive nature of the child," last mentioned on Line 6. A relevant discourse context for a replacement claim is the claim being superseded. Using such a structural analysis of the discourse enables effective modelling of R's long distance pronominalization.

Line 28: This same criteria of discourse pronominalization and structural analysis of a discourse, enables effective modelling of R's subsequent short distance nonpronominalization of "the two brothers" on Line 28 though they were just referenced on Line 21 and no other potential antecedents had intervened. By Line 28, Line 21 is no longer part of the relevant discourse context.

o Concluding a set of supportive utterances (Lines 20-23) with the claim they support (Line 24) removes the supportive utterances from the relevant discourse context.

Line 42: Line 42 is a restatement of Line 30 and Line 43 is a further support of it. (The utterances cannot be a continuation of Lines 39-41 because they are of definite modality, whereas the modality of Lines 39-41 is hypothetical.)

Despite D's intervening use of "they" to refer to "two people," his use of "they" on Line 42 to refer to "the two brothers" is unambiguous, because the utterances containing "two people" and the preceding "they" are no longer in the current relevant discourse context. They are therefore not possible antecedents for this pronominal form.

o Resumption of the initiating subject of an analogy (Line 42) simultaneously reinstantiates the initiating utterances as the current relevant discourse context, and removes all analogous and transitional utterances from it (Lines 32-41).

C. The ATN Grammar

The formalism chosen to encode the context space process model is an Augmented Transition Network (ATN) a la Woods [16] - register testing and action executions along ATN transitions seem a natural way capture many of the context sensitive aspects of extended discourse. In the discourse ATN, these tests and actions correspond to the preconditions and effects of conversational moves, and state transitions, often, correspond to a finer characterization of conversational move mode fulfillment .

Figure 1 in Appendix I represents a small portion of the discourse ATN. (Due to space considerations only "Push"/"Jump" actions are noted.) The model is written in terms of a basic loop, a single traversal of which represents the taking of a single conversational move. On each transition cycle, the process model begins in the "Produce-Next-Move" state, wherein it chooses a conversational move category; in one of the last arcs traversed, there is delineation of an abstract characterization of the message to be generated. The characterization specifies a semantic/logical

• See [12] for full discussion of further correspondences, and distinctions, between this discourse ATN and typical ATNs used in sentential processing.

relation between the utterances generated and utterances contained in the current controlling context space. This characterisation must be met if the subsequent utterances are to fulfill the given conversational role category. The characterizations are written in a predicate-calculus like language, where functions like "For All," "Infer," "Imply," and "Exclusive-OR," are considered primitives of the system.

There are three major modes of processing performed in a conversation: (1) finer and finer categorization of the type of message to be generated; (2) updating our mental models of the discourse in preparation for generation of such remarks, and (3) actual production. Correspondingly, the grammar's states (via the type of actions on their arcs) are of three modes: (1) organizational, wherein tests and decisions are performed in finer categorization of the forthcoming conversational move category; (2) constructive, wherein the updating actions associated with a given move, which include register assignments and the creating and updating of context spaces, are performed; and (3) productive, wherein the actions on arcs entail formation of the message to be generated.

1. Modelling informal debate moves

In Informal debating, our highest level categorization of likely conversational moves are (1) challenging an opponent (executing a challenge-choice expectation); (2) further challenging an opponent (executing a further-challenge expectation); and (37 giving support to one's claims. The following are the initial discourse model updating effects individually associated with each move.

The Challenge Move: A next speaker is selected who is either: (1) the speaker noted in the accompanying discourse expectation; (2) a conversant known to be on the expected speaker's side; (3) a previously neutral conversant who is appended onto the expected speaker's side; or (4) a conversant switching sides in the debate. In addition, the conversant being challenged (i.e., the last speaker) is assigned the role of Future-Defender, to reflect that s/he will most likely counterchallenge the forthcoming challenge.

The Further-Challenge Move: A further-challenge always entails a discourse pop to some preceding claim of an opponent which has led to current subargumentation. It therefore involves closing intervening argumentation and re-establishing the context space popped back to (or one of its direct subconstituentsj as the relevant discourse context for subsequent generation. This is accomplished by traversing the links between context spaces, beginning with the active apace and ending with the one being popped back to (i.e., the context space noted in the discourse expectation being processed).

A next speaker is then chosen in manner similar to the counterchallenge case. Here, however, the last speaker (who is a team member of the newly selected speaker) is not assigned the Future-Defender role, but rather, the Protagonist of the space popped back to is.

The Support Choice Move: Here too the grammar's first action is to select a next speaker, in this case, either the current speaker continues to hold the floor, or a speaker known to be on the current speaker's side is selected as next speaker. As a new challenge is not being generated, no conversant is put into the Future-Defender role.

2. Tracing Through Exoerpt 1

To illustrate the operation of the Discourse ATN, let us follow some details of the prooess modeling Excerpt 1.

R's move on Line 1 of the excerpt, as indicated by the clue words, "Except, however," is a challenge conversational move. At this point in the conversation the oonversants are already in the midst of a debate, and R ia counter challenging D's preceding claim that most criminal behavior la not environmentally induoed* Let's begin then with the grammar having already decided to have R as next speaker performing a challenge conversational move. Major features of the grammar's ourrent model of the dlacourse, then, are:

o HEAD-CCS points to C1, the current controlling context space in the discourse environment.

o Major slot fillers of C1 are: State « Controlling; TYPE = Debative-Issue; Protagonist « R; Claim * Many criminals are Inherently evil; Antagonist = D; Counterclaims X C2;

o CCS points to C2, the current active context space in the discourse.

o Major slot fillers of C2 are: TIPS = Debative-Issue; Protagonlst = D; Claim « Genetics is not to blame for most people's criminal actions; Goal * Challenge; Co* Relator = C1; Method « Range-Application; State a Active.

o SPEAKER = R; FUTURE-DEFENDER « D; PARTICIPANT-LIST = (D M); SIDES = ((D).(R)); EXPECTATION-LIST • ((Further-

The prooess model begins by appending onto its list of outstanding discourse expectations the expectation that R is likely to later further challenge D'a preceding claim. Then, modeling R's move, It chooses an Indirect-Challenge mode of argumentation.

Indirect challenges (as contrastive with some forms of direct challenges) always entail citation of a substantive claim whose communicative goal is In direct opposition to that of the current active context apace. As such, this conversational move category always results in a oontext space shift and establishment of a new relevant discourse context. To set the proper environment for subsequent generation, therefore, the grammar now pushes to a constructive state, whose actions Include:

o changing the state value of the oontext space pointed to by HEAD-CCS (i.e., C1) to Generating. A Generating atate reflects that continued discussion is indirectly related to the context apaoe, and that therefore there is some chance of a later return to this space (as reflected by the (Further-Challenge, D, C1) expectation yet outstanding);

o changing the atate value of the oontext apace pointed to by CCS (i.e., C2) to Controlling, and assigning HEAD-CCS to it. This reflects that while subsequent generation will be directly related to the space, it will not be a continuation of its contained utterances.

o creating: a new debative-issue context apace, C3, to contain components of the forthcoming move. CCS is assigned to it, and its following slots are filled: State <- Active; Goal <- Challenge; Co-Relator <- C2; Protagonist <- R.

Returning from this constructive state, the gra ear is now ready to further subcategorize the

mode of Indirect challenge. Since the modality of D's claim is negative, a challenge based on Modua-Tollendo-Ponena, is appropriate (i.e., in response to an opponent'a claim of Not(B), a speaker claims Not(A), where A EXCLUSIVE-OR B is trueT.

The grammar begins by generating the clue words associated with this move, "Except, however," and, then, facilitates citation of an authority for the claim about to be given. Supportive utterances and the claim they support serve different functional roles in a diacourae and as suoh are dlatlnot constituents of It: supportive spaces are suboonstituents of the space they support. Therefore, in preparation for R'a support citation, the grammar first constructs a new supportive oontext space, C4, assigning its Goal slot to Support, and its Co-Relator slot to C3. R's authority citation la then generated, and inserted into the authority slot of this spaoe.

Returning from the support push, the grammar fills C3's SupportCS slot with the newly created support space. and then it generates R's challenging claim. The claim la inserted into C3's claim slot, and "Modus-Tollendo-Ponens" is inserted into its Method slot. Then, as oommon for all Indirect challenges, the new challenge oontext apace is inserted into the Counterclaim slot of the spaoe being challenged (i.e., the controlling context space C2).

The grammar then pops back to the general challenge state category, wherein it always creates the expectation that the challenged conversant (i.e., the one assigned to a Future-Defender role), will counterchallenge the challenge just cited (i.e., the active oontext space).

Having ended simulation of R's challenge move, the grammar re-enters its stsrt state where it begins to prooess the next conversational move. There it chooses to process this last discourse expectation created (i.e., (Challenge-Choioe1, D, C3)). Control therefore once again immediately passes to the general challenge stste of the grammar. This time, M, yet an unaligned converssnt, is ohosen as next speaker and she is appended onto D's side of the debate. R, the preceding: speaker, is assigned the Future-Defender role. control is then passed to the challenge directly state.

Since R's support of c3 only entailed citation of an authority, demanding some substantive support, via generation of a "how" "why" question, is appropriate. As this move does not involve citation of a contrary claim, the move does not result in the creation of a new context space or accompanying establishment of a new relevant discourse context. Instead, its effect is to restrict the addressed oonversant's subsequent conversational move to one of support. This constraint is noted in the counterchallenge expectation set up for the Future-Defender (i.e., (Challenge-Cholcel, R, C3, "Supply-Support-Claim") is appended onto the Expectation-List register).

On the grammar's next cycle through the network, it chooses to process this expectation: R is selected as next speaker, and M is assigned the role of Future-Defender. This time, however, transitions to either the direct or indirect challenge forms are forestalled by the Expectation register test on the aros of these transitions. In accordance with maxim-abiding constraints, the grammar, therefore, goes to the Support state, wherein it generates the demanded support, (a formal analysis of which has cited earUS!.

At this point, let's skip to the last section of the excerpt in illustration of the grammar's method of modeling context space resumptions. M's utterances on Lines 44-50 do not oontinue D's preceding conversational move, but rather, serve as a further challenge to R's claim on Line 24, via attack on its support of Lines 20-23* Formally apeaklng, M's challenge entails challenging R'a mappings of "two people sharing the same environment" onto "two twins living in a same home."

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As such, the relevant discourse context for subsequent generation should be C6, the supportive context space about to be challenged. However, currently, C6's state is closed, and the relevant discourse context is composed of D's debative-issue context space (C10, which contains his claim of Line 30/42) and its supportive context space (C16, which contains Line 43 of the excerpt). To remedy this situation the grammar must perform some extensive discourse model updating.

M's conversational move on Line 44 is a further-challenge. As discussed, the first action of this move is to close all intervening subargumentation stemming from the space being popped back to (as noted in the discourse expectation) up to and including the current active space. This is accomplished by traversing the network links between these context spaces. Major features of the grammar's context space configuration by Line 45 (of relevance here) are:

C6:   Line 20-23; Goal: Support; Method: Modus-Tollendo-Tollens; Co-Relator: C6; State: Closed.
C7:   Line 24; Goal: Fix-Claim; Method: Constrainment; Co-Relator: C3; SupportS: C7; CounterClaims: C8; State: Generating.
C8:   Lines 26-27; Goal: Challenge; Method: Irrelevance-By-Expansion; Co-Relator: C7; CounterClaims: C9; State: Generating.
C9:   Lines 28-29; Goal: Challenge; Method(1): Apply-Expansion; Co-Relator(1): C8; Method(2): Derived-From; Co-Relator(2): C7; CounterClaims: C10; State: Generating.
C10:   Lines 30, 42; Goal: Challenge; Method: Deny-Truth; Co-Relator: C9; SupportS: (C11, C16) State: Controlling.
C11:   Lines 32-34; Goal: Support; Method: Analogy; Co-Relator: C10; SupportS: (C12, C13); State: Closed.
C12:   Lines 35-37; Goal: Support; Method: Modus-Tollendo-Tollens; Co-Relator: C11; State: Closed.
C13:   Line 38; Goal: Support; Method: Modus-Tollendo-Tollens; Co-Relator: C11; State: Closed
C14:   Lines 39-40; Goal: Relate-Analogy; Method: Abstraction; Co-Relator: C10; SupportCS: C15; State: Closed.
C15:   Line 41; Goal: Support; Method: Modus-Tollens; Co-Relator: C14; State: Closed.
C16:   Line 43; Goal: Support; Function: Modus-Tollens; Co-Relator: C10; State: Active

Beginning with the active context space, C16, the grammar starts closing subarguments by reassigning its state and that of context spaces C10, C9, and C8, to Closed. Notice that intervening discussion contained in context spaces C15, C14, C13, C12, and C11, are not accessed in this traversal. This correctly reflects the influence of closed context spaces: they are entirely irrelevant to subsequent discourse processing (unless they are explicitly re-entered).

Having popped the discourse, the grammar now can select M, already aligned on D's side of the debate, as next speaker, and assign R, the Protagonist of the popped back to space, to the role of Future-Defender. The grammar now has to further subcategorize the type of further challenge to be processed. Two main subcategorizations are possible: (1) new counterclaim/countersupport specification; or (2) further support of a preceding counterclaim/countersupport. M, on the offense, chooses the former: CCS is reset to C7, and processing continues as for initial challenges - state transition to Challenge-Choice2, wherein the direct challenge form is chosen.

As M's challenge involves challenging specifics of R's preceding support for C7, control is passed to the support-specifics-challenge state, wherein, C6, C7's support space, is reinstantiated as controlling. A new debative-issue space is then created to contain M's subsequent utterances. (For further details of the force of M's argument, and the grammar's analysis of it, see [12].)

D.   Conclusion

The key element of this analysis is a structural and functional decomposition of a discourse into distinct, but related and linked, context space constituents. Context spaces are characterized by their functional role in a discourse and they contain information both explicit and implicit in the dialogue. This decomposition is enabled by:

o formalization of a set of standard conversational moves performed in discourse;

o formalization of the effects of each of these moves on a discourse context. Such effects constrain and set up predictions for subsequent thematic development;

o identification of clue word cues that signal a conversant'a forthcoming conversational move;

I have illustrated that such a structural decomposition enables the grammar to:

o effectively model discourse (non)pronominalization;

o identify the limited preceding section of "talk" serving as a point of reference for subsequent discourse generation and/or interpretation;

o clearly mark and hence ignore all intervening discourse that need not even be considered in re-establishment of a relevant discourse context;

o have explicit annotation of elements of a discourse that are only implicit in a speaker's verbalization of a given conversational move. Such explication enables the grammar to identify those components of a preceding move that an opponent is challenging, though, at a superficial level, the opponent does not deny anything that has been said.

The context space theory delineates a single abstract structure underlying all discourse forms - expository text, argumentative text, narrative text - and based on such structure characterization it is able to specify a single set of "maxim-abiding," "well-formedness," rules applicable to, and governing all discourse forms. Its basic components of segmentation, selective attention, relevant context identification, cues, and expectations, correspond to the fundamental elements of many cognitive processes [9, 10].

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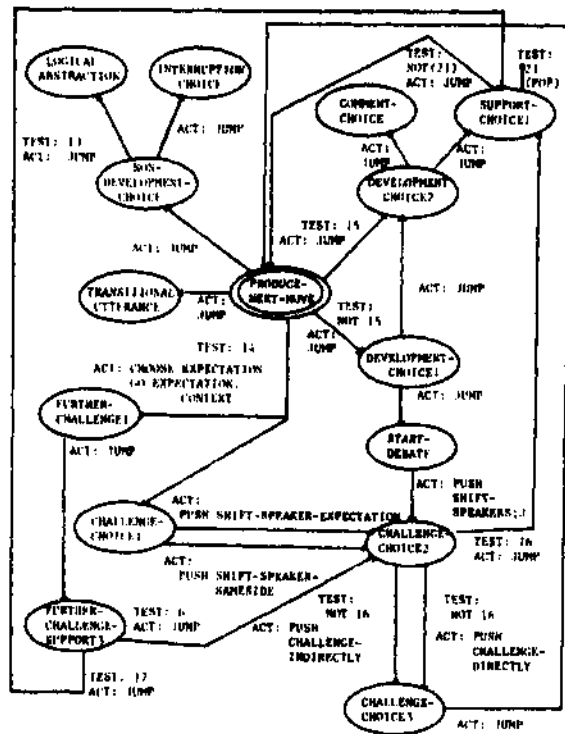
I. APPENDIX I

Figure 1 represents a small portion of the discourse ATN. The tests below correspond to those noted on the transitions.

Tests Applicable in Transitions

1. Expecting Support of a Flat Rejection
2. After Denial of Truth
3. After Unsubstantiated Flat Rejection
4. After Apply-Expansion
5. After a Preceding Challenge
6. Further-Challenge
7. No Preceding Propositional Support
8. Some Existing Support of Preceding Claim
9. After Expansion Challenge
10. After an Epistemic Claim
11. After a New-Factor Challenge
12. After an Analogy
13. Evaluative Claim Under Discussion
14. Some Outstanding Discourse Expectations
15. In Debate Mode
16. Expecting a Demanded Support for a Preceding Claim
17. Supporting a Preceding Counterclaim
18. Subordinating to a Controlling Context Space
19. Conceded a Support as Flawed
20. Some Authority for the Claim has been Cited
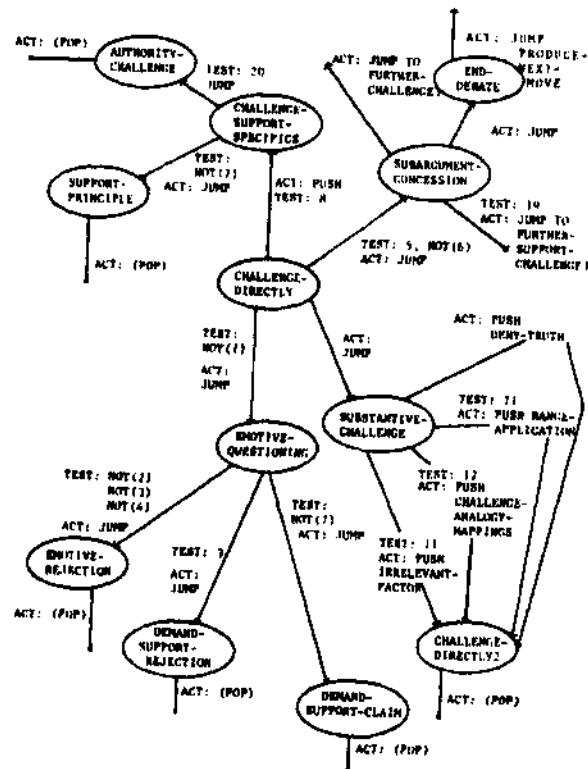21. Just Generated Support for an Implicit Challenge

FIGURE 1:   A PORTION Of THE DISCOURSE ATN