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COMPUTATION OF A SUBCLASS OF INFERENCES:

PRESUPPOSITION AND ENTAILMENT

ARAVIND K. JOSHI AND RALPH WEISCHEDEL

Department of Computer and Information Science
Moore School of Electrical Engineering
University of Pennsylvania, Philadelphia 19104

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Weischedel was associated with the University of California, Irvine, during the preparation of this manuscript. His present address is Department of Computer Science, University of Delaware, Newark.

SUMMARY

The term "inference" has been used in many ways. In recent artificial intelligence literature dealing with computational linguistics, it has been used to refer to any conjecture given a set of facts. The conjecture may be true or false. In this sense, "inference" includes more than formally deduced statements.

This paper considers a subclass of inferences, known as presupposition and entailment. We exhibit many of their properties. In particular, we demonstrate how to compute them by structural means (e.g. tree transformations). Further, we discuss their computational properties and their role in the semantics of natural language.

A sentence S <u>entails</u> a sentence S' if in every context in which S is true, S' must also be true. A sentence S <u>presupposes</u> a sentence S" if both S itself entails S" and the (internal) negation of S also entails S".

The system we have described computes this subclass of inferences while parsing a sentence. It uses the augmented transition network (ATN). While parsing a sentence, the ATN graph retrieves the tree transformations from the lexicon for any words in the sentence, and applies the tree transformation to the appropriate portion of the semantic representation of the sentence, to obtain entailments and presuppositions. Further, when a specific syntactic construct having a presupposition is parsed, the ATN generates the corresponding presupposition using tree transformations.

That presupposition and entailment are inferences is obvious. However, the requirement in their definition that they be independent of the situation (all context not represented structurally) is strong. Hence, it is clear that presupposition and entailment are strictly a subclass of inferences. As one would hope in studying a restricted class of a more general phenomenon, this subclass of inferences exhibits several computational and linguistic aspects not exhibited by the general class of inferences. Some of these are 1) presupposition and entailment seem to be tied to the definitional (semantic) structure and syntactic structure of language, 2) presupposition and entailment exhibit complex interaction of semantics and syntax; they exhibit necessary, but not sufficient, semantics of individual words and syntactic constructs, and 3) for the case of presupposition and entailment, there is a natural solution to the problem of knowing when to stop drawing inferences, which is an important problem in inferencing, in general.

0. Introduction

The term "inference" has been used in many ways. In recent artificial intelligence literature dealing with computational linguistics, it has been used to refer to any conjecture given a context (for instance, the context developed from previous text). The conjecture may be true or false. In this sense, "inference" includes more than formally deduced statements. Further, alternatives to formal deduction procedures are sought for computing inferences because formal deductive procedures tend to undergo combinatorial explosion.

A subclass of inferences that we have studied are presupposition and entailment (defined in Section 1). As one would hope in studying a restricted class of a more general phenomenon, this subclass of inferences exhibits several computational and linguistic aspects not exhibited by the general class of inferences.

One aspect is that presupposition and entailment seem to be tied to the definitional (semantic) structure and syntactic structure of language. As a consequence, we demonstrate how they may be computed by structural means (e.g. tree transformations) using an augmented transition network.

A second aspect is that presupposition and entailment exhibit complex interaction of semantics and syntax. They exhibit necessary, but not sufficient, semantics of individual words and of syntactic constructs.

Another aspect relates to the problem of knowing when to stop drawing inferences. There is a natural solution to this problem for the case of presupposition and entailment.

The definitions of presupposition and entailment appear in Section 1, with examples in Sections 2 and 3. A brief description of the system that computes the presuppositions and entailments of an input sentence appears in Section 4. (The details of the computation and the system are in Weischedel (1976).) Detailed comparison of this subclass of inferences with the general class of inferences is presented in Section 5. Conclusions are stated in Section 6. An appendix contains sample input-output sessions.

1. Definitions

In this section, we define the inferences we are interested in (presupposition and entailment), and comment on our use of the terms "pragmatics" and "context".

In order to specify the sub-classes of inferences we are studying, we need some preliminary assumptions and definitions. Inferences, in general, must be made given a particular body of pragmatic information and with respect to texts. Since sentences are the simplest cases of texts, we are concentrating on them. Presuppositions and entailments are particularly useful inferences for studying texts having sentences containing embedded sentences, and they may be studied to a limited extent independent of pragmatic information.

1.1 Subformula-derived

We assume that the primary goal of the syntactic component of a natural language system is to translate from natural language sentences to meaning representations selected in an artificial language. Assume further, that the meaning representations selected for English sentences have a syntax which may be approximated by a context-free grammar. By "approximated", we mean that there is a context-free grammar of the semantic representations, though the language given by the grammar may include some strings which have no interpretation. (For instance, the syntax of ALGOL is often approximated by a Backus-Naur form specification.)

Since we have assumed a context-free syntax for the semantic representations, we may speak of the semantic representations as well-formed formulas and as having well-formed subformulas and tree representations.

As long as the assumption of context-free syntax for semantic representations is satisfied, the same algorithms and data structures of our system can be used regardless of choice of semantic primitives or type of semantic representation.

Let S and S' be sentences with meaning representations L and L' respectively. If there is a well-formed subformula P of L and some tree transformation F such that

$L' = F(P)$,

then we say S' may be subformula-derived from S. The type of tree transformations that are acceptable for F have been formalized and studied extensively in computational linguistics as finite-state tree transformations.

The main point of this work is that the presuppositions and entailments of a sentence may be subformula-derived. We have built a system by which we may specify subformulas P and tree transformations F. The system then automatically generates presuppositions and entailments from an input sentence S.

1.2 Pragmatics and Context

We use context to refer to the situation in which a sentence may occur. Thus, it would include all discourse prior to the sentence under consideration, beliefs of the interpreter, i.e., in short the state of the interpreter. We use pragmatics to describe all phenomena (and computations modelling them) that reflect the effect of context.

1.3 Entailment

A sentence S entails a sentence S' if and only if in every context in which S is true, S' is also true. We may say then that S' is an entailment of S. This definition is used within linguistics more as a test rather than as a rule in a formal system. One discovers empirically whether S' is an entailment of S by trying to construct a context in which S is true, but in which S' is false.

Entailment is not the same as material implication. For instance, let S by "John managed to kiss Mary," which entails sentence S', "John kissed Mary." Givon (1973) argues that even if $\sim$ S' is true, we would not want to say that "John did not manage to kiss Mary." The reason is that "manage" seems to presume an attempt. Hence, if John did not kiss Mary, we cannot conclude that John did not manage to kiss Mary, for he may not have attempted to kiss Mary. Though S entails S', it is not the case that S $\supset$ S', since that would require $\sim$S' $\supset$ $\sim$ S.

We have shown that entailments may be subformula-derived, that is, that they may be computed by structural means. As an example, consider the sentence S below; one could represent its meaning representation as L. S entails S', with meaning representation L'.

S. John forced us to leave.

L. (IN-THE-PAST (force John
(EVENT (IN-THE-PAST (leave we)))))

S'. We left.

L'. (IN-THE-PAST (leave we))

From the meaning representation selected it is easy to see the appropriate subformula and the identity tree transformation which demonstrate that this is a subformula-derived entailment. (This is, of course, a trivial tree transformation. A nontrivial example appears in Section 1.4, for presupposition.) Many examples of entailment are given in Section 2.

Notice that it is questionable whether one understands sentence S or the word "force" if he does not know that S' is true whenever S is. In this sense, entailment is certainly necessary knowledge (though not sufficient) for understanding natural language. We will see this again for presupposition.

1.3 Presupposition

A second, related concept is the notion of presupposition. A sentence S (semantically) presupposes a sentence S' if and only if S entails S' and the internal negation of S entails S'. (Other definitions of presupposition have been proposed, Kartunnen (1973) discusses various definitions.)

From the definition one can easily see that all semantic presuppositions S' of S are also entailments of S. However, the converse is not true, as the sentence S and S' above show.

Again, this definition is primarily meant as a linguistic test for empirically determining the presuppositions of a sentence and not as a rule in a formal system.

Note that the truth of a presupposition of a sentence is a necessary condition for the sentence to have a truth value at all. If any of the presuppositions are not true, the sentence is anomolous. For instance, the sentence

"The greatest prime number is 23."

presupposes that there is a greatest prime number. The fact that there is none explains why the sentence is anomolous.

Other authors have referred to the concept of presupposition as "given information". Haviland and Clark (1975) as well as Clark and Haviland (1976) suggest a process by which humans use given information in understanding utterances. They present much psychological and linguistic evidence that confirms their hypothesis.

As an example of a subformula derived presupposition consider sentences S1 and S1' below. It is easy to see that whether S1 is true or false, S1' is assumed to be true.

S1: John stopped beating Mary.

L1: (IN-THE-PAST (stop (EVENT (beat John Mary))))

S1': John had been beating Mary.

L1': (IN-THE-PAST (HAVE-EN (BE-ING (beat John Mary))))

L1 and L1' are semantic representations for S1 and S1' respectively. The well- formed subformula in this case is all of L1. The tree transformation from L1 to L1' offers a nontrivial example of a subformula-derived presupposition.

Notice that one might wonder whether sentence S1 and the meaning of "stop" were understood if one did not know that S1' must be true whether John stopped or not. In this sense, presupposition is necessary (but not sufficient) knowledge for understanding natural language.

We have shown that presuppositions (as we have defined them above) may be subformula-derived. Henceforth, we will use "entailment" to mean an entailment which is not also a presupposition.

2. Elementary Examples

This section is divided into two subsections. Section 2.1 deals with presuppositions, section 2.2 with entailments. All example sentences are numbered. An (a) sentence has as presupposition or entailment the corresponding (b) sentence.

2.1 Presupposition

Presuppositions arise from two different structural sources: syntactic constructs (the syntactic or relational structure) and lexical items (semantic structure).

2.1.1 Syntactic constructs

Perhaps the most intriguing cases of presupposition are those that arise from syntactic constructs, for these demonstrate complex interaction between semantics and syntax.

A construction known as the cleft sentence gives rise to presuppositions for the corresponding surface sentences. Consider that if someone says (1) to you, you might respond with (2a).

1. I am sure one of the players won the game for us yesterday, but I do not know who did.

2. a. It is B who won the game.

   b. Someone won the game.

The form of the cleft sentence is the word "it" followed by a tensed form of the word "be", followed by a noun phrase or prepositional phrase, followed by a relative clause.

Note particularly that the presupposition (2b) did not arise from any of the individual words. Rather, the presupposition, which is clearly semantic since it is part of the truth conditions of the sentence, arose from the syntactic construct. Thus, the syntactic (or relational) structure of the sentence can carry important semantic information.

Cleft sentences illustrate one important use of presuppositions: co-reference. Cleft sentences asert the identity of one individual with another individual referred to previously in the dialogue.

Further, the syntactic constructions associated with definite noun phrases have presuppositions that their referents exist in the shared information between the dialogue participants. By "definite noun phrases", we mean noun phrases which make definite (as opposed to indefinite) reference. Such constructions include proper names, possessives, adjectives, restrictive relative clauses, and nonrestrictive relative clauses. For example, consider the following (a) sentences and their associated presuppositions as (b) sentences.

3. a. John's brother plays for the Phillies.
   b. John has a brother.
4. a. The team that the Phillies play today has won three games in a row.
   b. The Phillies play a team today.
5. a. The Athletics, who won the World Series last year, play today.
   b. The Athletics won the World Series last year.

"Restrictive relative clauses" are relative clauses that are used to determine what the referent is. "Nonrestrictive relative clauses" are not used to determine reference, but rather add additional information as an aside to the main assertion of the sentence. (In written English, they are usually bounded by commas, in spoken English by pauses and change of intonation.)

Note particularly that the restrictive clauses as in (4) presuppose merely that there is some referent which must have that quality. On the other hand, nonrestrictive relative clauses, such as (5) presuppose that the particular object named also has in addition the quality mentioned in the relative clause. Sentence (5a) might be taken as a paraphrase of "The Athletics play today, and the Athletics won the World Series last year." However, using the syntactic construct of the nonrestrictive relative clause adds the semantic information that not only is (5b) asserted true, but also that (5b) must be presupposed true. Thus, this distinction between the restrictive and nonrestrictive relative clauses demonstrates again that the syntactic construct selected can carry important semantic information.

It is well-known that one role of syntax is to expose (by reducing ambiguity) the relational structure of the meaning of the sentence. The examples of presuppositions of cleft sentences and restrictive and nonrestrictive relative clauses demonstrate that another function of syntax is to convey part of the meaning itself.

For other examples of syntactic constructs that have presuppositions, see Keenan (1971) and Lakoff (1971).

2.1.2 Lexical entry

Presuppositions play an important part in the meaning of many words; these presuppositions may therefore be associated with lexical entries. Only a few classes of semantically-related words have been analyzed so far; analyses of many words with respect to presupposition are reported in Fillmore (1971), Givon (1973), and Kiparsky and Kiparsky (1970). Examples and a summary of such analyses may be found in Keenan (1971) and Weischedel (1975).

All of the following examples of presuppositions arise from the lexical entries for particular words. Again, the (b) sentence in each example is presupposed by the (a) sentence.

The (very large) class of factive predicates provide clear examples of presuppositions, (see Kiparsky and Kiparsky (1970)). Factive predicates may be loosely defined as verbs which take embedded sentences as subject or object, and the embedded sentences can usually be replaced by paraphrasing them with "the fact that S."

6. a. I regret that the Phillies have made no trades.

   b. The Phillies have made no trades.

Example (6) above demonstrates that another function of presupposition in language is informing that the presupposition should be considered true. We can easily imagine (6a) being spoken at the beginning of a press conference to inform the news agency of the truth of (6b).

It should be pointed out that presuppositions arising from lexical items have been studied primarily for verbs and verb-like elements such as adverbs. For instance, presuppositions have not, in general, been associated with common nouns.

Fillmore (1971) has found presupposition to be a very useful concept in the semantics of a class of verbs that he labels the verbs of judging. For instance, (7a) presupposes (7b) and asserts (8b). On the other hand, (8a) presupposes (8b) and asserts (8b). Thus, "criticize" and "accuse" are in some sense the dual of each other.

7. a. The manager criticized B for playing poorly.

   b. B is responsible for his playing poorly.

8. a. The manager accused B of playing poorly.

   b. B's playing poorly is bad.

Keenan (1971) points out that some words, such as "return", "also", "too", "again", "other", and "another", carry the meaning of something being repeated. These words have presuppositions that the item occurred at least once before

9. a. B did not play again today.

   b. B did not play at least once before.

Note that these words include various syntactic categories. "Also", "too", "again", are adverbial elements (adjuncts). "Other", and "another" have aspects of adjectives and of quantifiers. Again we see that the phenomenon of presupposition is a crucial part of the meaning of many diverse classes of words.

Given these introductory examples, let us turn our attention to examples of entailment.

2.2 Entailment

Entailments appear to have been studied less than presupposition. All of the examples identified as entailment thus far seem to be related to lexical entries of particular words. Two comprehensive papers that analyze words having entailments are Karttunen (1970) and Givon (1973).

2.2.1 Classification of words having entailments

At least five distinct semantic classes of words having entailments have been identified by Karttunen (1970). In the following examples, the (b) sentence is entailed by the (a) sentence.

Predicates such as "be in a position", "have the opportunity", and "be able", are called "only-if" verbs because the embedded sentence is entailed only if the predicate is in the negative. For instance, (10a) entails (10b), but (11) has no entailment.

10. a. The Phillies were not in a position to win the pennant.

    b. The Phillies did not win the pennant.

11. a. The Phillies were in a position to win the pennant.

Verbs such as "force", "cause", and "compel" are "if" verbs, for the embedded sentence is entailed if they are in the positive.

12. a. Johnny Bench forced the game to go into extra innings.

    b. The game went into extra innings.

13. Johnny Bench did not force the game to go into extra innings.

Note that (12a) entails (12b), but (13) has no such entailment.

A "negative-if" verb entails the negative of the embedded sentence when the verb is positive. "Prevent" and "restrain from" are such verbs.

14. a. His superb catch prevented the runner from scoring.

    b. The runner did not score.

15. His superb catch did not prevent the runner from scoring.

Thus, (14a) entails (14b), but (15) has no such entailment.

The three classes of verbs above may be called one-way implicative verbs; there are also two-way implicative verbs. Such verbs have an entailment whether positive or negative.

If the entailment is positive, we may call these "positive two-way implicative" verbs. Examples (16) and (17) illustrate "manage" as such a verb.

16. a. B managed to win.

    b. B won.

17. a. B did not manage to win.

    b. B did not win.

There are also "negative two-way implicative" verbs. Consider (18) and (19).

18. a. B failed to make the catch.

    b. B did not make the catch.

19. a. B did not fail to make the catch.

    b. B made the catch.

For this class of verbs, the entailed proposition is positive if and only if the implicative verb is negated.

The five classes of words having entailments, then, are: _if_, _only if_, _negative if_, _positive two-way implicative_, and _negative two-way implicative_. All of the words cited in the literature as having entailments are predicates. In the examples here, many were verbs; some were adjectives such as "able". However, some are nouns such as "proof"; example (20) demonstrates this.

20. a. The fact that he came is proof that he cares.

    b. He cares.

We now turn our attention to various factors that must be accounted for in computing presuppositions and entailments of compound sentences.

3. Complex Examples: Embedded Entailments and Presuppositions

In this section, the following question is considered: Suppose that a sentence S has a set of entailments and a set of presuppositions. Suppose further, that S is embedded in another sentence S'. Are the entailments and presuppositions of S also entailments and presuppositions of S' as a whole?

This has been referred to as the projection problem for entailments and presuppositions. A solution to the problem involves rules for combining semantic entities of embedded (projected) sentences in order to compute the semantic entities of the whole sentence.

A solution to the projection problem evolved in Karttunen (1973, 1974), Karttunen and Peters (1975), Joshi and Weischedel (1974), Smaby (1975) and Weischedel (1975). The results are briefly reported here. A summary of the solutions may be found in Weischedel (1975).

Karttunen (1973, 1974) divided all predicates into four classes: the speech acts, predicates of propositional attitude, connectives, and all other predicates. The classes were defined according to the effect of the predicate on presuppositions of embedded sentences. We found that the same classification was appropriate for entailments, and extended the solution to include entailments, as well as presuppositions.

3.1 Presupposition

As an example sentence, consider (1), which presupposes (2).

1. Jack regretted that John left.

2. John left.

In the following sections, we will consider the effect on presupposition (2) of embedding (1) under various predicates taking embedded sentences.

3.1.1 Holes

Many predicates taking embedded sentences could be called holes because they let presuppositions of embedded sentences through to become presuppositions of the compound sentence. "Aware" is such a predicate; (3) presupposes (2).

3. Mary is aware that Jack regretted that John left.

All predicates taking embedded sentences, except for the verbs of saying, the predicates of propositional attitude, and the connectives appear to be holes.

3.1.2 Speech acts

The verbs of saying, or "speech act" verbs, permit the presuppositions to rise to be presuppositions of the compound sentence, but those presuppositions are embedded in the world of the claims of the actor performing the speech act. Smaby (1975) first pointed out this important fact.

For instance, (4) presupposes (5), not (2).

4. Mary asked whether Jack regretted that John left.
5. Mary claimed John left.

3.1.3 Predicates of propositional attitude

Analysis of predicates of propositional attitude is very similar to that of speech acts. Some predicates of propositional attitude are "believe", "think", and "hope". In general, presuppositions of sentences embedded under such a predicate must be embedded under the predicate "believe" to reflect that they are presuppositions in the world of the actor's beliefs. This was first pointed out by Karttunen (1974).

For example, (6) presupposes (7), not (2).

6. Mary thinks Jack regretted that John left.

7. Mary believes John left.

3.1.4 Connectives

The effect of connectives is rather complex, as (8) and (9) demonstrate. Sentence (8) presupposes (2), but (9) clearly does not.

8. If Jack was there, then Jack regretted that John left.

9. If John left, then Jack regretted that John left.

Let A and B be the antecedent and consequent respectively of the compound sentence "if A then B".

The examples of (8) and (9) are complex, for they seem to demonstrate that the context set up by the antecedent A must be part of the computation. This would in general require complex theorem provers in order to determine whether the presuppositions of B are implied by A, and therefore are not presuppositions of the compound sentence. However, Peters suggested (a footnote in Karttunen (1974)) that the presuppositions of "if A then B," (where material implication is the interpretation of "if - then"), arising from the presuppositions of B are of the form "if A then C", where C is a presupposition of B. Further, all presuppositions of A are presuppositions of "if A then B." This suggestion eliminates the need for theorem proving and offers instead a simple computation similar to that for the verbs of saying and the verbs of propositional attitude.

For the examples given then, (8) presupposes (10), and (9) presupposes (11) which is a tautology.

10. If Jack was there, then John left.

11. If John left, then John left.

One may easily verify that (8) presupposes (10) by a truth table computation.

Karttunen (1973) argues that the solution of "A and B" reduces to the solution of "if A then B" and that the solution to "A or B" reduces to the solution of "if not(A) then B".

This completes the description of the four classes of embedding predicates and their effect on embedded presuppositions. However, there is another phenomenon, that of embedded entailments becoming presuppositions of compound sentences.

3.1.5 Entailments promoted to presuppositions

Clearly, any entailment of a presupposition must be a presupposition also; this is evident from the definitions. For instance, (12) presupposes (13). Since (13) entails (14), (14) must also be a presupposition of (12).

12. Jack regretted that John's children forced Mary to leave.

13. John's children forced Mary to leave.

14. Mary left.

The five cases discussed above outline a solution to the projection problem for presuppositions.

3.2 Entailments

In the examples, we will embed (15) under various predicates, to see how the entailment (16) of (15) is affected.

15. Fred prevented Mary from leaving.

16. Mary did not leave.

3.2.1 Chain of entailments

Corresponding to the class of holes for presuppositions, two cases arise for entailments. One case was covered in 3.1.5; entailments of an embedded sentence which is a presupposition are presuppositions of the compound sentence.

A second, disjoint case involves setting up a chain of entailments. For instance, (17) entails (15) which entails (16).

17. John forced Fred to prevent Mary from leaving.

This is truly a chain of entailments, since breaking a link in the chain causes embedded entailments to be blocked. For instance, the presence (absence) of negation is crucial; if (17) were negative, it would not entail (15) nor (16), though (17) did.

Thus, for the case involving a chain of entailments, the entailments of an embedded sentence are entailed by the compound sentence only if such a chain of entailments can be set up.

3.2.2 Speech Acts

Smaby has pointed out that there are at least two subclasses of speech act verbs according to behavior of embedded entailments. Further, the syntactic shape of the embedded sentence affects entailments.

For instance, if the syntactic shape of an embedded sentence S is "whether S or not", "for NP to VP", or "if S", all embedded entailments are blocked. For instance, (18) entails nothing about Mary's leaving.

18. John asked whether or not Fred prevented Mary from leaving.

However, a "wh-some" embedded sentence (beginning with "who", "what", "when", "which", etc.) have all entailments of the embedded sentence promoted to presuppositions, since the embedded sentence is presupposed. For instance, (19) presupposes (20), and therefore presupposes that "Mary did not leave".

19. John asked who prevented Mary from leaving.

20. Someone prevented Mary from leaving.

For embedded sentences of the form "that S", we notice two subclasses of speech acts. Verbs such as "say", "declare", and "affirm" are like "if predicates", for embedded entailments are not blocked if the verb is not in the negative. However, in the positive, the embedded entailments become entailments of the compound sentence, but under the speaker's claims. For instance, (21) entails (22).

21. John said that Fred prevented Mary from leaving.

22. John claimed that Mary did not leave.

A second subclass of verbs includes "deny". They are analogous to "negative if verbs". When "deny" is in the negative, embedded entailments are blocked. However, when "deny" is positive the entailments of the negative form of the embedded sentence are entailed by the compound sentence, but under the speaker's claims. For instance, (24) is entailed by (23).

23. John denied that Mary was able to leave.

24. John claimed that Mary did not leave.

3.2.3 Predicates of propositional attitude

Smaby (1975) analyses these predicates in the same way as the speech acts. "Believe", "think", and "suspect" are examples of a subclass analogous to "if predicates" or to "say", "declare", and "affirm". "Doubt" is an example of a second subclass analogous to "negative two-way implicative predicates" such as "fail".

Though the subclasses for predicates of propositional attitude are analogous to those of the speech acts, the embedded entailments of propositional attitude predicates become entailments of the compound sentence under the actor's beliefs, rather than under the speaker's claims as in the speech act case. For instance, (25) entails (26).

25. John thought that Fred prevented Mary from leaving.

26. John believed that Mary did not leave.

3.2.4 Connectives

For "if A then B", the entailments are of the form "if A then C", where C is an entailment of B. For "A and B", the entailments are the union of the entailments of A and of the entailments of B, since both A and B are entailed by "A and B". For "A or B", there do not seem to be any useful entailments.

This concludes the analysis of the projection problem for presuppositions and entailments.

4. Outline of the solutions in the system

The purpose of this section is to give an overall view of the system and an outline of the methods used to compute presupposition and entailment. For a more complete, detailed description of the computational methods and the system see Weischedel (1976). Section 4.1 presents a block diagram of the system; 4.2 briefly outlines the computation for the various examples of sections 2 and 3; section 4.3 attempts to state some of the limitations of the system, including the memory and time requirements.

4.1 Block diagram

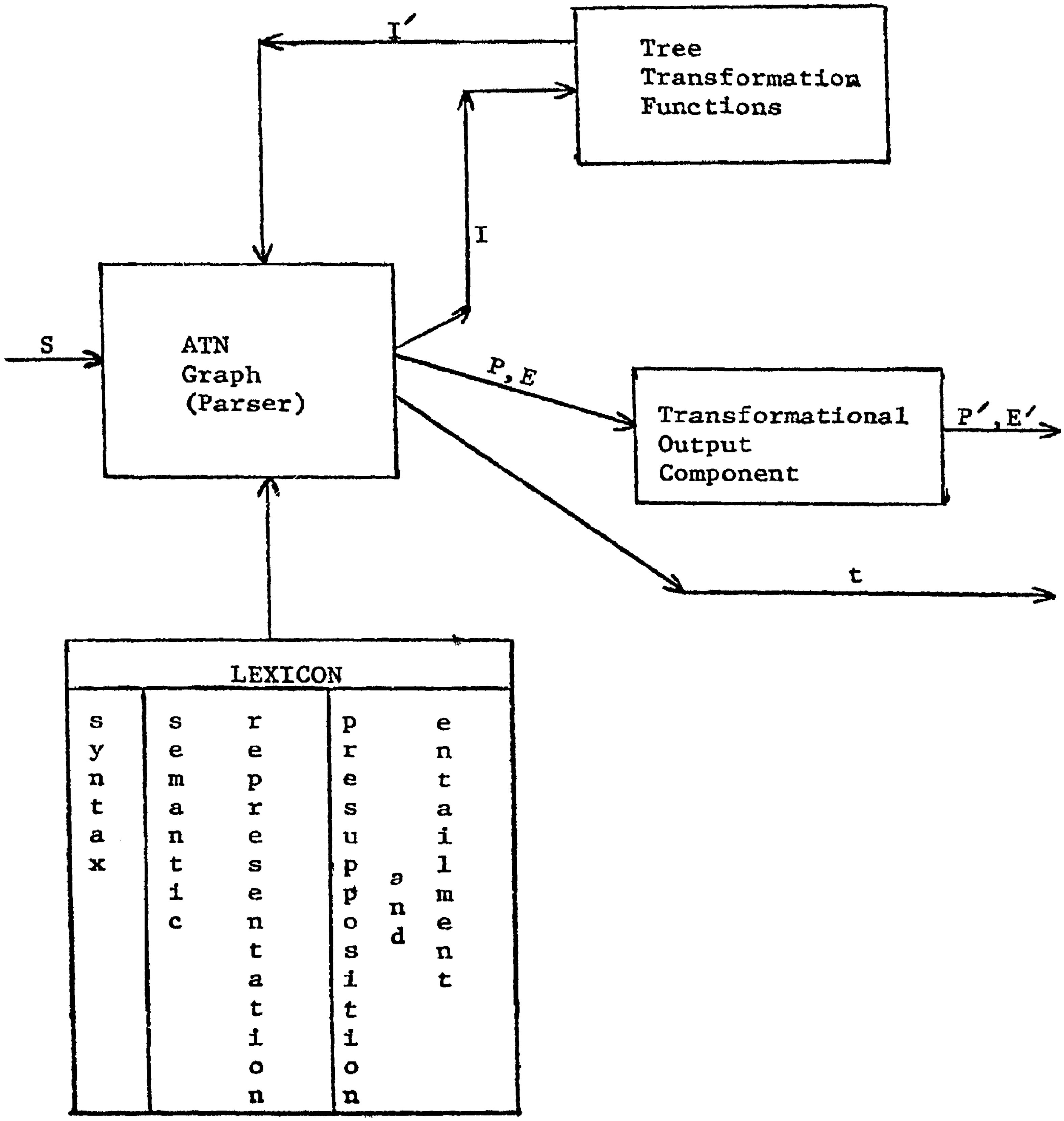
A block diagram of the system appears in Figure 4.1. All arrows represent data flow. A sentence S in English is input to the system. The parser is written as an augmented transition network graph (ATN). (Woods (1970) specifies the ATN as a formal model and as a programming language.) While parsing, the ATN refers to the lexicon for specific information for each word of the sentence S. Lexical information is of three types: syntactic information, information for generating the semantic representation or translation, and information for making lexical inferences--presuppositions and entailments. The organization of the lexicon for computing lexical inferences (presuppositions and entailments) is a novel aspect of the system.

From the definition of presuppositions and entailments, it is clear that the system needs a set of functions for manipulating or transforming trees. These appear as a separate block in Figure 4.1. The parser calls them while parsing; this is represented in the diagram as input I and values I' of functions. These functions are written in LISP.

Figure 4.1

System Structure

(All arrows represent data flow)



Using the lexical information, the relational or syntactic structure of the sentence, and the tree transformation functions, the parser generates the semantic representation (translation) t of the sentence and a set of presuppositions P and entailments E of the sentence.

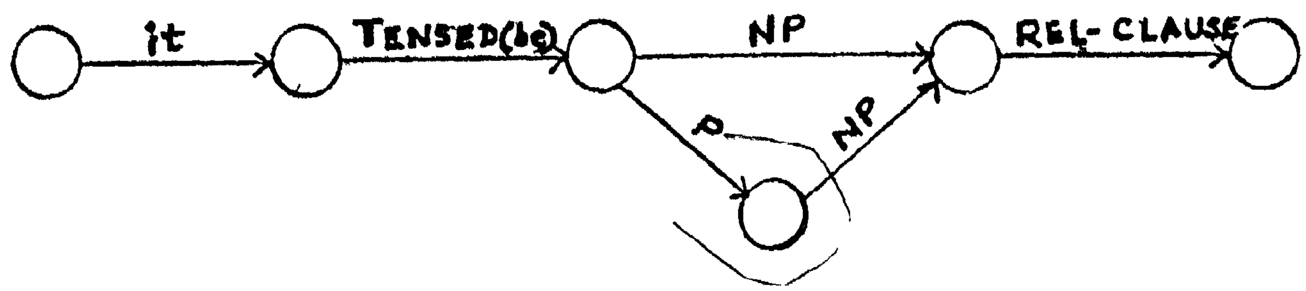
Since each presupposition P and entailment E is in the logical notation of the semantic representations of sentences, a small transformational output component has been included to give the presuppositions and entailments as output in English. These appear as P' and E'; in Figure 4.1. The transformational output component is also written in LISP. This output component is very small in scope and is not a major component of the work reported here.

4.2 Outline of solution

A sketch of the computation of presupposition and entailment is presented here; details of computation are presented in Weischedel (1976).

There are four fundamental phenomena exhibited in sections 2 and 3: presuppositions from syntactic constructs, presuppositions from particular words (lexical entries), entailments from lexical entries, and the projection phenomena.

In order to compute presuppositions from syntactic constructs, two principles are important: detecting the syntactic construction and dealing with ambiguity. Syntactic constructs are syntactically marked in the sentence. Thus, the parser may be constructed such that there is a parse generated when those syntactic markings are present. In the ATN, one may construct the graphs representing the grammar such that there is a particular path which is traversed if and only if the syntactic construct is present. Then, we may associate with that particular path the tree transformation yielding the presupposition of that syntactic construct. For instance, cleft sentences are syntactically marked as the word "it", followed by a tensed form of "be", followed by either a noun phrase or a prepositional phrase, followed by a relative clause. The path(s) in the graph might be as below.



Associated with this path would be a trivial tree transformation which returns the semantic representation of the relative clause as a presupposition.

The second principle deals with ambiguity. Even though we have structured the graphs in the way above, the same surface form may arise from two different syntactic constructs, one having a presupposition and the other not. In such a case, our system (and in fact any parser) should be able to give semantic representations for both parses; with one parse our system yields a presupposition, with the other parse our system would not have the presupposition. It is the role of general semantic and pragmatic components to distinguish which semantic representation is intended in the context. In fact, the difference in the presuppositions with the differing parses is one criterion which general semantic and pragmatic components could use to resolve the ambiguity.

For generating presuppositions of words (lexical entries), the chief problems are how to encode the tree transformation in the lexicon (dictionary) and when to apply it during parsing. In general a tree transformation would have a left hand side which is the pattern to be matched if the transformation is to apply and a right hand side giving the transformed structure.

The reason we can encode the left hand side in the grammar is simple. All of the examples in the literature dealing with presuppositions from lexical entries have in common the fact that the existence of the presupposition depends only upon the syntactic environment of the word and the word itself. Hence, we can structure the graph of the grammar in a way that the paths correspond to the necessary syntactic environments. Upon encountering a word of the appropriate syntactic category in such a syntactic environment, the system looks in the lexicon under that word for the (possibly empty) set of right hand sides of tree transformations.

The way of writing the right hand sides assumes that the parser in traversing a path undoes the syntactic construct encoded in that path, and assigns the components of the semantic representation according to their logical role in the sentence rather than their syntactic role. (This is not a new idea, but rather has been used in several systems pre-dating ours. As an example, the semantic representation of "Mary" in the following three sentences would be assigned to the same register while parsing, "John gave Mary a ball", "Mary was given a ball by John", and "A ball was given to Mary by John".) Thus, we can assume a convention for naming registers and assigning components of the semantic representation to them, independent of the syntactic environment. To encode the right hand side of the tree transformation, we use a list whose first element is the tree structure with constants as literal atoms and positions of variables as plus signs. The remaining elements of the list specify the registers to fill in the variable positions.

This, then, is how we integrate the tree transformations for presuppositions into the parse. The lexical examples for entailment also must employ tree transformations but are complicated by the five different classes of predicates yielding entailments and their dependence on whether the sentence is negated or not. A further complication was illustrated in section 3, for a chain of entailments must be set up.

For entailments, we encode the left hand side and right hand side in the same way as the lexical examples of presuppositions. However, for entailments, for each right hand side we also encode three other pieces of information. They are the pre-condition of whether negation must be present (or absent), whether the entailed proposition is negative or not, and whether the entailed propositional corresponds to the left sub-tree or right sub-tree. At each sentential level, we verify that the left hand side of the tree transformation is present. If it is, we make the transformation indicated in the lexicon and save the resulting proposition along with the other three pieces of information mentioned above associated with it. We save this in a binary tree, one level of tree per sentential level. It is a binary tree since all predicates taking embedded sentences seem to permit only one or two of its arguments to be embedded sentences.

Upon hitting the period (or question mark), all of the negation information is present so that we may simply traverse the tree from the root, doing a comparison at each level to verify that the conditions for negation being present (absent) are met. This completes an outline or computation of entailments.

Next we outline a solution to the projection problem. The structural solution to the projection problem traced in section 3 has simple computational requirements. We have structured the ATN graphs such that recursion occurs for each embedded sentence. At each sentential level, the graph returns as a value a list of at least four elements: the semantic representation of the sentence at this level, a list of presuppositions of this sentence and any embedded in it, a tree as described above for computing entailment at this and lower levels, as well as a list of semantic representations of noun phrases encountered at this or lower levels.

Just before popping to a higher sentential level a projection function is applied, which is merely a CASE statement for the four cases described in section 3. For holes, nothing is changed. For speech act predicates and of propositional attitude, the presuppositions of embedded sentences and propositions in the tree for entailments are embedded under a special semantic primitive (CLAIM for speech acts, BELIEVE for verbs of propositional attitude). Embedding under these primitives places the presuppositions and entailments in the world of the actor's claims or beliefs.

For connectives, the computation is just as described in section 3. Again, an embedding is involved, this time under a semantic primitive IF-THEN to place the propositions in the world of the context created by the left sentence of the connective.

We have only outlined how to compute presupposition and entailment. Many interesting and complex aspects of the computation are detailed in

Weischedel (1976). For instance, external negation affects the computation of presupposition, as does syntactic environment. In general, the tense and time of presuppositions or entailments cannot be computed simply by filling slots in the semantic representation of the inference with registers containing pieces of semantic representation of the input sentence; Therefore, a generalization of the BUILD function of an ATN is needed. Further, the computational means to account for the effect of negation on entailments of embedded sentences, for embedded entailments promoted to presuppositions, and for the effect of opague and transparent reference on presupposition are presented in Weischedel (1976).

4.3 What the System Does Not Do

The limitations of the system are of two kinds: those that could be handled within the frame work of the system but are not because of limitations of man-hours, and those that could not be handled within the present framework.

4.3.1 Limitations that could be removed

The system is currently limited in four ways, each of which could be removed, given time. One set of restrictions results from the fact that our program represents only a small part of a complete natural langauge processing system. Only the syntactic component is included (though these inferences, which are semantic, are computed while parsing). As a consequence, no ambiguity is resolved except that which is syntactically resolvable.

Second, though a transformational output component is included to facilitate reading the output, it has a very limited range of constructions. The principles used in designing the component are sound though.

A third aspect is computation time. Since our main interest was a new type of computation for a syntactic component, we have not stressed efficiency in time nor storage; rather, we have concentrated on writing the system fairly rapidly. Considering the number of conceptually simple, efficiency measures that we sacrificed for speed in implementing the system, we are quite pleased that the average CPU time to compute the presupposition and entailments of a sentence is twenty seconds on the DEC PDP-10. The memory requirements were 90K words including the LISP interpreter and interpreter for augments transition networks. For further details and the simple economies that we have not used, see Weischedel (1975).

As a fourth class, we mention the syntactic constructions allowable as input to the system. We have not allowed several complex syntactic problems which are essentially independent of the problems of computing presuppositions and entailments, such as conjunction reduction, complex anaphoric reference, or prepositional phrases on noun phrases. (A resursive transiton network is given ir Weischedel (1976), indicating exactly what syntactic constructions are implemented.)

The number of English quantifiers in the system is small. Also the dictionary is of very modest size (approximately 120 stem words). However, our lexicon is patterned after the lexicon of the linguistic string parser, which includes 10,000 words. Therefore, we have avoided the pitfall of grammatical ad hocness. (The linguistic string parser is described in Sager (1973).)

We have not included modal tenses or subjunctive mood. This is because the effect of modals and the subjunctive mood on presupposition and entailment has not been fully worked out yet. A limited solution for modals and subjunctives has been worked out for a micro-world of tic-tac-toe in Joshi and Weischedel (1975).

4.3.2 Limitations difficult to remove

We have dealt with specific time elements for presupposition and entailment in a very limited way. Time has been explicitly dealt with only for the aspectual verbs; however, time is implicitly handled in detail for all presuppositions and entailments through tense (see Weischedel 1976)). We have not included time otherwise, because we feel that the same solution presented for assigning tenses to presupposition and entailment may be adapted for explicit time elements.

A more serious difficulty would arise if presuppositions or entailments were discovered which depend on different information than any considered up until this time. For instance, the occurrence of presuppositions thus far discovered has depended only on syntactic constructions, lexical entries, and the four classes of embedding predicates (holes, connectives, speech acts, and verbs of propositional attitute). The existence of entailments thus far encountered has depended only on negation, syntactic constructions, lexical entries, and the four classes of embedding predicates.

It is conceivable that presuppositions and entailments will be discovered which depend on other entities; for instance, presuppositions or entailments of some predicate might be found to depend on the tense of the predicate. If such examples are found, different means of writing lexical entries would have to be devised in order to encode these dependencies.

5. Role of presupposition and entailment

In section 5.1, the role of presupposition and entailments as inferences is pinpointed. In section 5.2, the use of semantic primitives is considered.

5.1 Inferring

The term "inference" has been used recently to refer to any conjecture made, given a text in some natural language. Charniak (1973, 1972), Schank (1973), Schank and Rieger (1973), Schank, et. al. (1975), and Wilks (1975) concentrate on such inferences. All of the projects seek some computational means as an alternative to formal deductive procedures because those tend to combinatorial explosion.

That presupposition and entailment are inferences is obvious. However; the requirement in their definition that they be independent of the situation (all context not represented structurally) is strong. For instance, from sentence S below, one might feel that S' should be entailed; yet, it is not.

S: John saw Jim in the hall, and Mary saw Jim in his office.

S': John and Mary saw Jim in different places.

By appropriately chosen previous texts, S' need not be true whenever S is. For example, the previous text might indicate that Jim's office is in the hall. In general, common nouns do not seem to offer many examples of presupposition and entailment. From the example, it is clear that presupposition and entailment are strictly a subclass of inferences.

Presupposition and entailment are a subclass of inferences distinguished in several ways: First, presupposition and entailment are reliable inferences, rather than being merely conjectures. Presuppositions are true whether the sentence is true or false. Entailments must be true if the sentence is true.

Second, presupposition and entailment are inferences that seem to be tied to the structure of language, for they arise from syntactic structure and from definitional structure of individual words. The fact that they are tied to the structure of language enables them to be computed by structural means (i.e., tree transformations), a computational means not appropriate for all inferences.

Furthermore, since presupposition and entailment are tied to the syntactic and definitional structure of language, these inferences need to be made. For instance, upon encountering "John was not able to leave", one really does want to infer the entailment that "John did not leave". Whether or not it is wise to compute conjectural inferences, on the other hand, does not have a simple answer, by virtue of their conjectural nature.

A fourth distinction of presupposition and entailment is in the problem of knowing when to stop inferring. Inferences themselves can be used to make other inferences, which can be used to make still more inferences, etc. When to stop the inferences is an open question. Presupposition and entailment, as a subclass of inferences, do not exhibit such a chain reaction of inferences. The reason is that presupposition and entailment arise from either the individual words or the particular syntactic constructs of the sentence; presuppositions and entailments do not themselves give rise to more inferences.

We may summarize these distinguishing aspects of presupposition and entailment by the fact that presupposition and entailment are important semantically for understanding words and syntactic constructs. This does not deny the importance of other inferences; conjectural inferences are necessary to represent pragmatic aspects of natural language.

The role of presupposition and entailment in a complete natural language processing system, then, is that they are a subclass of the inferences which the system must compute. Inferences in general are made from an input sentence in conjunction with the system's model of the context of the situation. Presupposition and entailment are a subclass of inferences associated with the semantic structure of particular words and with the syntactic structure of the sentence. Thus, as we have shown, they may be computed while parsing using lexical information and grammatical information. The system's model of the context of the situation is not needed to compute the presuppositions and entailments for any reading or interpretation of a sentence; of course, to ascertain which reading or interpretation of a sentence is intended in a given context, the system's model of the context is essential.

5.2 Semantic primitives

Semantic primitives have been investigated as the element with which to associate inferences. (See Schank (1973), Schank, et.al. (1975), Yamanashi (1972)). This has the important advantage of capturing shared inferences of many similar words by a semantic primitive, rather than repeating the semantic information for those shared inferences for each word. Inferences would be made in the semantic component.

The assumptions of our computation do not preclude the use of primitives in semantic representations. On the contrary, the particular semantic representations our system uses do include primitives. However, we have not associated the computation of presupposition and entailment with semantic primitives.

The reason is that presuppositions arise from syntactic constructs, as well as from the semantics of particular words. Further, syntactic structure can interact with the entailments of words, as in the following example. Because S' is presupposed by S, S" becomes a presupposition of S, not merely an entailment.

S Who prevented John from leaving?

S' Someone prevented John from leaving.

S" John did not leave.

To compute such effects in the semantic component, sufficient syntactic structure of the surface sentence would have to be available to the semantic component. Whether that is possible or whether that would be wise is not clear. For that reason, we have not used semantic primitives to compute presupposition and entailment.

6. Conclusion

The main goal of this work is its demonstration of a method for writing the lexicon and parser for the computation of presupposition and entailment, and its exhibition of the procedures and data structures necessary to do this.

Presupposition and entailment comprise a special class of inferences, distinguished in three ways. First, they both may be computed structurally (by tree transformations), independent of context not inherent in the structure. Second, although inferences in general are conjectural, presupposition and entailment may be reliably asserted; entailments are true if the sentence entailing them is true; presuppositions are true whether the sentence presupposing them is true or false. Third, since presupposition and entailment are tied to the definitional and syntactic structure of the language, they do not spawn themselves nor lead to a chain reaction explosion, as other inferences may.

We suggest two areas of future research. One is to derive a means of accounting for presuppositions arising from syntactic constructs, in a way consistent with using semantic primitives to account for lexical examples of presupposition and entailment.

A second area is suggested by the interaction of syntax and semantics evident in presuppositions arising from syntactic constructs. A study of phenomena that cut across the boundaries of syntax, semantics, and pragmatics and a computational model incorporating them could prove very fruitful to our understanding of natural languages.

Included here is the output for several exemplary sentences. The semantic representations are a function and argument notation developed by Harris (1970) and modified by Keenan (1972). As in logic, variables are bound outside of the formula in which they are used. Any semantic primitives may be used, as long as they employ the function - argument syntax. Details about the semantic represention may be found in Weischedel (1975).

APPENDIX

We now describe the format of the output. The first item is the sentence typed in. Note that /, means comma and /. means period, because of LISP delimiters.

The semantic representation of the input sentence itself is printed next, under the heading "SEMANTIC REPRESENTATION".

Presuppositions not related to the existence of referents of noun phrases are printed under the label "NON-NP PRESUPPOSITIONS". Presuppositions about existence of referents of noun phrases are printed under the label "NP-RELATED PRESUPPOSITIONS". The set of entailments follows the label "ENTAILMENTS". If for any of these sets, the set is empty, then only the label is printed. For the two sets of presuppositions and the set of entailments, the semantic representation of the set of entailments in Keenan's notation is printed first, then the English paraphrase generated by the output component.

In some cases the tense of a presupposition is not known. In such instances, the output component prints the stem verb followed by the symbol "-UNTENSED-".

Examples of presuppositions from syntactic constructs appear in examples 1 and 2; the cleft construction gives a presupposition in 1; the definite noun phrase in 2 gives a presupposition. Presuppositions from lexical entries appear in 3 and 4. "Only" in 3 has a presupposition; "fail" in 4 also has a presupposition. Comparing 4 and 5 demonstrates the computation of a chain of entailments.

Several examples of the projection problem have been included. Examples of predicates which are holes appear in 4 and 5. The effect of speech acts appears in 6. The effect of "if ... then" (interpreted as material implication) is evident in 7 and 8.

The terminal sessions follow.

IT IS DR SMITH WHO TEACHES CIS591 /.

SEMANTIC REPRESENTATION

((CIS591 /, X0006) ((DR$SMITH /, X0005) (ASSERT I (IN-THE-PRESENT (BE
IT (IN-THE-PRESENT (TEACH X0005 NIL X0006)))))))

NON-NP PRESUPPOSITIONS

((CIS591 /, X0006) ((E INDIVIDUAL /, X0005) (IN-THE-PRESENT (TEACH X0
005 NIL X0006))))

SOME INDIVIDUAL TEACHES CIS591

NP-RELATED PRESUPPOSITIONS

((DR$SMITH /, X0005) (*UNTENSED (IN-THE-SHARED-INFO X0005)))

DR SMITH EXIST -UNTENSED- IN THE SHARED INFORMATION

((CIS591 /, X0006) (*UNTENSED (IN-THE-SHARED-INFO X0006)))

CIS591 EXIST -UNTENSED- IN THE SHARED INFORMATION .

((DR$SMITH /, X0005) (*UNTENSED (HUMAN X0005)))

DR SMITH BE -UNTENSED- HUMAN

ENTAILMENTS

Example 1

THE PROFESSOR THAT I ADMIRE BEGAN TO ASSIGN THE PROJECTS /.

SEMANTIC REPRESENTATION

((((COLLECTIVE PROJECT /, X0010) (NUMBER X0010 TWO-OR-MORE)) /, X0017
) ((((THE PROFESSOR /, X0008) (IN-THE-PRESENT (ADMIRE I X0008))) /, X
0009) (ASSERT I (IN-THE-PAST (START (EVENT (ASSIGN X0009 NIL X0017))
NIL)))))

NON-NP PRESUPPOSITIONS

((((COLLECTIVE PROJECT /, X0010) (NUMBER X0010 TWO-OR-MORE)) /, X0017
) ((((THE PROFESSOR /, X0008) (IN-THE-PRESENT (ADMIRE I X0008))) /, X
0009) ((((E TIME /, X0018) (IMMEDIATELY-BEFORE X0018 NIL)) /, X0019)
(AT-TIME (NOT (IN-THE-PAST (HAVE-EN (BE-ING (ASSIGN X0009 NIL X0017))
))) X00[illegible]))))

IT IS NOT THE CASE THAT THE PROFESSOR THAT I ADMIRE HAD BEEN
ASSIGNING THE PROJECTS

NP-RELATED PRESUPPOSITIONS

((((E PROFESSOR /, X0008) (IN-THE-PRESENT (ADMIRE I X0008))) /, X0009
)- (*UNTENSED (IN-THE-SHARED-INFO X0009)))

SOME PROFESSOR THAT I ADMIRE EXIST -UNTENSED- IN THE SHARED
INFORMATION

((((E PROJECT /, X0010) (NUMBER X0010 TWO-OR-MORE)) /, X0017) (*UNTEN
SED (IN-THE-SHARED-INFO X0017)))

SOME PROJECTS EXIST -UNTENSED- IN THE SHARED INFORMATION

ENTAILMENTS

((((COLLECTIVE PROJECT /, X0010) (NUMBER X0010 TWO-OR-MORE)) /, X0017
) ((((THE PROFESSOR /, X0008) (IN-THE-PRESENT (ADMIRE I X0008))) /, X
0009) ((((E TIME /, X0020) (IMMEDIATELY-AFTER X0020 NIL)) /, X0021) (
AT-TIME (IN-THE-PAST (BE-ING (ASSIGN X0009 NIL X00]7))) X0021))))

THE PROFESSOR THAT I ADMIRE WAS ASSIGNING THE PROJECTS

Example 2

```
ONLY JOHN WILL LEAVE /.


SEMANTIC REPRESENTATION

((((A INDIVIDUAL /, X0063) ((JOHN /, X0061) (NEQ X0063 X0061))) /, X0
062) (ASSERT I (NOT (IN-THE-FUTURE (LEAVE X0062)))))

NON-NP PRESUPPOSITIONS

((JOHN /, X0061) (IN-THE-FUTURE (LEAVE X0061)))

JOHN WILL LEAVE .

NP-RELATED PRESUPPOSITIONS

((JOHN /, X0061) (*UNTENSED (IN-THE-SHARED-INFO X0061)))

JOHN EXIST -UNTENSED- IN THE SHARED INFORMATION .

ENTAILMENTS
```

Example 3

THAT DR SMITH FAILED TO CHALLENGE JOHN IS TRUE /.

SEMANTIC REPRESENTATION

((JOHN /, X0045) ((DR$SMITH /, X0044) (ASSERT I (IN-THE-PRESENT (TRUE (IN-THE-PAST (NOT (COME-ABOUT (EVENT (CHALLENGE X0044 X0045)))))))))

NON-NP PRESUPPOSITIONS

((JOHN /, X0045) ((DR$SMITH /, X0044) (IN-THE-PAST (ATTEMPT (EVENT (CHALLENGE X0044 X0045))))))

DR SMITH ATTEMPTED TO CHALLENGE JOHN

NP-RELATED PRESUPPOSITIONS

((DR$SMITH /, X0044) (*UNTENSED (IN-THE-SHARED-INFO X0044)))

DR SMITH EXIST -UNTENSED- IN THE SHARED INFORMATION

((JOHN /, X0045) (*UNTENSED (IN-THE-SHARED-INFO X0045)))

JOHN EXIST -UNTENSED- IN THE SHARED INFORMATION .

ENTAILMENTS

((JOHN /, X0045) ((DR$SMITH /, X0044) (IN-THE-PAST (NOT (COME-ABOUT (EVENT (CHALLENGE X0044 X0045)))))))

DR SMITH FAILED TO CHALLENGE JOHN .

((JOHN /, X0045) ((DR$SMITH /, X0044) (NOT (IN-THE-PAST (CHALLENGE X0044 X0045)))))

IT IS NOT THE CASE THAT DR SMITH CHALLENGED JOHN .

Example 4

THAT DR SMITH FAILED TO CHALLENGE JOHN IS FALSE /.

SEMANTIC REPRESENTATION

((JOHN /, X0048) ((DR$SMITH /, X0047) (ASSERT I (IN-THE-PRESENT (NOT
(TRUE (IN-THE-PAST (NOT (COME-ABOUT (EVENT (CHALLENGE X0047 X0048))))
)))))))

NON-NP PRESUPPOSITIONS

((JOHN /, X0048) ((DR$SMITH /, X0047) (IN-THE-PAST (ATTEMPT (EVENT (C
HALLENGE X0047 X0048))))))

DR SMITH ATTEMPTED TO CHALLENGE JOHN .

NP-RELATED PRESUPPOSITIONS

((DR$SMITH /, X0047) (*UNTENSED (IN-THE-SHARED-INFO X0047)))

DR SMITH EXIST -UNTENSED- IN THE SHARED INFORMATION .

((JOHN /, X0048) (*UNTENSED (IN-THE-SHARED-INFO X0048)))

JOHN EXIST -UNTENSED- IN THE SHARED INFORMATION .

ENTAILMENTS

((JOHN /, X0048) ((DR$SMITH /, X0047) (NOT (IN-THE-PAST (NOT (COME-AB
OUT (EVENT (CHALLENGE X0047 X0048))))))))

IT IS NOT THE CASE THAT DR SMITH FAILED TO CHALLENGE JOHN .

((JOHN /, X0048) ((DR$SMITH /, X0047) (IN-THE-PAST (CHALLENGE X0047 X
0048))))

DR SMITH CHALLENGED JOHN .

Example 5

DR SMITH SAYS THAT A STUDENT FAILED TO LEAVE /.

SEMANTIC REPRESENTATION

```
((E STUDENT /, X0052) ((DR$SMITH /, X0050) (ASSERT I (IN-THE-PRESENT
(CLAIM X0050 (IN-THE-PAST (NOT (COME-ABOUT (EVENT (LEAVE X0052)))))))
)))
```

NON-NP PRESUPPOSITIONS

```
((DR$SMITH /, X0050) (*UNTENSED (HUMAN X0050)))
```

DR SMITH BE -UNTENSED- HUMAN

```
((E STUDENT /, X0052) ((DR$SMITH /, X0050) (IN-THE-PRESENT (CLAIM X00
50 (IN-THE-PAST (ATTEMPT (EVENT (LEAVE X0052))))))))
```

DR SMITH CLAIMS THAT SOME STUDENT ATTEMPTED TO LEAVE .

NP-RELATED PRESUPPOSITIONS

```
((DR$SMITH /, X0050) (*UNTENSED (IN-THE-SHARED-INFO X0050)))
```

DR SMITH EXIST -UNTENSED- IN THE SHARED INFORMATION

ENTAILMENTS

```
((E STUDENT /, X0052) ((DR$SMITH /, X0050) (IN-THE-PRESENT (CLAIM X00
50 (NOT (IN-THE-PAST (LEAVE X0052)))))))
```

DR SMITH CLAIMS THAT IT IS NOT THE CASE THAT SOME STUDENT LEFT

Example 6

IF JOHN LEFT /, THEN MARY APPRECIATED THAT HE LEFT /.

SEMANTIC REPRESENTATION

((MARY /, X0056) ((JOHN /, X0054) (ASSERT I (IF-THEN (IN-THE-PAST (LE
AVE X0054)) (IN-THE-PAST (APPRECIATE X0056 (FACT (IN-THE-PAST (LEAVE
X0054)))))))))

NON-NP PRESUPPOSITIONS

((JOHN /, X0054) (IF-THEN (IN-THE-PAST (LEAVE X0054)) (IN-THE-PAST (L
EAVE X0054))))

IF JOHN LEFT THEN JOHN LEFT

((MARY /, X0056) ((JOHN /, X0054) (IF-THEN (IN-THE-PAST (LEAVE X0054)
) (*UNTENSED (HUMAN X0056)))))

IF JOHN LEFT THEN MARY BE -UNTENSED- HUMAN .

NP-RELATED PRESUPPOSITIONS

((JOHN /, X0054) (*UNTENSED (IN-THE-SHARED-INFO X0054)))

JOHN EXIST -UNTENSED- IN THE SHARED INFORMATION .

((JOHN /, X0054) (IF-THEN (IN-THE-PAST (LEAVE X0054)) ((MARY /, X0056
) (*UNTENSED (IN-THE-SHARED-INFO X0056)))))

IF JOHN LEFT THEN MARY EXIST -UNTENSED- IN THE SHARED
INFORMATION

ENTAILMENTS

Example 7

IF JOHN MANAGED TO LEAVE /, THEN MARY WILL ADMIRE HIM /

SEMANTIC REPRESENTATION

((MARY /, X0060) ((JOHN /, X0058) (ASSERT I (IF-THEN (IN-THE-PAST (CO
ME-ABOUT (EVENT (LEAVE X0058)))) (IN-THE-FUTURE (ADMIRE X0060 X0058))
))))

NON-NP PRESUPPOSITIONS

((JOHN /, X0058) (IN-THE-PAST (ATTEMPT (EVENT (LEAVE X0058)))))

JOHN ATTEMPTED TO LEAVE .

NP-RELATED PRESUPPOSITIONS

((JOHN /, X0058) (*UNTENSED (IN-THE-SHARED-INFO X0058)))

JOHN EXIST -UNTENSED- IN THE SHARED INFORMATION .

((JOHN /, X0058) (IF-THEN (IN-THE-PAST (COME-ABOUT (EVENT (LEAVE X005
8)))) ((MARY /, X0060) (*UNTENSED (IN-THE-SHARED-INFO X0060)))))

IF JOHN MANAGED TO LEAVE THEN MARY EXIST -UNTENSED- IN THE
SHARED INFORMATION .

ENTAILMENTS

Example 8

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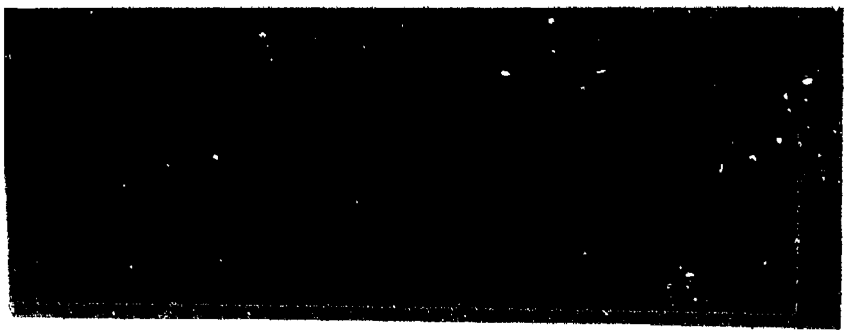

INFORMATION CHANGES, CONCERNS, CHALLENGES:

Changing Role of Government
Changes and Challenges in Indexing
Concerns in Research
Challenges of Deposited Documents

March 8-9, 1977

Stouffer's National Center Hotel
Arlington, Virginia

Nineteenth Annual Conference

1977 NFAIS Annual Conference

Schedule of Events

Tuesday, March 8, 1977

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8 00 a m -5 00 p m – Registration
(Roanoke, Rappahannock, and James Rooms)

---

9 00 a m 9 15 a.m — Welcome and General Program Introduction

Wecome. *John E. Creps, Jr.*
NFAIS President
Engineering Index, Inc.

Program Outline *Russell J. Rowlett, Jr.*
1977 Conference Program Chairman
Chemical Abstracts Service

9 15 a m -10 45 a.m — **Theme Session I The Changing Role of Government Information Programs**

Chairman *Hubert E. Sauter*
Defense Supply Agency

George P. Chandler, Jr.
National Aeronautics and Space Administration

Fred E. Croxton
Library of Congress

William M. Thompson
Defense Documentation Center

NATIONAL FEDERATION OF ABSTRACTING & INDEXING SERVICES
3401 MARKET STREET • PHILADELPHIA, PA. 19104 • (215) 349-8495

11:00 a.m.-12:15 p.m. **Continuation of Theme Session I**

A. G. Hoshovsky
Department of Transportation

Peter F. Urbach
National Technical Information Service

12:15 p.m.-2:00 p.m. Lunch Break
(Attendees must make their own arrangements)

2:00 p.m. 4:30 p m **Theme Session II: Indexing, the Key to Retrieval**

Chairman. *Lois Granick*
American Psychological Association

* Techniques Used in Printed Indexes

A Keyword or Natural Language Indexing

Joyce Duncan Falk
American Bibliographical Center, CLIO Press

B. Thesaurus or Controlled Language Indexing

Peter Clague
INSPEC

C Continuity Indexing

Ben-Ami Lipetz
Documentation Abstracts, Inc

* Computer Generated Indexing (re-indexing) for On-Line Retrieval

Daniel U. Wilde
New England Research Application Center

4.30 p.m.-5.30 p.m. **NFAIS Assembly Business Meeting**

6:00 p.m.-8:00 p.m. Conference-wide Reception
(Decatur Room)

Wednesday, March 9, 1977

8:30 a.m.-2:00 p.m. – Registration
(Roanoke, Rappahannock, and James Rooms)

9:00 a.m.-11.45 a.m. **Theme Session III: Current Activities Related to Abstracting and Indexing of the National Science Foundation Division of Science Information**

Chairman *Lee G. Burchinal*
National Science Foundation

(speakers to be announced)

– No coffee break this morning –

11:45 a.m.-12:30 p.m. **Miles Conrad Memorial Lecture**

Dr. William O. Baker
Bell Laboratories

* * *

Dr. Baker has long been active in scientific and technical information matters at a national level. He chaired the panel of the President's Science Advisory Committee that authored the landmark study "Improving the Availability of Scientific and Technical Information in the United States" (The Baker Report) in 1958 He also served as chairman of the Science Information Council of the National Science Foundation from 1959 through 1961 and was a member of the Weinberg Panel that produced the report "Science, Government, and Information" in 1963. He currently is a member of the Board of Regents of the National Library of Medicine, a director of Annual Reviews, Inc., a member of the National Commission on Libraries and Information Science, and a participant in many other important national committees and commissions.

The Miles Conrad Memorial Lecture was established to honor G. Miles Conrad, first president of NFAIS This lecture is "to be presented every year at the Annual Meeting of the Federation by an outstanding person on a suitable topic in the field of abstracting and indexing, but above the level of any individual service."

* * *

12 30 p m 2·00 p m Conference Luncheon
(Decatur and Farragut Rooms)

2 00 p m -4 30 p m Theme Session IV Deposited Documents and Other Evolving Publication Media

Chairman *James L Wood*
Chemical Abstracts Service

Karl F Heumann
Federation of American Societies for Experimental Biology

Larry X Besant
The Ohio State University

Albert L Batik
American Society for Testing and Materials

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PUBLICATIONS

NEWSLETTER

N1 NFAIS Newsletter Subscription - $20 per calendar year (issued bi monthly) Separate issues available at $5 00 each

REPORT SERIES

R2 Position Statement on SATCOM Report, January, 1970. $5 00

R6 National Federation of Abstracting and Indexing Services Member Service Descriptions, July, 1973 $5.00

R7 Science Information Services in an Environment of [illegible]

R8 USSR/USA Scientific and Technical Information in Perspective. Dale B. Baker (1974 Miles Conrad Memorial Lecture) September, 1974 $5 00

R9 Science Literature Indicators. Project supported by NSF OSIS Contract C873 May, 1975 $5 00

OTHER FEDERATION PUBLICATIONS

FP10 1975 Miles Conrad Memorial Lecture, Melvin S. Day (Published in NFAIS Newsletter Apr I 1975 issue). $5 00

FP11 On Line Commands Chart (A Quick Users Guide for Bibliographic Search Systems) Barbara Lawrence and Barbara G Prewitt May, 1975 $1 00

FP12 KEY PAPERS (On the Use of Computer-Based Bibliographic Services) Joint publication with American Society for Information Science October, 1973 $10 00 (ASIS & NFAIS Members $8.00)
NOTE· Contains Federation Report No 3, Data Element Definitions for Secondary Services June, 1971, and Report No 4, The Canadian National Scientific and Technical Information (STI) System, A Progress Report. Jack E. Brown (1972 Miles Conrad Memorial Lecture, May, 1972)

CP1 1971 Conference Digest, Washington, D C, 1971 $10 00

CP2 1970 Conference Digest, Boston, Mass, September, 1970 $7 50

CP3 1969 Annual Conference Proceedings, Raleigh, N C., September, 1970 $10 00

CP4 1963 Annual Meeting of NFSAIS, Washington, D C, March 20-22, 1963 (Contains the National Plan for Science Abstracting and Indexing Services prepared by Heller Associates.) $4.50

CP5 1962 Annual Meeting of NFSAIS, Boston, Mass, March 28-30, 1962 January, 1963. $3 50

American Association for the Advancement of Science

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	John W. Murdock Informatics, Inc.

NEW FELLOWS OF SECTION T

Lee G. Burchinal

Ruth M. Davis

Odom Fanning

ANNUAL MEETING - DENVER - FEBRUARY 20-25, 1977

The following frames contain lists of participants and summaries of symposia as furnished by organizers in the fall of 1976.

EMERGING NATIONAL AND INTERNATIONAL POLICY ON INFORMATION

Arranged by L. B. Heilprin (University of Maryland); with E. B. Adams (George Washington University): A. A. Aines (National Science Foundation); and, G. Chacko (University of Southern California)

Tuesday, 22 February — Holiday Inn, Silver Plume

9:00 a.m. Presiding: Elizabeth B. Adams (Assoc. Prof., Management, George Washington University)

Impact of Science and Technology on Information Systems
Joseph C. R. Licklider (Prof. of Electrical Eng., MIT)

Impact of New Technology on National Copyright Policy
Arthur J. Levine (Natl. Comm. on New Technol. Uses of Copyrighted Works)

FCC Policy Towards Computers and Communication
Donald A. Dunn (Prof. of Eng. Econ. Systems, Stanford University)

Are there "Responsible Computer Systems" and is a National Policy in Sight?
Ruth M. Davis (Dir., Inst. for Computer Sciences and Technol., Natl. Bur. Standards)

Discussants: Elizabeth B. Adams, Ruth M. Davis, Donald A. Dunn, Arthur J. Levine, and Joseph C. R. Licklider

3:00 p.m. Presiding: Laurence B. Heilprin (Prof. Emer. of Info. Science, University of Maryland)

Conflict and Agreement Between National and International Policy on Copyright
Barbara A. Ringer (Register of Copyright, Library of Congress)

Global Probems in International Information Sharing
Andrew A. Aines (NSF and Natl. Comm. on Lib. and Info. Science)

Is an Interntional Policy or Meta-Policy on Information in Sight?
Donald G. Fink (Exec. Consultant, IEEE)

Discussants: Andrew A. Aines, Lewis M. Branscomb, Donald G. Fink, Laurence B. Heilprin, and Barbara A. Ringer

Evidence that the post industrial society is an information society includes proliferation of data and information; a growing community of researchers and writers, processors and disseminators; increase in number and variety of channels that handle and deliver information; institutionalization and internationalization of information systems, networks, programs. A few countries, with the United States in the van, are emerging as information societies employing electronics as key means of information banking and delivery. As we enter this age economists, political scientists, sociologists, legislators and public administrators deal increasingly with issues which may emerge as a composite national policy on information. In parallel, international issues and policies are taking shape. The morning session will consider national policy.

The afternoon session will extend the discussion to international policy. Special emphasis will be placed on needs of developed and developing countries and on information barriers that separate them, including the imperative to remove barriers as wisely as possible.

Each session will end with a "blue sky" discussion, open to the floor. They will consider such matters as obstacles to flow of knowledge in existing national and international channels; possible impacts of yet new telecommunication technology; need for policies concerning conduits of knowledge and the flow of scientific and technical information; and the need to facilitate the one-world global village thrust deriving from the information technology and other revolutions.

(Sponsored by AAAS Section T. cosponsored by Section P and by the American Society for Information Science)

BEYOND GUTENBERG: COMMUNICATION WITHOUT PAPER?

Arranged by Harold E. Bamford, Jr. (Program Director, Access Improvement Program, National Science Foundation, Washington, D.C.)

Wednesday, 23 February Holiday Inn, Cripple Creek

9:00 a.m. Presiding: Harold E. Bamford, Jr.

An On-Line Intellectual Community
Dr. Murray Turoff

Getting and Using Scientific Information at a Computer Terminal
Dr. William Paisley

Access to Computer-Readable Data and Literature
Dr. Roger Summit

Recording Newly Discovered Information
Mr. David Staiger

Toward an Integrated Communication System
Dr. George Chacko

Even if the paper-based communication system of science can continue to expand with the body of knowledge and the population of users, it offers little hope that scientific information will ever be much more readily accessible than it is today. An attractive alternative may result from the marriage of computer technology with telecommunications The panel will discuss various options of this electronic alternative, considering their likely impact on user productivity and demand for information services, their technical and economic feasibility, their legal and policy implications, and obstacles to their realization. In preparing their presentations the panelists will have engaged each other over a period of months in computer conference, one of the techniques which they will discuss.

(Sponsored by AAAS Section T)

TOWARD THE HUMAN USE OF HUMAN BEINGS:

A CYBERNETIC APPROACH TO ASSESSMENT OF CHILDREN

Arranged by Mark N. Ozer (Assoc. Prof. Child Health & Development, George Washington School of Medicine, Washington, D.C.)

Wednesday, 23 February   Holiday Inn, Silver Heels

3:00 p.m.   Presiding: Frank Baker (Dir. Div. Commun. Psych., SUNY, Buffalo, N.Y.)

The Joint Regulation of Infant-Child Interaction
T. Berry Brazelton (Assoc. Prof. Ped., Harvard Med. Sch., Boston, Mass.)

A Cybernetic Approach to Psychological Testing
Irving E. Sigel (Educational Testing Service, Princeton, N.J.)

Cybernetic Testing
Bernard Brown (Div. Res. & Eval., Off. Child Devel., Washington, D.C.)

Assessment as an Interactive Process
Mark N. Ozer

Discussants: William Powers (author, Northbrook, Ill.)

Historically, cybernetics has tended to focus on the interaction between people and machines. Cybernetic issues of control and feedback of information are to be explored in this symposium as they relate to human interaction. The application of these issues to human systems requires an awareness of the sharing of control and informational feedback as the aspect to be highlighted. More specifically, the assessment of children will be explored as a place to illustrate the value of this concept. The traditional testing process has viewed the subject as someone who is to be manipulated by the examiner. The application of a cybernetic approach to assessment offers a model for the revision of the power relationship that has direct relevance to the process of child development. The examiner is intent upon the effects of the very process of examination on the person being assessed. In order to sample the process of child development, the examiner must now stimulate it. The individual being examined must become aware of some reciprocal effect upon the examiner as a simulation of what happens in the natural process of growth and development. Assessment is viewed as more nearly an interactive process between the individuals involved. The person being examined is no longer merely subject to the examiner. With even rather young children, it becomes possible to make such reciprocal effects explicit by providing feedback as to the value of the input provided to the interaction. It is the feedback as to the reciprocity of the relationship that is the crucial parameter that distinguishes the human use of cybernetic concepts.

(Sponsored by the American Society for Cybernetics and AAAS Sections J, T, and Q)

SCIENCE INFORMATION

INTERNATIONAL COMMUNICATION FOR RESEARCH IN BIOMEDICINE

Arranged by Arthur W. Elias (Director of Professional Services, BioScience Information Service, Phila., Pa.)

Wednesday, 23 February Denver Hilton, Beverly

3:00 p.m. Presiding: Arthur W. Elias

Communications for Research in Biomedicine in the United Kingdom and Commonwealth Countries
Brian Perry (British Library)

Communications for Research in Biomedicine in Western Europe
Rolf Fritz (Dimdi)

Communications for Research in Biomedicine in Canada
George Ember (National Research Council)

Communications for Research in Biomedicine in Scandinavia
Goran Falkenberg (MIC, Karolinska Institutet)

Communications for Research in Biomedicine in the United States
Mary Corning (National Library of Medicine)

Communications for Research in Biomedicine in UNISIST-The World System
Lee Burchinal (National Science Foundation)

The symposium will attempt to bring together authoritative decision makers in the fields of biomedical information retrieval from the scientific world. It will try to redate national activities of the present in supporting biomedical research through information activities and to forecast future impacts and developments. In addition to national plans, the symposium will attempt global perspectives in relation to regional cooperation (eg. EEC) and overall programs (UNISIST).

(Sponsored by AAAS Section T)

THE MANY FACES OF INFORMATION SCIENCE

Arranged by Edward C. Weiss (Program Director, Information Science Program, Division of Science Information, National Science Foundation, Washington, D.C.)

Friday, 25 February Denver Hilton, Denver

9:00 a.m. Presiding: Edward C. Weiss

An Integrated Theory of Information Transfer
William Goffman (Dean, Sch. of Lib. Science, Case Western Reserve University)

Theoretics of Information for Decision-Making
Marshall C. Yovits (Chm., Dept. of Computer and Info. Science, Ohio State University)

Information Structures in the Language of Science
Naomi Sager (Linguistic String Project, N.Y. University)

Knowledge Transfer Systems
Donald J. Hillman (Dir., Center for Info. Science, Lehigh University)

The Portent of Signs and Symbols
Vladimir Slamecka (Dir. School of Info. and Computer Science, Georgia Institute of Technology)

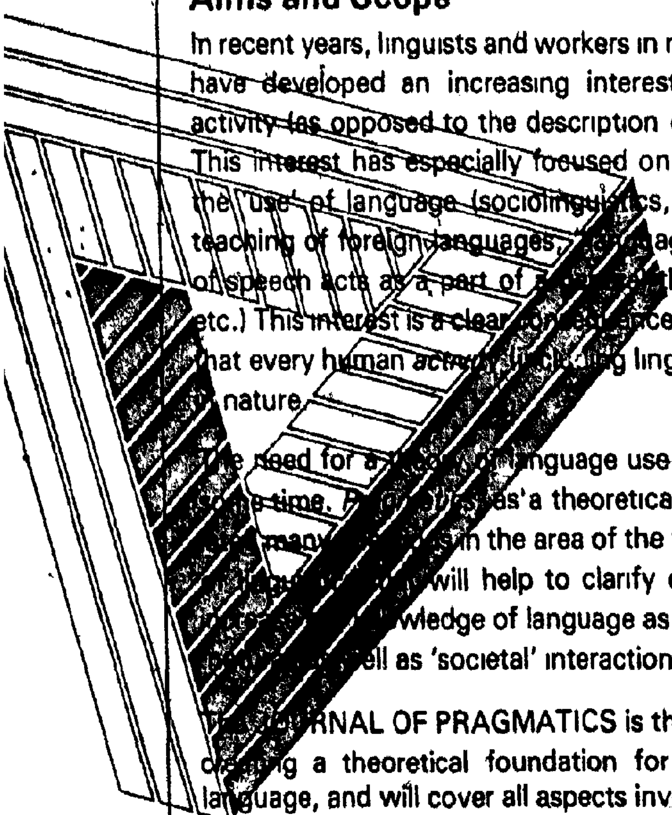
This symposium will examine the various faces of information science as an emerging discipline. The growth in the development of digital technology in the last quarter century has been phenomenal, yet there is a surprising mismatch between the high capacity of the technology and the logical level at which it is employed for information and retrieval. The problem appears to be with the state of the discipline itself; we have been trying to develop and apply a technology without having a well-developed scientific foundation upon which to support it. A discipline rests on three major parts: a science, applications, and education; each part must support the others. In information science, the weakest component today is the science itself. Two questions emerge: what does information science consist of and how can we strengthen it to provide a sound theoretical structure from which future applications will derive. The purpose of this symposium is to review the current status and explore possibilities for break-throughs.

(Sponsored by the American Society for Information Science and the AAAS Section T)

New Journal

journal of PRAGMATICS

An Interdisciplinary Quarterly of Language Studies



Aims and Scope

In recent years, linguists and workers in neighboring disciplines have developed an increasing interest in human linguistic activity (as opposed to the description of language systems). This interest has especially focused on the social aspects of the 'use' of language (sociolinguistics, language acquisition, teaching of foreign languages, "language in context", theory of speech acts as a part of a [illegible] theory of social action, etc.) This interest is a clear consequence of the growing insight that every human activity (including linguistic activity) is *social* in nature.

The need for a [illegible] language use has been manifest for some time. [illegible] as a theoretical discipline, has formu- [illegible] many [illegible] in the area of the theoretical foundations. [illegible] will help to clarify our understanding and [illegible] knowledge of language as one of man's tools for [illegible] as well as 'societal' interaction.

THE JOURNAL OF PRAGMATICS is the first journal to aim at [illegible] a theoretical foundation for pragmatic studies of language, and will cover all aspects involved It will attempt to bridge the gap between the developing fields of sociolinguistics, psycholinguistics, man-machine interaction, applied linguistics, and several other areas.

The advisory editors will not only act as specialists in their respective fields, but will furthermore attempt to integrate developments originating in different (scientific as well as geographical) areas, thereby providing a forum for mutual information and increased debate on ongoing research and practical projects. Linguists, anthropologists, philosophers of language, as well as workers from related fields will find much of interest in the articles now being prepared for the forthcoming issues by experts in the various areas of linguistic pragmatics.

CONTENTS Volume 1:

no. 1

Editorial: Pragmatics and linguistics *(H. Haberland* and *J. Mey).* Assertions, conditional speech acts, and practical inferences *(D. Wunderlich).* School problems of regional dialect speakers: ideology and reality. Results and methods of empirical investigations in Southern Germany *(U. Ammon).* Methodological questions about artificial intelligence: approaches to understanding natural language *(Y. Wilks).* The classification of question-answer structures in English *(M. Baumert).* Reviews.

no. 2

What is a theory of use? *(A. Kasher).* Patterns in purported speech acts *(D. Hackman).* "I'm dead". A linguistic analysis of paradoxical techniques in psychotherapy *(S. Trömel-Ploetz* and *D. Franck).* Some analogies between adaptive search strategies and psychological behaviour *(G. Engström).* Language acquisition as the acquisition of speech act competence *(H. Ramge).* Reviews.

no. 3

Pragmatique et rhétorique discursive *(W. Settekorn).* How to understand misunderstanding: Towards a linguistic explanation of understanding *(D. Zaefferer).* Towards a theory of pragmatics *(H. Õim).* The concept of function in recent Soviet linguistics *(F. Pasierbsky).* Reviews.

no. 4

On so-called "rhetorical" questions *(J. Schmidt-Radefelt).* On the concept of communicative competence: some consequences for the teaching of language *(K. Sornig).* Some remarks on "explanation" in recent sociolinguistic work *(N. Dittmar).* The formation of role concepts in texts: The concept "Mother" in German schoolbooks *(I. Kummer).* On the distinction between presuppositions and conversational implications *(Th. Kotschi).* Reviews.

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AUTOMATIQUE
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RECHERCHE OPERATIONNELLE

DIVISION THEORIE ET TECHNIQUE DE L'INFORMATIQUE

PRESENTATION DES ACTIVITES DU GROUPE DE TRAVAIL

"Analyse et Expérimentation dans les Sciences de l'Homme par les Méthodes informatiques"

POUR L'ANNEE 1977

INFORMATIQUE INTERACTIVE ET SCIENCES DE L'HOMME

SYSTEMES ET LANGAGES INTERACTIFS COMME ELEMENTS CONCEPTUELS DANS L'ELABORATION D'UNE DÈMARCHE EXPERIMENTALE EN SCIENCES HUMAINES

---------0---------

Le développement rapide des méthodes et techniques interactives et l'utilisation croissante de systèmes et/ou de langages interactifs dans des démarches expérimentales dans les sciences humaines ont conduit le groupe de travail de l'A.F.C.E.T. "Analyse et expérimentation dans les sciences de l'homme par les méthodes informatiques" à organiser ses activités, pour cette année, autour du thème général "Informatique interactive et sciences de l'homme". L'étude approfondie de certains aspects de ce thème contribuera à éclairer un ensemble de questions liées à l'introduction de ces méthodes dans les disciplines des sciences de l'homme. Cette réflexion permettra, sans nul doute, de faire émerger des axes de recherche dont les objectifs correspondent à ceux que le groupe s'est fixé lors de sa création, il y a maintenant plus d'un an.

Des travaux technologiques importants ont abouti à la conception d'organes d'entrée-sortie très sophistiqués - télétypes, affichage visuel alphanumérique, graphique, claviers spéciaux, photostyles, etc. - appropriés au dialogue homme-machine. Parallèlement à leur réalisation, de nombreux logiciels interactifs-systèmes, langages, procédures orientées, etc. - ont été développés, implémentés, et rendus opérationnels. L'expérience montre que de tels dispositifs - ordinateurs, interfaces, logiciels - ont été utilisés pour contribuer à résoudre une large variété de problèmes dans un nombre très divers de disciplines. Des études sur les différents modes d'interaction impliqués par ces travaux ont porté essentiellement sur les aspects techniques des liaisons, sur ceux des systèmes et de la communication et enfin sur le comportement psychologique des utilisateurs. Néanmoins les modalités d'insertion de telles machines, tant du point de vue méthodologique que du point de vue technique, dans des dispositifs expérimentaux n'ont que rarement fait l'objet de recherche spécifique et approfondie. L'une des raisons essentielles de cette lacune réside dans le fait que ce type de réflexion se situe à la frontière des méthodes de l'informatique interactive et de celle du domaine qui les utilise.

La complexité de la structure des données et des traitements à opérer - analyse et statut des données par rapport à certains objectifs, formulation d'hypothèses, détermination de modèles, évaluations et validations des résultats, etc. - dans le domaine des sciences de l'homme pose de manière plus aigue le problème de l'insertion et de l'utilisation des méthodes et techniques interactives dans la conduite d'expériences. L'examen des questions liées à cette introduction devraitconduire à dégager des thèmes de réflexion sur la contribution méthodologique de ces éléments dans la conception et l'élaboration de toute expérience, ainsi que sur les modifications éventuelles que ces méthodes peuvent apporter dans le déroulement du processus expérimental.

L'inventaire raisonné des possibilités conceptuelles offerts par les méthodes interactives et leur intégration logique dans tout dispositif expérimental fondent le programme des activités du groupe de travail qui sera en conséquences centré sur le sujet suivant : Systèmes et langages interactifs comme éléments conceptuels dans l'élaboration d'une démarche expérimentale dans les sciences de l'homme".

PROGRAMME DES SESSIONS

Ce programme se décompose en 4 sessions.

1/ La première sera consacrée à l'étude comparative de deux dispositifs interactifs en relation avec la conception architecturale (Vendredi 11 Février 1977).

2/ La problématique de l'insertion des méthodes interactives dans un dispositif expérimental en sciences humaines fera l'objet de la deuxième session, qui durera 2 journées, les 17 et 18 Mars 1977.

3/ La troisième portera sur l'étude du développement des méthodes interactives en sciences humaines (juin 1977).

4/ Enfin la quatrième session fera la synthèse de ces travaux dans le cadre d'un atelier organisé parallèlement au déroulement du congrès de l'A.F.C.E.T. "Modélisation et Maitrise des systèmes" qui se tiendra à Versailles les 22-23-24 Novembre 1977.

Les Animateurs : E. CHOURAQUI
J. VIRBEL

xx Pour tout renseignement ou prise de contact concernant le groupe de travail et le programme de l'année 1977, s'adresser à : E. CHOURAQUI ou J. VIRBEL

C.N.R.S.-L.I.S.H.
31, Chemin Joseph Aiguier
13274 MARSEILLE Cédex 2
Tél. (91) 75.90.42.

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AUTOMATIQUE
INFORMATIQUE
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RECHERCHE OPÉRATIONNELLE

DIVISION TTI

GROUPE DE TRAVAIL

"Analyse et Expérimentation dans les Sciences de l'Homme par les Méthodes informatiques"

Animateurs : E. CHOURAQUI, J. VIRBEL

C.N.R.S.-L.I.S.H.
31, Chemin Joseph Aiguier
13274 MARSEILLE Cédex 2

THEME DES ACTIVITES : "Informatique interactive et sciences de l'homme"

Systèmes et langages interactifs comme éléments conceptuels dans l'élaboration d'une démarche expérimentale dans les sciences de l'homme.

SESSION 1

DATE : Vendredi 11 Février 1977 à 10 Heures (toute la journée)

LIEU : Ecole d'Architecture de Marseille-Luminy
Salle de Conférence du GAMSAU

TITRE : Présentation et Comparaison des objectifs et des hypothèses d'utilisation d'ARLANG et de TROPIC

INTERVENANTS : M. LATOMBE, ENSEGP (Grenoble)

MM. AUTRAN, FREGIER, RODRIGUEZ, ZOLLER, GAMSAU (Marseille-Luminy)

RESUME :

L'idée essentielle du Système TROPIC est de permettre au concepteur de décrire un problème en termes principalement déclaratifs pour obtenir une solution produite automatiquement par le système. Celui-ci est suffisamment général pour permettre de travailler dans des disciplines différentes. Il met en oeuvre des techniques d'Intelligence Artificielle dont les éléments les plus intéressants sont : la représentation des connaissances en items, un mécanisme de sélection des connaissances utiles, l'application d'une stratégie descendante, la collaboration de deux programmes de résolution de problèmes, une technique de retour (backtrack) évoluée et une procédure d'apprentissage.

Le but du langage ARLANG est de fournir aux concepteurs de l'aménagement un outil de description des données et de recherche de solutions à leurs problèmes par des procédures interactives compatibles avec leur pratique ou entraînant des modifications acceptables de leur démarche.

Le concepteur décrit les données sous forme d'arborescence de description munie d'opérateurs "et" et "ou".

La recherche de solutions s'effectue par l'écriture de blocs de programmes permettant :

- de réaliser des algorithmes de traitement des données décrites
- de spécifier la sémantique opératoire de relations descriptives
- d'obtenir des données dynamiques décrites potentiellement et générées par algorithmes.

Ces différentes actions autorisent la création et l'enrichissement d'une base données, à chaque modification correspond alors un état de la base qui peut être conservé s'il est jugé pertinent par le concepteur. L'ensemble des états conservés constitue la trace du processus de conception.

From The Linguistic Reporter, A newsletter in applied linguistics, Published by the Center for Applied Linguistics, 1611 North Kent Street, Arlington, Virginia 22209. Volume 19, Number 4, January 1977, 3.

Stanford Phonology Archive Invites Retrieval Requests

The Stanford Phonology Archive is an NSF-sponsored project whose goal is to compile a computer-accessible file of phonetic and phonological information based on an areally and gentically balanced sample of 200 languages (including the 11 most widely spoken languages in the world). Operationally, the Archive staff analyzes, encodes, and computerizes information found in published phonetic and/or phonological descriptions, so that data from different languages can be accurately and meaningfully compared. The project, which began in 1971, is currently in its final compilation and formalization stages.

One of the Archive's major functions is to provide a usable information retrieval service to members of the linguistic community. Some of the topics which compose the Archive's data base include: specific phonetic segments and/or phonological processes (or classes of segments or processes), the frequency or areal distribution of segments or processes; systems of phonemic contrasts for classes of segments (such as tones, nasal consonants, oral vowels), patterns of segment alternations (allophonic or morphophonemic), the effects of specific segments in proximate conditioning environments; phonotactic constraints in various word and syllable positions; descriptions of stress-accent systems or syllable structure.

Extensive use has been made of the Archive's data base, and some sample requests submitted and answered include:

- Are assimilation rules primarily preservatory (progressive) or anticipatory (regressive)?
- What are the phonotactic constraints on word and syllable-initial consonants?
- How is the distribution of front rounded vowels limited areally?
- Does every language which has rising tones also have at least one falling tone?
- Do nasalized vowels tend to be more mid in height than corresponding oral vowels (i.e., lowered if high, raised if non-high)?
- In stop systems with a voicing contrast, which segments are more frequently missing from a complete phonemic paradigm?
- What is the most common environment for the voicing of voiceless obstruents; for the spirantization of stops, for shifts in point of articulation; for vowel backing or fronting, for nasalization?

All retrieval services are currently performed free of charge upon request. The Archive staff, however, places the following limitations on its capacities: (1) since they are still in the process of refining and evaluating material, some of the information in the Archive is still in "draft form"; (2) the Archive contains no syntactic, lexical, or textual data for any language; (3) the Arc..ve is completely synchronic; (4) although most correspondence is answered as it is received, there may be occasional delays in processing.

The specific fields of data available for searching are described in greater detail in a publication entitled *A Reference Manual and User's Guide for the Stanford Phonology Archive*. Copies are available for $5 00 from Dept of Ling, Stanford U, Stanford CA 94305