A SITUATION SEMANTICS APPROACH TO
THE ANALYSIS OF SPEECH ACTS[1]

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1. INTRODUCTION

During the past two decades, much work in linguistics has focused on sentences as minimal units of communication, and the project of rigorously characterizing the structure of sentences in natural language has met with some success. Not surprisingly, however, sentence grammars have contributed little to the analysis of discourse. Human discourse consists not just of words in sequences, but of words in sequences directed by a speaker to an addressee, used to represent situations and to reveal intentions. Only when the addressee has apprehended both these aspects of the message communicated can the message be interpreted.

The analysis of discourse that emerges from Austin (1962), grounded in a theory of action, takes this view as central, and the concept of the speech act follows naturally. An utterance may have a conventional meaning, but the interpretation of the actual meaning of the utterance as it is used in discourse depends on evaluating the utterance in the context of the set of intentions which represent the illocutionary mode of its presentation. Put another way (paraphrasing Searle (1975:3)), the speaker's intention is to produce understanding, consisting of the knowledge of conditions on the speech act being performed.

If we are to take seriously Searle's (1969:16) assertion that "the unit of linguistic communication is not ... the symbol, word, or sentence, ... but rather the production or the issuance of the symbol, word or sentence in the performance of the speech act," then we should be able to find some formal method of characterizing speech acts in discourse. Unfortunately, linguists have too often employed speech acts as taxonomic conveniences, as in Dore (1977), Labov and Fanshel (1977), and elsewhere, without attempting to give anything more than a descriptive definition. Only in the artificial intelligence literature, notably in the work of Allen, Bruce, Cohen, and Perrault (e.g. Allen (1979), Bruce and Newman (1978), Cohen and Perrault (1979), Cohen (1978), Perrault, Allen, and Cohen (1978)), does one find an attempt to define speech acts in terms of more general processes, here specifically, operations on planning networks.

2. TYPES OF SPEECH ACTS

A great problem for the computational linguist attempting to find a formal representation for speech acts is that the set of speech acts does not map uniformly onto the set of sentences. In terms of "goodness of fit" with sentences, several types of speech acts can be described. One type, the so-called performatives, including ASSERT, DECLARE, etc., can be effected in a single utterance. But even some of these can undergo further decomposition. For example, assuming that the usual felicity conditions hold (cf. Searle (1969:54ff)), both (1) and (2) below can count as an apology, though neither sentence in (2) alone has the effect which their combination achieves.

(1) *I apologize for what I did.*
(2) *I did a terrible thing. I'm very sorry.*

In (2), the first sentence contributes to the effect of an apology only to the extent that an addressee can infer that it is intended as part of an apology. The second sentence, which makes overt the expression of contrition, also expresses the sincerity which is prerequisite for a felicitous apology. But its success, too, depends on an inference by the addressee that it is intended as part of an apology. If the addressee cannot make that inference -- because, for example, the addressee believes that the speaker is speaking sarcastically -- the effect of the apology is lost not only for the second sentence, but for the first as well. In this case, the illocutionary effect APOLOGIZE can be regarded as supra-sentential, though, as in (1), appropriate single sentences can be used to achieve its effect.

There are other types of speech acts, however, that cannot be performed in single utterances, but require several or even many utterances. For example, DEFEND (as in a lawyer's action on behalf of his client), REFUTE (as in polemical argumentation) and PROVE (as in demonstrating effects from specific causes) cannot be effected as performatives: one cannot make a refutation by uttering the words, *I refute X*, as one might make an assertion by uttering the words, *I assert X*.

One might wonder whether these supra-utterance modes should count as speech acts. Certainly, the term "speech act" has traditionally been used in reference to single sentences or to certain classes of non-sentential expressions which have single utterance independence in discourse (e.g. *Hello*). But consider again the traditional definition. Paraphrasing Searle (1969:48ff), a speech act is the use of an utterance directed at an addressee in the service of a set of intentions, namely,

1.) the intention to produce a certain illocutionary effect in the addressee,
2.) the intention to produce this effect by getting the addressee to recognize the intention to produce the effect, and
3.) the intention to produce this recognition by means of the addressee's knowledge of the rules governing the utterance.

There is nothing in this characterization that requires that utterance be understood as sentence. The crucial point is that the utterance (of whatever length) serve the set of intentions represented by 1.) - 3.). A valid speech act can be regarded as defining an illocutionary mode which is governed by conventions which constrain the sorts of interpretations that can be given to utterances which occur within that mode (including our judgments on their appropriateness). These conventions also define the conditions that must be met for the target effect to be achieved.

Thus for the utterance *I will be home by noon* to count as a promise (and not, say, as a prediction), it must be viewed as an utterance issued in the illocutionary mode of promising, which not only defines certain well-formedness conditions on the utterance itself (making statements in the past tense -- e.g. *I was home by noon* -- impossible as direct speech act promises[2]), but also gives the criteria which determine whether the act is successful (including the felicity conditions, etc.).

Similarly, for a series of utterances to count as a refutation, they must be seen as operating in the illocutionary mode of refutation, as for example, in the text below:

(3) *You have stated that 2 + 2 = 3. But take any two individual objects and any other two individual objects, and place them in a row. Then count them, say, from left to right. What do you get? Not 3 but 4. Therefore, 2 + 2 cannot equal 3.*

We cannot interpret any of these utterances accurately unless we recognize that each contributes to the achievement of a focused goal, viz. a refutation. Once that intention is recognized, appropriateness and well-formedness conditions can be applied to the text; and the success of the act can be measured against the set of criteria which are relevant to refutations, including the usual felicity conditions, but also specific conditions on the production of factual evidence and the demonstration of contradiction.

Following this new characterization of speech acts, yet another type can be described, operating not at the utterance level, or the supra-utterance level, but at the sub-utterance level. As an illustration of the phenomenon involved, consider the following unexceptionable utterance:

(4) *I told the guy at the door to watch out, but he wouldn't listen.*

The second reference to the guy of the first clause is made via the anaphoric pronoun *he*. But suppose, instead, a definite referring expression were used. Consider the following:

(5) *I told the guy at the door to watch out, but the person wouldn't listen.*

The person is a distinctly odd coreferent, and seems inappropriate[3]. An examination of this context reveals that the only definite[4] referring expressions which corefer felicitously are pronominal epithets, such as *the idiot*, *the fool*, etc.; descriptions which can be given an interpretation as derogatives, such as *the sophomore*; and expressions whose literal interpretation contributes some sense of explanation to the situation being represented -- viz. that, though warned, the guy at the door didn't heed the warning -- as in *the deaf-mute*.

It can be shown that the principle involved is a speech act-like phenomenon. First, it can be noted that the choice not to use the unmarked coreferent, *he*, signals that the speaker has some special intention in mind. Second, following a suggestion in Bolinger (1977:7ff), it can be argued that a repeated definite description functions not only to refer but also to characterize the referent as having the sense of the definite description. Finally, it can be shown that all the acceptable definite descriptions in this context can be interpreted uniformly as offering an explanation[5] for the failure to listen expressed by the second clause.

Note that the choice of coreferent in the case of the use of a definite referring expression is not, strictly speaking, lexically governed. Furthermore, the use of selectional features, as in Chomsky (1965) and more recent work on generative grammar, cannot constrain the context for such a choice. In short, the problem is one of interpretation, and appropriateness is governed by the intention being served by the choice of the referring expression.

Consider, then, an utterance such as the following:

(6) *I told the guy at the door to watch out, but the idiot wouldn't listen.*

The difference between (4) and (6) is not merely one of different lexical items (*he* and *the idiot*). Rather, the use of *the idiot* makes (6) a more complex utterance than (4), involving an embedded speech act, namely, a characterization whose purpose is to express an attitude and thereby (indirectly) offer explanation.

3. SITUATION SEMANTICS AND DISCOURSE

If speech acts or speech act-like phenomena are found at many levels of discourse, and if it is not possible to give a syntactic definition of a speech act, how can the notion of speech acts be integrated into a formal, and in particular, a computational analysis of discourse? The natural alternative to a syntactic definition is a semantic one[6], and the approach to semantics which offers the greatest promise in treating discourse is the situation semantics being developed at Stanford by Jon Barwise and John Perry (cf. Barwise (forthcoming), Barwise and Perry (1980), Barwise and Perry (forthcoming, a), and Barwise and Perry (forthcoming, b)).

Briefly, this new semantics is informed by the notion that the actual world can be thought of as consisting of situations, which in turn consist of objects having properties and standing in relationships. Any actual situation is far too rich in detail to be captured by any finite process, so in practice, perceptions of situations, beliefs about situations, natural language descriptions of situations, etc., are actually situation-types, which are partial functions characterizing various types of situations. (Cf. Barwise (1981) for a more complete discussion of this point.)

In situation semantics, sentences do not map directly to truth-values, but rather are understood as designating situation-types. Totally understanding a statement would entail that one be able to derive a situation-type which includes all the objects, properties, and relationships represented in the statement.

A series of statements in discourse can be viewed as creating, modifying, embellishing, or manipulating sets of situation-types. Some utterances invoke situation-types; some act as functions taking whole situation-types as arguments. For example, an initial act of reference coupled with some proposition about the referent can be seen as initiating the construction of a situation-type around the referent; an act of coreference, with some proposition, can be seen as adding a new property or relationship to an individual in an existing situation-type.

The discourse situation, too, can be represented as a set of situation-types, initially containing at least the speaker, the addressee, and the mutual knowledge of speaker and addressee that they are in a discourse situation. Any utterance which occurs exploits this discourse situation and cannot be interpreted independently of it. The utterance itself, however, effects a change in the discourse situation, as its interpretation is added. It is in representing the effect of the utterance that the theory of speech acts has application.

The dynamic process of discourse can be modelled as a step by step modification of the discourse situation, with each step taking the set of situation-types of the discourse situation, coupled with the interpretation of the utterance, to a new set of situation-types of the discourse situation.

There are many interesting details to this model which must be ignored in a paper of this scope, but several observations relevant to speech acts can be made.

First, this model accommodates the distinction made by most speech act theorists between what a speaker says -- the locutionary act -- and what a speaker intends to communicate (or means) -- the illocutionary act[7]. This distinction is repeated and captured here in the treatment of the actual discourse as a pair of sets of situation-types. One gives the set of situation-types of the text (written or spoken) -- s_t -- and can be regarded as representing the locutionary aspect of the act. The other gives the set of situation-types of the discourse situation (including author and reader and speaker and addressee) -- s_d -- and can be regarded as representing the state of knowledge about the discourse -- including the information revealed by inferring the intentions of the speaker -- at the time the utterance is produced. The interpretation of s_t relative to s_d, $f(\langle s_t, s_d \rangle)$, gives a new set of situation-types of the discourse situation, s_d'. The illocutionary act can be thought of as difference between s_d' and s_d.

Second, this characterization of an illocutionary act is consonant with psychological features of actual discourse. In actual interaction, what the speaker says -- the locutionary act -- is highly volatile: the exact words of an utterance more than a few seconds past may be lost forever. What remains is the effect of those words, in particular, as composed in longer-term memory. What is remembered represents the state achieved by the discourse, and that reflects directly what the addressee has inferrred about' the speaker's intentions. Put another way, what becomes stored as memory represents what the addressee inferred about what the speaker meant by his utterance.[8]

Third, one can regard the problem of interpreting the current status of the discourse as similar to the problem of deriving the current state in a STRIPS-like system (cf. Fikes and Nilsson (1971)): the correct version must be the result of the application of a series of operations, in correct order, to all previous states. The current set of situation-types of the discourse situation can be seen as representing the accumulation of the effects that have resulted from a series of discrete operations.

4. OPERATIONS ON SITUATION-TYPES

There are various ways that a word or phrase can count as an operation on a situation-type. For example, an utterance or part of an utterance could
(a) take a whole situation-type as an argument, or
(b) introduce an object and a property, or
(c) introduce two or more objects and a relationship, or
(d) introduce an object or a property or a relationship into an existing situation-type.

Case (a) would apply to phrases like *by the way, anyway,* etc., which have the effect of shifting focus or "clearing the slate" for a new text fragment. Cases (b) and (c) ensure that the utterance or part of utterance, if text initial, contains enough information to enable a situation-type to be derived. Case (d) accounts for those instances where a situation-type is clearly established and a single word or reference can effect a change in the situation-type.

For example, the name *John* (used constatively) at the beginning of an interaction cannot count as a operation on a situation-type, as no situation-type of the discourse text then exists, and the name *John* alone cannot create one. However, the name *John* after a question, such as *Who took my book?,* can count as a operation, since it, together with the interpretation of the question, serves to introduce a new object and properties into an existing situation-type.

Returning to a sentence like (6) (repeated below), it is possible to see that, in fact, a series of operations are involved in deriving the final situation-type of the text.

(6) *I told the guy at the door to watch out, but the idiot wouldn't listen.*

The utterance corresponding to the first grammatical clause creates the situation-type in which there is the guy at the door and the speaker and the relationship of the speaker having told the guy at the door to watch out. The word *but* can be viewed as function mapping situation-types into situation-types where a relationship or property somehow implicated in the first situation-type is shown explicitly not to hold in the derived situation-type. The balance of the second clause modifies the situation-type so that the guy at the door now has the property both of having been told by the

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speaker to watch out, and of having not listened, manifesting the violation of supposed normative behavior. The fact that the guy at the door has been referred to as *the idiot* has added a further property, or characterization.

The situation-type of the text at the end of the utterance of the second clause includes the speaker with the property of having told the guy at the door to watch out and having judged him as an idiot for not listening, and the guy at the door who had been told to watch out by the speaker but who did not listen, and who has been judged to have behaved idiotically. (There actually are other relationships here, but a more complete description adds nothing to the general point being illustrated.)

In this case, then, there are at least three steps in the "semantic" parsing of the utterance: the initial creation of the situation-type (the first clause), the interpretation of *but*, and the modification of the initial situation-type to accommodate the information in the second clause.

5. SPEECH ACTS AS OPERATIONS ON SITUATION-TYPES

Thus far the relationship between situation-types and speech acts has not been made explicit. Recall that speech acts can be characterized as having both an intentional component and some representation of the conditions which must be met for the speech act to have been successfully performed. But more importantly, a speech act is not successfully performed until the addressee recognizes that its performance was attempted; and that recognition effects a change in the relationship between the speaker and the addressee. This change in relationship can be regarded as an effect of an operation on the set of situation-types of the discourse situation (not of the text). But a speech act, even if clearly understood as intended, is not successful unless it effects specific changes in the set of situation-types of the text, as well. Therefore, speech acts can be thought of as the effects of the application of one or more inference enabling functions to the pair of sets of situation-types giving the model of the discourse (f ($\langle s_t, s_d \rangle$)).

It is possible to use situation-types as the basis of a definition of speech acts by requiring that speech acts be the result of the application of an inference enabling function to an utterance in a discourse situation such that the derived situation-type conforms to one of a (finite) number of speech act-types. In other words, for an utterance or a series of utterances to count as a speech act, the utterance or utterances must minimally
   (i) perform an operation on a situation-type, and
   (ii) derive a situation-type which is defined (for speaker and addressee) as the legitimate end state of a speech act.

This means that the rules governing the form of speech acts are actually rules specifying the relationships that must obtain in the situation-type which would result from the successful performance of the speech act. In short, this allows us to view speech acts as being driven by certain situation-types as goals.

Simpler speech act-types, such as performatives, correspond neatly to various unary operations on situation-types. An assertion operates on the situation-type of the text by introducing objects and properties or relationships that correspond to the proposition of the assertion. But it also introduces the speaker in an ASSERT relationship to the proposition. And given the constraints on truly felicitous assertions, this would also introduce the implicature that the speaker believes the proposition. In particular, following the taxonomy and characterization of illocutionary acts in Bach and Harnish (1979:39ff), an assertion has the effect, for any speaker, S, and any proposition, P, of creating the following situation-type:

   s (believe, S, P) = 1

By accepting the assertion -- different from accepting the truth of the assertion -- the addressee acknowledges that the above situation-type is added to the set of situation-types giving the discourse situation.

A complete description of the speech act-type ASSERT would consist of the following set of situation-types:

   ASSERT P
      s_1: s (say, S, P) = 1
      s_2: s (believe, S, P) = 1
      s_1, s_2 are in s_d'

Sub-utterance speech acts can be accounted for, now, by viewing the situation-types of the text which they achieve as being dependent on or coincident with the situation-types achieved by the whole of the utterance in which they are embedded. Of course, there must be an accompanying operation on the situation-type of the discourse situation representing the effect of the perceived intention to achieve the sub-utterance speech act -- as in the marked choice of a definite referring expression instead of a simple pronoun, as in (6).

Supra-utterance speech acts can also be captured in this framework. A speech act like REFUTE, for example, cannot be defined in terms of any specifiable number of steps, or any specifiable ordering of operations. Its only possible definition is in terms of a final state in which all the conditions on refutation have been satisfied. In terms of situation semantics, this corresponds to a set of situation-types -- albeit very complex -- in which all the necessary relationships hold. Since such complex sets of situation-types represent the accumulated effects of all the operations which have occurred, without representing the order of application of those operations, there is nothing in the definition of REFUTE that requires that a specific order of operations be carried out. Someone might refute an argument very efficiently; someone else, only after a series of false starts or after the introduction of numerous irrelevancies. The end result would be, and should be, the same, from a speech act-theoretic point of view.

This characterization of speech acts, as the end states of a derivation on a sequence of situation types, explains naturally some of the culture-relative characteristics of supra-utterance speech acts. To take but one example, it has been noted in Taylor (1971) that in agrarian Japanese society there is no notion that corresponds to NEGOTIATE. Clearly, given the manifest success of urban Japanese to obtain lucrative foreign contracts, the absence of such a speech act-type among rural Japanese cannot be attributed to facts of the Japanese language. What we could say, given the argument here, is that the set of situation-types which is the end-state of NEGOTIATE is not, part of the inventory of distinguished speech act-types in the rural Japanese "discourse dialect."

6. SOME EXAMPLES OF SPEECH ACT-TYPES

The following sets of situation-types can serve as examples of the states achieved by several simple, constative speech act-types. As before, the taxonomic features are based on Bach and Harnish (1979), with speaker, S, addressee(s), A, and proposition, P.

   INFORM P
      s_1: s (say, S, P) = 1
      s_2: s (believe, S, P) = 1
      s_3: s (believe, A, P) = 1
      s_1, s_2, s_3 are in s_d'

   RETRACT P
      s_1: s (say, S, P) = 1
      s_2: s (believe, S, NOT P) = 1
      s_3: s (believe, S, P) = 1
      s_2 is in s_d
      s_1, s_3 are in s_d'

   CONTRADICT P
      s_1: s (say, S, NOT P) = 1
      s_2: s (believe, S, NOT P) = 1
      s_3: s (believe, A, P) = 1
      s_3 is in s_d and s_d'
      s_1, s_2 are in s_d'

The characterization of speech acts presented here focuses on end-state conditions, but clearly the starting states (specifically, the set of situation-types of the discourse situation and of the text from which an end-state is to be achieved) also affect speech act performance. A more complete specification of the initial and final states of the discourse pair of sets of situation-types for a variety of speech act-types, involving an elaboration of the role of inference enabling functions and other constraints on the interpretation of utterances, is given in Evans (in progress).

FOOTNOTES:

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2. It has been pointed out to me by Dwight Bolinger that some utterances in Spanish in the past tense can count as direct speech act promises (e.g. *Un momento y acube.*). This sort of promise is similar to the English exclamation, *Done!*, which can be used in sufficiently constrained contexts to effect a promise or commitment.

3. This particular example was first brought to my attention by Terry Winograd.

4. It is clear that strongly demonstrative definite referring expressions using *this* or *that* do not manifest this sort of inappropriateness.

5. The observation that this context seems to be servicing an explanation was first made by John Perry in a discussion of these data.

6. The notion of semantics I am employing should be understood as including certain features usually segregated under pragmatics.

7. It would be outside the realm of speech acts proper to consider the third horse in this semiotic troika: what a speaker actually achieves by his utterance, i.e. how his utterance affects the addressee — the perlocutionary effect. This three-way contrast was first articulated by Austin (cf. Austin (1962:100ff)).

8. Attempts to incorporate this aspect of actual discourse into models of discourse processes are certainly not new. In artificial intelligence applications, episodic memory has been used to maintain representations of the discourse situation, as, for example, in Grosz (1977), Hobbs (1976), Mann, *et al.* (1977), and elsewhere.

REFERENCES:

Allen, J. (1979) *A plan-based approach to speech act recognition.* Technical Report No. 131/79, Dept. of Computer Science, University of Toronto.

Austin, J. L. (1962) *How to do things with words.* Cambridge, Mass.: Harvard University Press, and London: Clarendon Press.

Bach, Kent, and Robert M. Harnish (1979) *Linguistic communication and speech acts.* Cambridge, Mass.: The M.I.T. Press.

Barwise, Jon (1981) Some computational aspects of situation semantics, in this volume.

Barwise, Jon (forthcoming) Scenes and other situations, in *The Journal of Philosophy.*

Barwise, Jon and John Perry (1980) The situation underground, in *Working Papers in Semantics.* Vol. 1, Stanford University.

Barwise, Jon and John Perry (forthcoming, a) Semantic innocence and uncompromising situations, in *Midwest Studies in Philosophy,* 6.

Barwise, Jon and John Perry (forthcoming, b) *Situation semantics.*

Bolinger, Dwight (1977) Pronouns and repeated nouns, Bloomington, Ind.: Indiana University Linguistics Club.

Bruce, B. and D. Newman (1978) Interacting plans, in *Cognitive Science,* 2, 195-233.

Cohen, P. R. (1978) On knowing what to say: planning speech acts, Technical Report No. 118, Dept. of Computer Science, University of Toronto.

Cohen, P. R. and C. R. Perrault (1979) Elements of a plan based theory of speech acts, in *Cognitive Science,* 3, 177-212.

Chomsky, Noam (1965) *Aspects of the theory of syntax,* Cambridge, Mass.: The M.I.T. Press.

Dore, John (1977) Children's illocutionary acts, in R.O. Freedle (Ed.) *Discourse Production and Comprehension,* Norwood, N. J.: Ablex Publishing Corporation, 227-244.

Evans, David A. (in progress) *Situations and speech acts: toward a formal semantics of discourse,* Stanford University Ph.D. dissertation.

Fikes, R. and N. J. Nilsson (1971) STRIPS: A new approach to the application of theorem proving to problem solving, in *Artificial Intelligence,* 2, 189-208.

Grosz, Barbara (1977) The representation and use of focus in dialogue understanding, Stanford Research Institute Technical Note 151, Stanford Research Insititute, Menlo Park, California.

Hobbs, Jerry R. (1976) A computational approach to discourse analysis, Research Report No 76-2, Department of Computer Sciences, City College, City University of New York.

Labov, William and David Fanshel (1977) *Therapeutic discourse,* New York: Academic Press.

Mann, W., J. Moore, and J. Levin (1977) A comprehension model for human dialogue, in *Proceedings of the international joint conference on artificial intelligence,* Cambridge, Mass., 77-87.

Perrault, R. C., J. Allen, and P. R. Cohen (1978) Speech acts as a basis for understanding dialogue coherence, in *Proceedings of the second conference on theoretical issues in natural language processing,* Champaign-Urbana, Ill.

Searle, John (1969) *Speech acts, an essay in the philosophy of language,* Cambridge: Cambridge University Press.

Searle, John (1975) Meaning, communication and representation, unpublished manuscript.

Taylor, C. (1971) Interpretation and the sciences of man, in *The Review of Metaphysics,* Vol. 25, No. 1, 3-51.