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1. *Introduction: Conversation Theory versus Dialectic*

My purpose in writing this article is to define a study, which I will call **Formal Conversation Theory**, which is intended to do for certain sorts of conversation what formal deductive logic does for deductively valid arguments, and what inductive logic allegedly does for inductively strong arguments.

I choose the awkward term "conversation theory" to mark a key ambiguity in the term “argument.” The term “argument” can mean something I give (a claim and my evidence for it): but it can also mean something you and I have (a conversation of a special sort). Logic is most often conceived of as the analysis of arguments in the first sense; the analysis of arguments in the second sense is generally treated (if at all) under the rubric of "fallacies" or (worse yet) "informal logic." The distinction between logic as the analysis of implication-relations and logic as the analysis of conversation-structure is precisely the difference between logic strictly so-called and what I propose to call **conversation theory**. To reiterate, my purpose is to define the subject (in both the real and the nominal sense).

Now, some readers may be tempted to respond to my remarks by saying that such a study is really nothing new, having been practiced for centuries under the rubric "dialectic.” Indeed, dialectic, as a philosophic discipline, has a long history. But the work has been totally non- analytic; that is, it has been carried out by philosophers who do not analyze the concepts they employ in dealing with the philosophic problems addressed. Thus I seek to differentiate the analytic study of conversations from the non-analytic study of conversations (whether by the Marxist, Ramean or other approaches). I reserve the term “dialectic” for the latter and Conversation Theory (hereafter abbreviated CT") for the former.

If I will be contrasting CT with ordinary logic, I ought to briefly state what I mean by "ordinary logic." (I speak of ''ordinary" logic to indicate I do not have in mind deviant logics like erotetic, deontic, temporal or other such studies). Let me begin with the term "argument."

I mean by an **argument** a set of declarative sentences (or if you prefer, statements — the difference will not be important for us), some of which are its premises, and one of which is its conclusion.[4](#bookmark3) By **logic**, then, I mean the study, involving both explication and evaluation, of evidential relations between premises and conclusions of arguments. **Formal logic** (inadequately characterized as "symbolic logic") is the explication of the evidential relations between premises and conclusions of arguments by means of symbolic models.

An argument is **deductively valid** if and only if it is impossible for the premises to be true and the conclusion false. An argument is **inductively strong** if and only if it is not valid, but if it is highly improbable that the conclusion is false given that the premises are true. **Deductive logic,** then, is essentially the study of deductively valid arguments; **formal deductive logic** involves the creation of partially interpreted symbolic languages with context-free transformation

1. The definition I give of “argument,” “deductive logic,” and “inductive logic” are from the introduction to Sidney Luckenbach’s *Probabilities, Problems, and Paradoxes* Encino, CA: Dickinson Publishing Company, 1972.

rules. **Inductive logic** is essentially the study of inductively strong arguments; formal inductive logic has no agreed upon method.

The most important thing — for our purposes — to note about an argument is that it is a pair, consisting of a set of declarative sentences (premises) and another declarative sentence (the conclusion). Moreover, this set is ordered; after all, the notion of "being evidence for" involves order. The premises are evidence for the conclusion, and not vice versa.

Let us now briefly define **CT** as the study, involving both explication and evaluation, of conversations, and turn now to a more precise definition of the concept of a conversation.

To begin with, we must make the traditional distinction between a process and a product of that process. An argument (in the sense defined above) is the result, the summation, of the process of reasoning. Similarly, a conversation (in the sense I will be using it) is the result of conversing, somewhat like a court transcript is a result or — more precisely — a summation of the actual proceeding. We will be constructing a definition of conversation (as product) by looking at aspects of (the process of) conversing, but the reader should keep the process/product distinction in mind.[5](#bookmark4)

The first aspect of a conversation to note is that it is conducted by a number of participants for a certain length of time. We somehow must capture the notion of length and number of participants in the final definition of conversation. Well, does length of a conversation mean the number of sentences in it? No, this wouldn't be accurate, for one of the participants may keep talking after the other participants have left. Rather, by "length" of a conversation we have in mind the number of rounds, the number of sentence-plus-responses-to-it sets. If there are n participants, a round consists of a sentence and (n-l) responses to it. Hence, the length m of a conversation is the number of n-tuples of sentences in it, where n is the number of participants.

The reader should recall the difference between an ordered set and an unordered one. The very notion of a "response" involves order: if sentence y is a response to sentence x, then the set of x and y must be ordered. Again, the very notion of a "round" involves order: the first round is followed by the second round, the second in turn by the third, etc. So the rounds are likewise ordered: <R1, …, Rm>, where m is the length of the conversation, and Ri = <S1,…, Sn> with n the number of participants.

Summing up, while an argument is an ordered pair consisting of a set of premises (or a conjunction thereof) and a conclusion, a conversation is an ordered set of m ordered n-tuples of sentences. Thus we can visualize a conversation as an m by n (m rows, n columns) matrix, with Si,j denoting the jth response in the ith round:

S1,1 , S1,2,. . . S1,n….first round

S2,1, S2,2,. . . S2,n

1. Actually, I would prefer to state the distinction this way: we must distinguish between an *activity* and a *representation*, or idealized description, of that activity. Reasoning, researching, and conversing are all rational activities. We represent these activities in various ways, and logic (and CT) assesses those *representations.* Naturally, in representing an activity, we focus on some aspects of that activity and ignore other aspects of that activity. One may view CT as focusing on a different aspect of reasoning from the one that logic focuses on.

………………

………………

Sm,1, Sm,2,. . .Sm,n.....last round

But there remains much more to be said.

People converse for various reasons. People chatting to pass the time, lawyers arguing in court, scientists debating a scientific point, parishioners participating in a mass, children playing games, old men engaged in heated political argument — all have different goals in mind, different reasons for conversing.[6](#bookmark5) More to the point, if we remember to distinguish between the purpose of the conversation and the purposes of the participants, the *conversations* have different purposes. The lawyers may want to win the case and collect fat fees, but the purpose of the *trial* is to assess guilt; the scientists may want to gratify their egos, but the purpose of their *debate* is to arrive at the truth about physical reality; the parishioners may be trying to impress their neighbors with their piety, but the *mass* is intended to commune with God.

The purpose of the conversation shows up (in the process), among other ways, in the kind of speech acts involved. For instance, idle chit-chat involves questions, promises, exhortations, statements, exclamations and every other kind of speech act I can think of. On the other hand, legal conversations (trials) essentially involve (need only involve) questions, statements and oaths (akin, I suppose, to promises). Yet again, scientific debates (carried out, say, in journals) essentially involve questions and statements.[7](#bookmark6) And what sort of speech acts characterize masses, group prayer, "razzing" (the mutual exchange of insults by opposing athletic teams), I leave to the reader to figure out. The point is this, though: the kind of speech acts countenanced in the process is represented in the sort of sentences (interrogative, declarative, exclamatory) in the product conversation.[8](#bookmark7)

Thus, another key difference between an *argument* (as defined earlier) and a *conversation* (as defined above) is that an argument consists of statements, whereas a conversation includes questions, proposals, exclamations, and so on.[9](#bookmark8)

On the other hand, the purpose of a conversation also shows up in the sort of moves allowed, i.e., in the rules governing how people should converse to that purpose. When speaking in terms of conversations as products, "rules governing how we should converse" amount to rules of acceptability of dialogs, in a sense that will be investigated in section three of this paper.

1. I do not mean to equate masses, trials, and such like, as conversations: I merely intend to represent them as such for the purposes of this paper.
2. This claim may seem implausible, at first. But scientists distinguish quite strongly between polemical writing, which includes exhortations and promises (of future achievements), and scientific discussion. In respected journals polemical articles rarely appear. Note that the difference between a polemical and a scientific article appears, not only in the speech acts countenanced, but also in the rules of procedure as well. For instance, in the former special pleading is acceptable, whereas it is strictly verboten in the latter.
3. Naturally, one can use declarative sentences to ask questions, interrogative sentences to make statements, and so on. When I say "Do you really believe Sue is innocent?", I am really stating that Sue is not innocent. (We call such pseudo-questions "rhetorical questions"). But we can require the participants to use an interrogative when and only when they want to ask a question, use a declarative when and only when they want to make a statement, etc.
4. Again, the difference between a question and an interrogative sentence, a proposition and a statement and a declarative sentence, etc. will be unimportant for our purposes.

Let us restrict our field of vision at this point. I have been speaking of developing a theory of conversations; however, we are basically interested in conversations whose purpose is to acquire information about the world. Such conversations essentially involve only questions and statements, so we should lay down the following stipulative definition. By a **dialog** I mean an ordered set of m ordered n-tuples of sentences, each of which is either an interrogative or a declarative. From this point on, I will mean by **CT** the study, involving both explication and evaluation, of dialogs.

But immediately two questions arise, centering around the relation of CT to logic. First, how do we "evaluate" dialogs? (Are some dialogs "good" and some "bad"? Why and in what way? In the way an argument is valid or invalid?) Second, how does the evaluation of a dialog differ from the evaluation of the moves in that dialogue? (Can't we use ordinary logic, perhaps augmented by a deviant logic?) Both these questions will be addressed in section three; however, further preliminary remarks are in order.

1. *CT versus Gricean Analysis*

To give further insight into CT as I conceive it, let me contrast it with something it is not. I do not have in mind as being CT the sort work done by H.P. Grice in his delightful article "Logic and Conversation."[10](#bookmark9)

In this article, Grice is concerned to refute the doctrine that there are "divergences in meaning" between the logical symbols "(x)", "(x)", "&", “”, "v", "" and "" (given the usual semantic interpretation) and their analogs in ordinary language. Grice is further concerned to show that this mistaken (in his view) doctrine arises from the neglect of the conditions governing conversation. In trying to establish these claims, Grice attempts to delineate the

general conditions which govern or apply to any conversation "irrespective of its subject matter."[11](#bookmark10)

Grice points out that rational conversations do not merely consist of random comments by the participants, but rather are cooperative efforts. There is a common purpose, which may change as the conversation goes along, but which rules out some possible conversational moves as unsuitable. Grice formulates a sort of overarching condition on participants, called the "Cooperative Principle": "Make your conversational contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged."[12](#bookmark11)

As subsidiary groups of more specific rules of conversing, Grice lists these:[13](#bookmark12)

* 1. Rules of quantity:
		1. Make your contribution as informative as required;
		2. Do not make it more informative than required.
	2. Rules of quality.
1. H. P. Grice, “Logic and Conversation,” in *The Logic of Grammar*, edited by Donald Davidson, Encino, CA: Dickinson Publishing Co. 1975. Reprinted in *Understanding Argument* by Robert Fogelin, NY: Harcourt, Brace, Jovanovich 1978, pp. 329-343.

11 *Ibid.,* p. 331.

12 *Ibid.,* p. 333.

13 *Ibid.,* p. 335.

* 1. Do not say what you believe false;
	2. Do not say that for which you lack adequate evidence.
	3. Rules of relation:
		1. Be relevant (Grice admits the lack of clarity of this rule).
	4. . Rules of manner:
		1. Avoid obscurity of expression;
		2. Avoid ambiguity;
		3. Be brief;
		4. Be orderly.

Grice feels that not only do these rules describe how people actually converse, but also how they ought to converse. How to show that latter claim he is apparently unsure, but he thinks that it would involve showing that anyone interested in the central goals of communication (exchange of information and influencing others) would have to participate in conversations governed by those rules.

Now, I heartily recommend Grice's work for its subtle analysis of conversation in general, and conversational (as opposed to logical) implication in particular. Yet I do not view this work as contributing to CT as I view the subject. There are two key differences between what he is doing and what I call CT.

First, Grice's approach is, to use a distinction similar to that made by Hamblin,[14](#bookmark13) descriptive, whereas CT is meant to be a formal study. By a **descriptive study** of conversation I mean a non-symbolic analysis focusing upon how people actually converse. By a **formal study** of conversation I mean a symbolic analysis of how (ideally) people ought to converse. In keeping with the narrowed scope mentioned at the end of section one, this means a symbolic analysis of how people ought to converse if they are to increase their information about the world.

Now, the reader might object that Grice already has this in mind –he feels his rules govern not only how people do, but how they ought to converse. Although this is true, he begins by concentrating on realistic conversations, I propose to look at highly idealized models, which I will call **conversation games** ("**c-games**" for short), and develop CT piecemeal from the analysis of these simplified models. Compare this approach with perhaps the paradigm of a formal study, classical mechanics, which gives a mathematical description of how particles would behave were they perfectly elastic spheres (the "billiard-ball model"). In a formal study of the behavior of entities of a given kind one seeks to find particular models (or one comprehensive model) which exhibit how entities of that sort would behave were they to have certain ideal properties. In CT, one seeks to develop models which exhibit how ideally rational participants in a conversation (whose purpose is to acquire information about the world) would converse. Thus it is of the essence of CT that we look at model dialogs in trying to develop a method of evaluating dialogs.

The second central difference between Gricean analysis of conversations and CT is that the former is a pragmatic undertaking, while the latter is intended to be a semantic/ syntactic one. This is best brought out by considering Grice's rules. Granted "pragmatic" is an ambiguous word, meaning to some "involving explicit reference to context", to others "involving explicit reference to the speakers", and to others "involving explicit reference to the community of language users"; still, Grice's rules of conversation are pragmatic by anybody's definition. I will only say at this

1. C.I. Hamblin, Fallacies, London: Methuen 1970, p. 256.

point that CT is "pragmatic" only in the sense that the semantic context of dialogs must be taken into account. We will return to this matter in the next section.

1. *Rules in CT*

I said in the first section of this paper that CT is the analysis, involving both explication and evaluation, of dialogs; moreover, in the second section I indicated that the analysis is a semantic task best approached piecemeal, by examining model dialogs (c-games). In section four I will begin (only begin) that analysis; but first I want to examine more closely what it is to "explicate and evaluate" dialogues.

The key insight required to see why conversations are evaluable, have a structure which can meaningfully be called "good" or "bad", is the recognition that there can be both rational and irrational paths to the same logically defensible conclusion. This insight is analogous to the recognition that there can be both moral and immoral paths to (means of achieving) a given laudable end.[15](#bookmark14) Even if two different dialogs arrive at the same conclusion, even though that conclusion is quite true, one of those dialogs may have an acceptable structure while the other has a completely unacceptable structure. The same situation obtains in ordinary logic, and in CT we must address it in the same way: concentrate on finding rules which allow us to demonstrate when a given dialog has an acceptable form.

Thus, to "explicate" a dialog is to reveal its form; to "evaluate" a dialog is to evaluate its form, which requires us to adduce a set of rules of justification of dialogs (akin to the rules of natural deduction in deductive logic). But what sort of rules governs the evolution of a "good" or "acceptable" dialog?

First, there are rules governing the structure of any given round, that is, governing the responses to any given move. I will call these rules the narrow rules of response. To delineate the narrow rules of response, we must study the form of acceptable responses to any given type of move. Since a dialog consists only of statements and questions, to study the epistemic relations between any move and the responses to it is just to study the epistemic relations between statements and other statements and the epistemic relations between statements and questions. Hence the task of delineating the narrow rules of response is not a study unique to CT; it is simply the study of ordinary (inductive and deductive) logic plus deviant (specifically, erotetic) logic. Hence, part of doing CT is investigating the logic of statements and the logic of questions.

An example may help make this clear. Consider this one - round dialog:

1. All men are evil, and Jason is a man.
2. Therefore, it follows that Jason is evil.

Here, B is responding to A by drawing out a logical consequence of his statements. But the rules governing B's inference (and hence the adequacy of his response) are simply the rules of deductive inference. Usually, I draw conclusions from statements I have made. But (as reflected in our definition of "argument"), it is a matter of indifference whether you state the premises or if five people do so: in either case, the product is the same.

Thus, the narrow rules of response evaluate the relation of deductive implication, and (as a similar dialog would show) the relation of inductive "implication" (if one there be), and the

1. This useful analogy was suggested to me by Professor Tom Nickles of the University of Nevada, Reno.

relations between various types of questions and answers. They do so because these are the ways participants in a dialog (as opposed to other types of conversation) can respond to a given initial move in a round.

Besides the narrow rules of response, however, there are other rules governing the evolution of (acceptability of) dialogs. If we view dialogs as information-games (take c-games as our models of dialogs), we see that there are "rules of strategy" governing the playing of the game. Compare, if you will, the game of poker. In poker, there are rules (listed, for example in Hoyle) that define how the game is played and state what moves are legitimate. But there are also rules of strategy, such as "never draw to an inside straight", which any player is free to break, but which he would do well to follow. Indeed, the analogy extends to deductive logic: any good logic textbook[16](#bookmark15) will contrast the rules for justifying steps in a proof (inference rules) with rules of strategy for devising those proofs.[17](#bookmark16)

There is yet a third type of rule governing the evolution/acceptability of dialogs. In contrast to the rules of strategy, these rules are part of the essence of the game. But in contrast to the narrow rules of response, these rules govern the evolution of the rounds, the relation between responses to a given move and prior moves, and between any given move and prior moves. Let me call such rules the **broad rules of response**. Some examples: never ask the same question twice; never ask a question which presupposes the negation of a previous answer; never ask a question with a false presupposition; etc.

This is where the analogy with poker breaks down. These are nothing like broad rules of response in poker, because the legitimacy of a move in any given hand is never dependent upon prior hands. Hands in a poker game are not like rounds in a conversation. Put another way, poker would not be a good model of dialogs, not a good choice as a c-game.

Of the rules of strategy for dialogs I will have nothing more to say. Any consideration of such rules falls under what C.S. Peirce called the "economics of research," and is beyond the scope of this paper. Basically, then, the heart of doing CT is delineating the narrow rules of response (really, as I said earlier, a task for logicians) and the broad rules of response (a task unique to CT). This task is to be done by looking at progressively more complex models; moreover, these rules must be (ultimately) semantic in their formulation. Clearly the narrow rules of response are semantic — indeed, they are context-free. But what about the broad rules of response, which are context-sensitive? Recall that I include as semantic context-sensitive rules of a special sort. I can now elaborate on this.

Let's look at the process of conversing from a grossly pragmatic point of view. Each of the participants in a given dialog is a member of a large welter of communities — social, political, ethnic, economic, religious, linguistic, cultural, etc. And certainly the disparate backgrounds of (say) a Canadian Catholic lawyer and an American Protestant businessman determine in great part the shape of their discussion. But since dialogs (as I defined the term) are discussions concerned with acquiring information, and since we are interested in reasons for

1. For instance, see Donald Kalish and Richard Montague, *Logic: The Techniques of Formal Reasoning*, NY: Harcourt, Brace, Jovanovich, 1964.

belief rather than psychological causes of it, we are interested only in what I call the epistemic community of each participants. By **epistemic community { S1, …, Sn}** (abbreviated "**EC**

**{S1, …, Sn}**") I mean the set of people who believe statements S1, …, Sn. This will be an important concept in what follows.

There is some distortion involved in focusing in on epistemic com-munities; after all, a religion is more than a set of tenets, a political orientation more than the mere espousal of a set of doctrines. But even though the communities to which a participant in a dialogue belongs are not each equivalent to a set of statements held by the members of that community, we can represent to any desired degree of precision each community as an EC.

Clearly, then, any given person is simultaneously a member of a large number of epistemic communities: he may at once be a member of those who hold 1979 American middle- class "common sense" beliefs, of those who accept the Copenhagen interpretation of quantum theory, of those who accept the tenets of the Republican Party, etc. Further, if you accept Whorf’s thesis, then all members of a linguistic community are *ipso facto* joint members of at least one EC.

On the other hand, it is plausible to suggest that no two people have precisely the same belief system, so there are probable many ECs which have only one member. Indeed, we can represent the entire epistemic background — or any portion we consider relevant — of any dialogue participant as a set of statements taken as defining an EC. We will return to this point in section four.

Let me digress to look at a seeming difficulty with the concept of an EC. Basically, we identify an EC by the set of beliefs {S1, . . . ,Sn} shared by the people in the community. But S1,

…,Sn are all presumably sentences in *our* language (the meta-language), Standard American English. And there is an abstract problem of translation, i.e., of telling whether someone who speaks a different language believes what is said using a given sentence from one's own language. Actually, this problem is more than abstract, for if T.S. Kuhn's views (as expressed in *The Structure of Scientific Revolutions*) are correct, every alteration in scientific thought, every scientific revolution, changes the language, and thus people in different paradigms (holding different theories ) speak different languages. Thus, e.g., Standard American English as spoken by a proponent of the General Theory of Relativity would differ from the Standard American English of a Newtonian. How could we, using the former as our meta-language, tell if our ascription of sentence S to a speaker of the latter is correct? We can't ask him, since our language and his are incommensurable!

How, indeed? My guess is that Kuhn's "incommensurability thesis" is false; but more to the point, even if his thesis is true, the question whether to ascribe a belief stated in one language to a person of a different language is simply an empirical question, answerable by linguistic and historical research carried out in our meta-language. But whether the reader agrees with my assessment of this problem or not, the whole issue will be irrelevant to what follows. In the cases we will consider, the language of the dialog participants (the object language) and the language in which we carry out the analysis (the meta-language) will be precisely the same.

Having introduced the concept of an EC, let's now employ it to return from the domain of pragmatics to the realm of semantics. Clearly, many of the statements and questions in the dialog will involve presuppositions. Some of these presuppositions will be the results (answers or inferred conclusions) from previous rounds. But some will be background assumptions, part of the EC to which all of the participants belong. (It is clear why there must be an E.C. to which they all belong: if the participants in a dialog did not share some beliefs, the dialogue could never

"get off the ground"). Thus the EC "shapes" the dialog, as it were. And the broad rules of response must, in part, address the epistemic (background) context of the dialog, for the acceptability of questions and statements depends in great measure on that epistemic context.

But by representing epistemic communities as sets of statements, we can then state the context-sensitive rules without reference to communities of speakers, cultural or ethnic groupings, or other undeniably pragmatic types of context. The context with which CT is concerned is merely a set of statements, and the (context-sensitive) broad rules of response simply state what transformations of sentences are allowed in given forms of context. How this works in practice will be examined in the next section.

At the end of section one I framed two questions about CT. First, I asked what sort rules of justification characterize CT. We can now answer that: the broad rules of response, unique to CT, are context-sensitive in the semantic sense outlined above. We discover these rules by looking at model dialogs, and noting how later moves depend upon prior ones, and the first move depends upon the EC the participants belong to. And we can enunciate such rules without referring to the speakers. To the second question about whether CT is a subject over and above logic, we now turn.

To see the force of the second question, consider how a hypethetico-deductivist views scientific method.[18](#bookmark17) Under this view, a scientist investigating a problem conceives an hypothesis (in a manner not susceptible of logical analysis), call it "H1” and then deduces a test from it. If this observational consequence is false, the hypothesis H1 is refuted, and the scientist conceives another, H2. Again, a consequence (observational test) is deduced and checked. If it turns out true, then the hypothesis H2 is confirmed, and another consequence is deduced and tried. We can thus represent this dialectical trial-and error process as a chain of arguments:

Argument #1: H1 O1

O1

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H1

Argument #2: H2 O2

O2

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H2

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Argument #n: Hn On

1. There is a deep connection between the study of dialogues and the study of scientific method. One can view the research of a scientist in any given domain as a dialogue between the researcher (and other researchers working in that domain) and nature. Indeed, I believe that the dispute over whether there is a "logic" of discovery is as sterile as it is because "logic" is taken in too narrow a sense. CT is meant to remedy that.

On

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Hn

Argument #(n+1): Hn+1 On+1

On+1

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Hn+1 is confirmed.

.

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Argument #(n+k): Hn+k On+k

On+k

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Hn+k is established

Here, the first n arguments are all deductive, while the last k arguments are all inductive.

Thus, since we can view a scientist's research as a dialog between himself and nature, if we generalize upon the hypethetico-deductivist account, we might say that any process of conversation is representable as simply a chain of arguments. Thus CT as such would not exist; only ordinary (and perhaps deviant) logic would be needed to explicate and evaluate dialogs.

This seems to me to be a powerful objection, and indeed kept me from recognizing the existence of CT for a considerable length of time. However, I think there are several reasons why one cannot even in such simple cases as trial and error dialogs (much less dialogs in general), represent dialogs as chains of arguments.

First, a dialog consists of questions and statements, not just statements alone. Consider the hypethetico-deductivist account again. Note that it is singularly weak on explaining where the initial hypothesis Hi (or any of the other hypotheses) comes from. The hypethetico- deductivist ignores the fact that an hypothesis is a conjectured answer to a problem (a question).

Much of the concern about the role of "background theories," "paradigms", and "presuppositions" reflects the fact that even the simplest dialogs involve questions, and moreover, that the initial question especially involves presuppositions assumed by the EC to which the dialog participants belong. Also, the Duhemian point that when we say (e.g.) "O1” was seen to be false" we are in fact saying something hypothetical (because we assume in testing an hypothesis many auxiliary hypotheses dealing with experimental design, etc.), is a recognition of the fact that at all points in the dialog, statements and questions presuppose beliefs held by the EC of the participants.

The second reason we cannot represent even simple dialogs as chains of arguments is that the broad rules of response are completely overlooked. Consider our example of the hypethetico-deductivist (trial-and-error) model of scientific research: it clearly overlooks the fact that there are rules governing the introduction of new hypotheses. For example, ji cannot be the same as (the previously rejected) Hi. And the set of beliefs that characterizes the EC of the researchers acts as a set of constraints upon the introduction of new hypotheses.

Such considerations are the main force behind the demand for a "logic of discovery," and simply reflect the fact that besides narrow rules of response governing the interior structure of each round in a conversation, there are broad rules of response which govern the evolution of the rounds, in the context of the EC and the results of prior rounds. To say a dialog is more than a string of arguments — and thus CT more than just logic — is in part to indicate that the broad rules of response exist over and above the narrow rules of response.

However I will concede this to my critic. CT is not some new vast uncharted continent — it is more like a hitherto uncharted island. The narrow rules of response far outnumber the broad. Moreover a complete CT must await the development of both inductive and erotetic logic. In sense, especially, CT may be said to depend upon logic.

I trust by now the reader has a general idea of what CT is supposed to be. Let me try to impart a more concrete vision of the subject by looking at a few c-games, sketching out an analysis of them, and then concluding with a discussion of what my future research focus on.

1. *Some Simple C-games*

Recall that we can represent a conversation as being a matrix S1,1, ....,S1,n

S2,1, …,S2,n

.

.

.

Sm,1, …,Sm,n

Each Si,j of which is either a statement pi,j, a question ?pi,j , or else (the null response). We can represent any null response by the tautology "p v ~p". In what follows, however, this cumbersome notation will be unimportant.

What will be important, is this simplification: in the games we will consider, there are two participants, an active partner A, and a "dummy" partner D. As the name indicates, A is the one who plays the game, while D simply answers questions put to him by A. Thus we need only consider the EC to which A belongs. Note that winning any of these c-games amounts to discovering the desired information.

*C-game #1:* Let's begin with a very simple game, called "the proof game." In this game, A is given several statements by D, and is told to take them as premises. D then feeds A proposition after proposition, requiring A to prove each given proposition from the original given premises.

Clearly, in this game, the EC to which A belongs is EC = {the given premises}. The narrow rules of response are the rules which govern deductive inference, the rules of natural deduction. But what are the rules of response? Well, does any round depend upon prior rounds? No — after proving any given proposition from the premises given initially, A is given another. But the order in which the propositions to be deduced are given is irrelevant. Thus there are no rules governing the evolution of the rounds, since the rounds are independent of one another, hence there are no broad rules of response.

However, it is easy to imagine a variant game which does have broad rules of response. Imagine D giving the first proposition P1 to A, requiring him to check whether it follows from the given premises (by truth tables, say; let's assume we are dealing with sentential arguments

only), if it does having A prove it follows, and if it doesn't, having A add P1 to the group of premises. D then gives another proposition P2, and A does the same as in round one except the EC set of premises now includes P1. Here, the broad rule of response is: in any round, prove the proposition given (if it is deducible) using the initial information plus all the propositions given previously not entailed by that set.

*C-game #2:* In the proof game, the narrow rules of response are deductive. A more interesting game is "the evidence game". In this game, D sets forth a set of propositions — the initial set of information. D then gives A a proposition, and A must select from the EC set (the initial information) those statements which most support it, but without entailing it.

I cannot state explicitly the narrow rules of response for this c-game, since there is no inductive logic analogous to deductive logic, with inference rules and the like. Also, in c-game

#2, there are no broad rules of response, but (as with c-game #1) we can devise variants of the game which do have broad rules of response.

*C-game #3:* In this game, called "the one-card game", D draws a card from a regular deck of playing cards, and A must determine what card D drew without seeing it. A can only ask whether-questions ("yes-or-no" questions). Thus, unlike the first two c-games, this c-game involves interrogative as well as declarative sentences. Clearly, A is a member of EC = {the card drawn is one of the following: ace of spades, two of spades, …, king of spades, ace of hearts, two of hearts, …, king of hearts, ace of clubs, two of clubs, …, king of clubs, ace of diamonds, . .

., king of diamonds}. We can imagine several ways the game might proceed, i.e., there arc several equally acceptable such dialogues. For instance:

Round 1: A: Is the card a spade?

 D: No.

Round 2: A: Is it a club?

 D: Yes.

Round 3: A: Is it a club higher than eight?

 D: No.

Round 4: A: Thus it is either an eight or less than an eight.

 D: (Null response).

Round 5: A: It is a club higher than five?

 D: Yes.

Round 6: A: Then it is the six, the seven, or the eight.

 D: Null response.

Round 7: A: Is it the six of clubs?

 D: Yes.

Round 8: A: The card is then six of clubs.

 D: (End game).

But A could equally well (from the *logical* point of view, though not from a s*trategic* point of view) have simply worked through the deck, card by card, asking D whether the unknown card is the ace of spades, the king of spades, and so on. Again, figuring out what the best *strategy* is in any c-game is a study in the economics of research, and beyond the scope of this paper.

Any acceptable c-game #3, however, is governed by the rules of deductive inference plus the rule that when D is faced with a whether-question, he must select one of the two alternatives (i.e., D must answer yes or no, not maybe). These are the narrow rules of response. The single broad rule of response is that the whether-question in any round (r+1) may not presuppose the falsity of any answer given in rounds 1 through r.

*C-game #4:* called "the hide-and-seek game", is in part similar to c- game #3. In hide-and-seek D hides an object o, and A must find it. A can only ask whether-questions. We can suppose without loss of generality that the game is played in a 20' by 20' room, that A has a rules, and that o is a ball-bearing hidden in the carpeting. So the EC to which A belongs is identified by the set

{o is a ball bearing hidden in the carpeting in a 20' by 20' room}. Further, A can look at the rug In this game, the narrow rules of response are simply (as in c-game #3) the rules of

deductive logic plus the restrictions on how whether-questions can be answered. And the broad rule of response is (as before) that the whether-question in any round must incorporate in its formulation (must not presuppose the negation of) the answers (the information discovered) in the previous rounds, or the initial information.

Note something very different about c-game #4, however. While A could simply ask questions like "Is o closer to the north wall than the south?" "Is o within ten inches of the west wall?" etc., and within a finite time get arbitrarily close to the location of o, this would obviously be a bad strategy. A is, after all, permitted to look at the rug. Thus a could, if he wished, simply get down on his hands and knees and begin checking the rug visually. Again, this would be bad strategy, but still rational or "logically" acceptable. A's best strategy would be to ask several questions to narrow down the area where o can possible be, and then visually check that area. The question is, then, how do we represent this observational input?

Let me introduce the concept of channels of information: a **channel of information** for a given participant in a dialog (and we usually focus on one participant, the active partner) is any mode by which he can acquire information not already in the set of propositions defining the EC to which he belongs. Thus, besides the other participants (especially dummy partners) in the dialog, observation, perusal of relevant literature, and such like, are all channels of information, and can be represented by (but not equated with) other dialog participants.

Thus, we can profitably represent a c-game #4 where A does use observation like this:

Round 1: A: Is o within two inches of the west wall?

 O: (observation): 

 D: Yes.

Round 2: A: Then o is either in the two inch strip which runs from the from the north wall to the half-way line dividing north and south, or else in the two inch strip which runs from the dividing line to the south wall.

O: o is not in the two inch strip which runs from the north wall to the dividing line.

 D: 

Round 3: A: Then o is in the strip which runs from the dividing line to the south wall, (and so on).

1. *Concluding Remarks*

I regret that the foregoing section was so brief: however, I merely wished to give the reader a concrete illustration of CT to complement the abstract characterization sections of this paper. To illustrate just how much work remains to be done in CT, let me mention just a few of the simplifications inherent in the four c-games I considered.

First, the dialogs had only two participants. In reality, however, most conversations have several participants, even several active participants. Think of modern scientific research: gone are the days of one scientist engaging in solitary work (the lone scientist being the active partner, nature the observation channel). Now, science is a cooperative effort of groups of researchers, or better, *teams* of researchers.

Second, the dialogs I considered had either no questions, or only whether-questions, allowed. But there are many other types of questions to consider, chief among them being why- questions. And the most interesting sorts of dialogs (conversations devoted to acquiring information) involve seeking explanations for phenomena of interest, involve asking why- questions. (My current work in CT is focusing in on just this area).

Third, we have viewed the EC to which the participants belong as remaining static over the course of the conversation. But "background information" rarely remains an inert lump, merely acting as a set of constraints, during the process of discovering information. The constraints themselves are modified by the information acquired, in a very subtle and complex way.

Thus, CT as I conceive it, has much ground to cover. Still, the sooner we start, the sooner we will finish.

1. *Bibliographical Appendix*

Needless to say, there has been much philosophical work done on many of the areas upon which my paper touches. For instance, the literature devoted to Dialectics is vast, beginning (if not with Plato himself) at least in the Middle Ages, and is continued to this day by Marxist and non-Marxist scholars alike. To single out books from this vast literature for special recommendation is perhaps an exercise in hubris, but I make the following recommendations:

* *Logic and Reality. An Investigation into the Idea of a Dialectical System*, by Leslie Armour, 1972, Van Gorcum & Co., Assen.
* *Dialectics*, by Nicholas Rescher, 1977, State University of New York Press, Albany,

N.Y. However, my approach is rather different from Dialectics, and my focus much narrower. I am primarily interested in the analysis and assessment of model dialogues, conversations, analogous to (but not equivalent to) "proofs." A roughly similar task is addressed in:

* *Elemente der Sprachkritik*, by Kuno Lorenz, 1970, Suhrkamp Verlag, Frankfurt am Main, esp. pp. 147-242.
* *Fallacies*, by C.L. Hamblin (cited earlier in footnotes). However, their approach is pragmatic, mine syntactic/semantic. In my paper, I did not take up the topic of erotetic logic, although erotetics (the logical study of questions) clearly figures in to conversation theory as I conceive it. I highly recommend to the reader:
* *The Logic of Questions*, by Nuel Belnap and Thomas Steele, 1976, Yale University Press, New Haven, Conn. not only for its clear presentation of erotetic logic, but also for its very complete and excellent bibliography of articles and books on the logical structure of questions and answers. Finally, it should be noted that many of the issues I have raised are approached from a linguistic perspective in "text linguistics" or "text grammar". See especially:
* *Studies in Text Grammar*, ed. by J.S. Petofi and H. Rieser, 1973, D. Reidel. Dordrecht.