
How can logic best be applied to arguments?

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Abstract

This talk surveys a number of methods currently being developed that assist in applying logic to the evaluation of arguments used in particular cases. A case is seen as specified by a given text and context of discourse. The methods used are pragmatic, and are based on the Gricean Cooperative Principle (CP), as implemented in several types of goal-directed conversational exchanges.

How can logic best be applied to arguments?

The goal of this address is to extend the boundaries of the subject known as logic towards the task of evaluating arguments as found in given cases of natural language argumentation. Of course, recently in philosophy, many influential voices are saying precisely that it is not possible to carry out this task (in an objective way that would be suitable for use in logic). I will argue that it can be done, or at least that there are resources available that can be brought to bear to show this task is quite possible and doable (at least, to some already worthwhile degree). These resources need to be drawn from work in several fields through a collaborative interdisciplinary project, for this effort towards an applied (or so-called informal) logic to advance further. Unfortunately, even the current term ‘informal logic’ is unnecessarily divisive.

1 The problem with teaching logic

The problem with teaching logic in the twentieth century is that, at least as taught in philosophy, logic is expected to be a subject that will improve critical thinking. That is, the presumption is that logic can be applied to argumentation in natural language, of the kind we commonly use to resolve disputes, carry out inquiries, solve problems, and so forth. However, anyone who teaches logic for very long comes to realize that the capability of logic to carry out such a practical task is extremely limited, in several important respects.

Teaching students natural deduction in classical logic clearly does have important benefits for students. It teaches them to reason carefully in an organized step-wise fashion from a hypothesis. It probably has many other benefits as well, especially for students who are not very used to careful analytical reasoning or rigorous thinking.

But the limitations of this kind of logic as an instrument of teaching critical thinking become apparent when any kind of realistic and potentially deceptive arguments are

encountered and attempts are made to evaluate them*. One big problem is that, in many realistic cases, it is hard to know what the argument is, *i.e.* what the premises and conclusion are supposed to be. Many textbooks try to avoid this problem by saying that these are “designated” propositions, but of course this kind of hand-waving does not solve the problem. One subproblem that will not go away is that it is inherently difficult to tell whether something is supposed to be an argument or an explanation. This problem is complicated even further by the existence of abductive arguments that are partly composed of explanations.

Another subproblem is that of relevance. Attempts to define a practically useful notion of relevance using a formalistic deductive calculus have clearly failed. And it is clear the only potentially useful way to define relevance for logic is as a pragmatic notion of how an argument is used in a given case to relate to some issue that is supposedly being discussed. To evaluate relevance, then, we have to look at the global context of conversation in which an argument was used for some purpose, for example, to resolve a conflict of opinions, that is, the issue supposedly being discussed in the given case. Then we have to ask whether the given argument can be extrapolated forward so that it connects up with the propositions on one side or the other of this conflict of opinions that is the issue of the dialogue. Can the given local argument be chained forward in a connected sequence of reasoning that is probatively useful in the dialogue? That is, does it bear on the issue in the given case? If such a connecting up between the given local argument and the global issue of the dialogue can be made, the given local argument is relevant (dialectically relevant, to be more precise). Otherwise it is not. The tool used to evaluate relevance in a given case is the so-called profile of dialogue — see section two below.

But clearly this type of determination of relevance is pragmatic in nature. It has to do with how a given local argument is used, or can be used, to bear on the issue of a larger dispute that is part of the context of the local argument in a given case (insofar as that context is evident in the given case). Once it is realized that relevance is pragmatic, a lot of notions students find peculiar in deductive logic, like the “paradoxes of implication” can be made much more tractable.

2 Re-orientation of logic

What I advocate in teaching logic is to re-orient to seeing a given text of discourse in which an argument is supposedly embedded as an individual case. The pragmatic problem of evaluation is then to see how the argument (if it is one) was used for some purpose in that case. A case comprises not only a given text of discourse (a chunk of discourse that is closed off by assumption), but also a context of use. Context means that the argument was supposedly used as part of a conventional type of goal-directed conversational exchange between two parties. These types of conventional exchanges are of different types, with different goals and rules (Walton and Krabbe [16]).

All these types of dialogue are governed by the Gricean collaboration 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.” (Grice [4, p. 67]). Following this principle, an argument as used in a

*As in the informal fallacies section of a logic course.

TABLE 1. **Eight types of dialogue**

TYPE OF DIALOGUE	INITIAL SITUATION	INDIVIDUAL GOALS OF PARTICIPIANTS	COLLECTIVE GOAL OF DIALOGUE	BENEFITS
Persuasion	Difference of Opinion	Persuade Other Party	Resolve Difference of Opinion	Understand Positions
Inquiry	Ignorance	Contribute Findings	Prove or Disprove Conjecture	Obtain Knowledge
Deliberation	Contemplation of Future Consequences	Promote Personal Goals	Act on a Thoughtful Basis	Formulate Personal Priorities
Negotiation	Conflict of Interest	Maximize Gains (Self-Interest)	Settlement (Without Undue Inequity)	Harmony
Information-Seeking	One Party Lacks Information	Obtain Information	Transfer of Knowledge	Help in Goal Activity
Quarrel (Eristic)	Personal Conflict	Verbally Hit Out at and Humiliate Opponent	Reveal Deeper Conflict	Vent Emotions
Debate	Adversarial	Persuade Third Party	Air Strongest Arguments for Both Sides	Spread Information
Pedagogical	Ignorance of One Party	Teaching and Learning	Transfer of Knowledge	Reserve Transfer

given case is evaluated as reasonable (rightly used) or not when it contributes to the goal of a conversation of a type that the argument in the given case was supposed to be part of (or does not). An argument is fallacious if used to go against the goals of the conversation, but in a way that gives it a deceptive appearance of making a genuine contribution to the conversation (typically because there has been a deceptive or concealed shift to a different type of conversation).

It is important to distinguish between reasoning and argument. Reasoning is a sequence of inferences. An inference is a set of propositions and a Toulmin warrant joining the premise propositions to the conclusion (Toulmin [13]). Reasoning is not necessarily goal-directed it can go in any unanticipated direction. But reasoning is used in argument. An argument is the use of reasoning in a dialogue (conversation) exchange between two parties — a proponent and a respondent — where the joint purpose of the exercise is to realize a goal for a certain type of conversation by collaboratively reasoning together. Thus argument is essentially a dialectical notion involving two parties who reason together.

The re-orientation of logic is to go beyond viewing the evaluation of an argument

as a localized inference, and to judge globally how it was used in a broader context of dialogue of which it is a part. Typically, using all the resources of formal dialectical reconstruction would be too onerous, however, and the best method is to use a *profile of dialogue*, a local sequence of connected moves in argument, and replies to those moves, that are part of a larger sequence of moves in a dialogue exchange[†]. A good example here is the evaluation of cases of the so-called fallacy of many questions, where a question containing presuppositions inimical to the side of the respondent is put in such a way that the respondent is supposed to give a direct answer, and where whatever direct answer he gives would incriminate him. In a given case, this fallacy is best evaluated using a profile of dialogue.

Generally, the problem of evaluation is posed by the embedding of an argument (or something that is a move in an argument, or is supposed to be an argument) in a text of discourse in a given case. The first task is to identify the argument (if there is one), *i.e.*, to determine what the premises and conclusion are, what type of argument it is supposed to be (deductive, inductive or presumptive), and what the argument scheme is, *i.e.* what particular form of argument it is supposed to be[‡]. The second task is to analyze the argument, looking for additional premises that have not been explicitly stated, but may be conjectured, as having been used. The third task is the evaluation of the argument. And, as noted above, this task requires placing the local argument given in a global context of dialogue.

3 Enthymemes

The biggest single problem of argument reconstruction is that of identifying premises or conclusions that have not been explicitly stated in a text of discourse. This is the so-called problem of enthymemes. Etymology is confusing here. Aristotle did not use the term enthymeme (*enthymema*) to mean an argument (or, in particular, a syllogism) with a non-explicit premise. He defined an enthymeme (*Prior Analytics* 70a12) as “a syllogism from probabilities or signs.” What has traditionally been translated as “argument from probability” (*eikos*) is another source of confusing terminology. It is not probability in the post-enlightenment sense of statistical likelihood, but something better rendered as “plausibility” or “seeming to be true.” The classic example of argument from probability is described by Plato (*Phaedrus* 273b3) and Aristotle (*Rhetoric* 1402a17): a weaker man is accused of having assaulted a stronger man, and he argues in his defence that it is not probable that he would attack a man stronger than himself. This argument is not based on statistical probability, but on what would appear plausible to the jury. The argument has the function of shifting the burden of proof somewhat, making it harder for the stronger man to support his side of the case as plausible to the jury.

Hopefully, logic will one day be mature enough to correct these ancient, and fundamental confusions of terminology, but as Joseph [7, p. 361] suggests, for the present, we are probably stuck with the meaning of ‘enthymeme’ as ‘argument with a premise (or conclusion) that was not explicitly stated’, or with constantly explaining this terminological point.

[†] On profiles of dialogue, see Krabbe [9].

[‡] On argumentation schemes, see Kienpointner [8].

Anyway, the main thing about enthymemes is that we can use a calculative basis for filling in the missing premises (or conclusions), but this calculative basis can never be complete, without bringing in another factor (that is more difficult to calculate). I will explain this cryptic remark by starting with deductive logic.

As the textbooks have long taught, missing premises can be identified (at least in some cases) by taking a deductive calculus like propositional logic or syllogistic logic, and plugging in the missing preposition that would normally be needed as a premise to make the argument valid. The traditional example is “All men are mortal, therefore Socrates is mortal”. This system can be made even better in AI in an expert system. By using abduction, the system can search back through the knowledge base to identify the facts and rules (if they are in the knowledge base) needed to make the given argument valid. In such a system, we can use a calculative basis for filling in the missing premises (or conclusions) in an argument in a given case.

It is possible to have a similar system using inductive rules based on probabilistic generalizations. Or it is even possible to have a presumptive system based on plausible reasoning of the kind that is subject to exceptions. But any such system, of any of these three kinds, will be incomplete, in a sense we now turn to explaining. The basic reason is that in many cases there can be many different candidates for the missing premises, any of which would make the argument valid (by the given criterion being used). In identifying arguments used in a given text of discourse in a given case, we need to go beyond this formalistic criterion and ask which candidate proposition the arguer was really using to make his point.

To explain the problem here it is useful to refer to the distinction made by Ennis [3, pp. 64–66] between *need* and *use*. A needed assumption is a proposition an argument needs in order to be as good an argument as it can be (by some standard). But according to Ennis (p. 64), used assumptions are unstated reasons that we look for “when we are engaged in understanding someone.” In evaluating and criticizing arguments, reconstructing enthymemes needs to be done on a basis of use, if we are to avoid committing the straw man fallacy, and other abuses that stem from wrongly or unfairly attributing assumptions to an arguer.

But how could we attribute missing premises on a basis of use? The answer is that we need to take the commitments of the arguer into account, as far as these can be determined by the text and context of discourse in a given case. The methods for carrying out this task have been developed in Walton and Krabbe [16].

4 Practical reasoning

A good deal of the reasoning used in argumentation is not well represented by the usual deductive and inductive structures that are the mainstay of logic courses today. Many cases involve a kind of reasoning that has by longstanding tradition in philosophy been called “practical reasoning,” based on Aristotle’s notion of practical wisdom (*phronesis*). As shown by Hamblin [6, p. 206], *phronesis* involved not only knowledge, skill and deliberative excellence, but also moral virtue. However, there is a narrower sense of practical reasoning that has no necessary implication attached that the goal to be attained is morally good, that the reasoner is a good person, or that the action recommended is morally acceptable. This type of reasoning, as characterized in Wal-

ton [14] could be described as instrumental or means-end reasoning carried out by an intelligent agent acting in particular circumstances.

Practical reasoning (in this instrumental sense) is a goal-driven, knowledge-based, action-guiding species of reasoning that coordinates goals with possible alternative courses of action that are means to carry out these goals, in relation to an agent's given situation as he/she/it sees it, and concludes in a proposition that recommends a prudent course of action. Practical reasoning is carried out by an agent, a complex entity with a capability for intelligent action. An agent does not necessarily have to be a person. An *agent* is an entity that is a self-contained unit in the sense that it has goals, is capable of autonomous action, based upon its ability to perceive its external circumstances, and can modify its actions in accord with such perceptions. This ability to modify its actions to correct for deviations from its goals in the perceived consequences of its actions by an agent is *feedback*.

Typically, in familiar cases, practical reasoning is a nonmonotonic kind of reasoning that is presumptive in nature. It works best when hard knowledge is not available to determine the best course of action in a changing set of circumstances where some sort of action is needed. However, in some cases, practical reasoning can be closed off under what is called "the closed world assumption," and in some such cases it can be represented deductively.

According to Reiter [11, p. 158] the *closed world assumption* is the drawing of the inference that any positive fact not stated in a database may be assumed to be false. The general assumption is that all of the relevant positive information has been stated, so if a particular relevant positive proposition has not been asserted in the database, we may assume it is false. In logic, this form of argument is traditionally called the "appeal to ignorance" or *argumentum ad ignorantiam* (Walton [15]). Although traditionally classified as a fallacy, it is very clear from AI that this form of argument can be reasonable, under the right conditions, in some cases.

As shown in Table 2 (a variant of the table in Walton [14, p. 48]), practical reasoning is based on two characteristic inference schemes. The agent is represented by the pronoun 'I' and the variables A, B, C,... represent *states of affairs*, propositions that can be made true (or false) by an agent at a particular time, or during a period of time.

According to Table 2, the agent is thought of as a solitary reasoner, but such an agent can also be represented dialectically as engaged in a type of conversational exchange called a deliberation — see Table 1 — with another agent.

According to the dialectical account, the local inference used in practical reasoning is called the *argumentation scheme for practical reasoning*.

- (SP) A is the goal.
 B is necessary to bring about A.
 Therefore, it is required to bring about B.

Corresponding to the use of this argumentation scheme by one party in a deliberation conversation is a set of appropriate critical questions that can reasonably be asked by the other party.

TABLE 2. Practical Reasoning: The Basic Inference Schemata

	Necessary Condition Schema
(N1)	My goal is to bring about A (<i>Goal Premise</i>).
(N2)	I reasonably consider on the given information that bringing about at least one of $[B_0, B_1, \dots, B_n]$ is necessary to bring about A (<i>Alternatives Premise</i>).
(N3)	I have selected one member B_i , as an acceptable, or as the most acceptable necessary condition for A (<i>Selection Premise</i>).
(N4)	Nothing unchangeable prevents me from bringing about B_i as far as I know (<i>Practicality Premise</i>).
(N5)	Bringing about A is more acceptable to me than not bringing about B_i (<i>Side Effects Premise</i>).
	Therefore, it is required that I bring about B_i (<i>Conclusion</i>).

	Sufficient Condition Schema
(S1)	My goal is to bring about A (<i>Goal Premise</i>).
(S2)	I reasonably consider on the given information that each one of $[B_0, B_1, \dots, B_n]$ is sufficient to bring about A (<i>Alternatives Premise</i>).
(S3)	I have selected one member B_i as an acceptable, or as the most acceptable sufficient condition for A (<i>Selection Premise</i>).
(S4)	Nothing unchangeable prevents me from bringing about B_i as far as I know (<i>Practicality Premise</i>).
(S5)	Bringing about A is more acceptable to me than not bringing about B_i (<i>Side Effects Premise</i>).
	Therefore, it is required that I bring about B_i (<i>Conclusion</i>).

- (CQ) Are there alternatives to B ?
 Is B an acceptable (or the best) alternative?
 Is it possible to bring about B ?
 Does B have bad side effects?
 Are there goals other than A that need to be considered?

These critical questions obviously correspond to the various premises in the inference schemes in Table 2 above. The proponent advances a practical inference in the form of (SP) to argue that B is a prudent course of action to solve the problem posed, shifting a burden of proof to the respondent to reply. By asking an appropriate critical question, the respondent can shift the burden back to the other side. That's how practical reasoning works, and that's how it should be evaluated.

5 Commitment in dialogue

Hamblin [5, p. 225] defined a dialectical system as “regulated dialogue, or family of dialogues,” in which (in the simplest case) there are two participants. *Descriptive dialectic* studies “the rules and conventions that operate in actual discussions” like parliamentary debates (p. 256). *Formal dialectic* “consists in the setting up of simple systems of precise but not necessarily realistic rules,” and the plotting out of dialogues that could take place in accord with these rules (p. 256). Typically, in such a dialogue, one party plays the role of questioner, and the other party that of answerer.

The central concept of dialectic is the *commitment store* (or *commitment set*), a store of statements that “keep a running tally of a person’s commitments” at each move of the running of a dialogue (p. 257). For example, if a particular point in a dialogue, a speaker asserts statement A , then A will be inserted into her commitment store. A speaker can also retract commitments, but as Hamblin notes (p. 257), such retractions may be limited by the obligation to maintain consistency. The problem of determining when retractions are allowed or not at different kinds of moves in different types of dialogue is the central problem tackled in the analysis of commitment in dialogue given in Walton and Krabbe [16].

Commitment in dialogue, as viewed by Hamblin [5], van Eemeren and Grootendorst [17] and Walton and Krabbe [16], is meant to be a normative and dialectical concept, not a psychological concept. That is, commitment represents what a participant in a dialogue or conversational exchange should be held to, according to the normative requirements for the type of dialogue she is supposed to be taking part in, based on what she said, or more generally, on the moves she made in the past sequence of moves in a given dialogue exchange. What a person really believes is a different matter. As Hamblin put it (p. 257), although the commitment store can be said to represent a “kind of *persona* of beliefs,” it need not correspond with a person’s real beliefs. Although commitment, in this sense, could be said to represent a kind of rational acceptance, it would be inappropriate to equate it with belief. Commitment represents the idea of what one has gone on record as advocating, judged from the context of dialogue in a given case, plus the known moves one has made in the past sequence of dialogue exchanges up to the given point where the assessment is made.

In analyzing an actual case, and trying to determine what the missing premises are of an argument used in that case, establishing the arguer’s commitments will

obviously be a very important factor of the analysis. This factor will be especially important if the analysis of the enthymeme is being undertaken on a use basis, as opposed to a need basis (referring to the distinction made above). Instead of just using a formalistic and semantic criterion (like syllogistic) to fill in missing premises (or conclusions) on a need basis, logic needs to take a more practical and applied approach of using the analysis of an arguer's commitments, as known in a given case, as an important part of the jobs of argument identification and analysis.

Here again, a practical case study approach of viewing an argument as a connected sequence of interpersonal reasoning used in a context of dialogue is the way to go. One should start with given text of discourse in the case, and fit the dialectical requirements appropriate for the case onto the particulars of the case. The missing parts can then be reconstructed on a provisional basis. Yes, the resulting analysis is an interpretation, but it is an interpretation that can be supported (or questioned) by textual and dialectical evidence that is reproducible.

6 Arguments and explanations

Reasoning is used in both arguments and explanations. Moreover, the indicator-words, 'thus', 'therefore', 'consequently' and so forth, are similar, in many cases, in arguments and explanations. So how do you tell, in a given case, whether the reasoning used is an argument or an explanation? The answer is to be sought in analyzing what sort of why-question the argument or explanation is supposed to be a reply to, in the context of dialogue in which the reasoning was used, in the given case, insofar as that is evident from the text of discourse. In short, the distinction is a dialectical one.

According to Hamblin [5, pp. 270–273], a why-question is a dialectical exchange is essentially a request by the speaker for the hearer to furnish an argument where the premises are commitments of the speaker (or propositions the speaker could eventually be led to assent to) and the conclusion is the proposition queried. In this sense, if I ask you 'Why A ?', what I want is an argument with a set of premises B_0, B_1, \dots, B_i , that I am committed to, and that permit the inference to A by the rules of inference appropriate for the dialogue. But this is only one type of why-question — the asking for an argument type of why-question.

Hamblin also concedes (p. 274) that there is another sense of 'why' that makes it a request for an explanation. This sense of 'why' is harder to define dialectically. But roughly what is requested by the speaker is some story or account that will make the queried proposition more comprehensible to him by relating it to something he is already familiar with or understands (or thinks he understands). In other words, the purpose of an explanation is essentially different from that of an argument.

But it is notoriously true — see the examples cited by Thomas [12, pp. 13 ff] — that in some cases, the same text of discourse, although it seems comprehensible, could equally well be interpreted as being an argument or an explanation. Many now throw up their hands at this point and say, "There you go. You really can't tell the difference between an argument and an explanation. So there really is no difference, and it's all subjective, *etc.*" But this leap to postmodernism is a hasty conclusion.

It is quite reasonable to expect that there will be cases where the text of discourse is

incomplete, so that there is insufficient textual and contextual evidence to tell, in the given case, whether the reasoning was being used (as far as we can tell) as an argument or an explanation. Moreover, some types of dialogue — like the pedagogical type of dialogue typically encountered in a college textbook designed for use in the classroom — tend to thoroughly blend arguments and explanations in a way that makes it very hard, and perhaps even arbitrary, to tell them apart. But it hardly follows from this case that there is no difference between an argument and an explanation, or that it is not possible or important to distinguish between the two in some cases where the goal is to evaluate cases of argumentation in given texts of discourse (as in a practically oriented logic class, where the purpose is to evaluate cases of arguments in discourse).

There are some cases that are arguments but not explanations, and some cases that are explanations but not arguments. The best test is to look for indicator-words in the text of discourse, and judge how the reasoning is being used dialectically to reply to a why-question in the context of dialogue. The central question featured in the test is whether the proposition being queried (the proposition *A* in the why-question) fits as an answer to one, and not the other, of the following pair of questions.

1. Is the hearer adopting a stance of doubting or disagreeing with *A*, and thereby requesting the speaker to give him a reason for accepting *A* as a commitment, based on premises the hearer already accepts (or can be brought to accept in the subsequent dialogue)?
2. Is *A* a proposition both parties already accept, or at any rate are not doubting or disputing?

If the reasoning in question is being used as an explanation, then the presumption is that whether *A* is true is not being disputed by either party. Instead, the speaker is merely requesting some kind of story or account that gives him understanding of how *A* connects up with something he is already familiar with — this could be a scientific theory, or a causal sequence of events, or an analogy to something else, or any one of a number of different kinds of accounts that could make *A* comprehensible to the speaker.

At any rate, the details of the criteria that should be used to test a particular case to judge whether it is best seen as an argument or an explanation are less important than the recognition that such a judgement is best seen as dialectical in nature. It is not a matter of the reasoning itself, or the links of inference that join up the steps in the reasoning. It is a matter of how that reasoning was used (as far as we can tell) in a context of dialogue.

7 Applied logic

I do not believe any longer that the changes required to develop good methods for applied logic will come about exclusively within philosophy departments. It seems at the moment that the best hope is for an interdisciplinary effort that uses computer software for teaching critical thinking skills, and that takes into account the new ways of thinking about reasoning being developed in AI. The currently popular logic texts in philosophy have ossified into a traditional pattern that sharply separates formal and informal logic, and each text goes its own way in the informal part, without

the benefit of any established theory of applied logic. It seems very hard to crack these established practices within philosophy departments, and to get any respect for applied logic as a recognized subject for scholarly research at the graduate level. These ossified curricula will change, but it seems to me that within philosophy, it may take a few hundred years.

More likely to be useful I think will be the development of software to teach critical thinking, using methods based on the dialectical approach to applied logic sketched out above. Automated programs for argument reconstruction could have a tutorial use in guiding students who are having difficulty in carrying out tasks like filling in nonexplicit premises.

The first step is to identify the chain of reasoning in a given case, by mapping the propositions in the text of discourse in the case onto a directed graph. The next step is to determine how the reasoning is being used, as an argument or an explanation. If it is an argument, then it needs to be judged how it is being used to make a point, and what the nonexplicit premises and conclusions are. Only then should the process of evaluating the argument go forward. It is critical, in analyzing and evaluating particular cases, to leave room for the possibility that insufficient information is given in the case to permit decisions to be made, one way or the other, at all the various points of the identification and analysis process.

But even more critical, in my opinion, is to try to develop better methods for applied logic through interdisciplinary research that takes the re-orientation of logic as an applied subject seriously, as a subject worth pursuing.

Acknowledgement

The author would like to acknowledge that the work in this talk was supported by a Research Grant from the Social Sciences and Humanities Research Council of Canada.

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Received July 1996. Revised 18 March 1997