

USING CONVERSATION POLICIES TO SOLVE PROBLEMS OF AMBIGUITY IN ARGUMENTATION AND ARTIFICIAL INTELLIGENCE¹

Abstract

This investigation joins recent research on problems with ambiguity in two fields, argumentation and computing. In argumentation, there is a concern with fallacies arising from ambiguity, including equivocation and amphiboly. In computing, the development of agent communication languages are based on conversation policies that make it possible to have information exchanges on the internet, as well as other forms of dialogue like persuasion and negotiation, in which ambiguity is a problem. Because it is not possible to sharply differentiate between problems arising from ambiguity and those arising from vagueness, obscurity and indeterminacy, some study of the latter is included. The semantic web is based on what are called ontologies, or systems of classification of concepts, shown to be useful tools for dealing with these problems.

Key Words: conversational rules, polysemy, equivocation, amphiboly, legal argumentation, multi-agent communication, semantic web, ontologies.

Ambiguity is often held to be a bad thing in argumentation, because fallacies like equivocation and amphiboly may occur (van Laar, 2003). Ambiguity, along with its partners in logical crime, vagueness and obscurity, can also result in miscommunications of a kind that can be amusing, but can sometimes be harmful to communication and highly deceptive (Walton, 1996). For example, ambiguity in legal contracts, statutes and wills can quite often be a cause of serious litigation (Plug, 2002). Another area where ambiguity is important is in multi-agent communications on the internet, for example in transmitting information, searching for data, and in electronic commerce (Bench-Capon, 1998). On the other hand, as shown in this paper, ambiguity can often be quite tolerable not only in everyday conversations, but also in many other types of goal-directed dialogue exchanges, where is not especially harmful. As Dascal (2002, p. 19) observed, ambiguity and other forms of indeterminacy can even be shaped into cognitive tools, like fuzzy logic, that can be used to increase precision and thus aid logical reasoning.

If not all cases of ambiguity are harmful or fallacious, the way forward to studying it should take a pragmatic direction of studying how it can be identified and evaluated in a pragmatic context. In this paper it is shown conversation policies, rules for communication between rational agents on the internet (Greaves, Holmback and Bradshaw, 2000), comparable to the conversational postulates of Grice (1975) and van Eemeren and Grootendorst's (1984) rules for critical discussion, familiar in argumentation, provide useful tools for taking this pragmatic direction. It is also shown how the semantic web (Antoniou and van Harmelen, 2004) can provide some tools that are useful for dealing with problematic ambiguity in argumentation.

As Gullvag (1196, p.1408) remarked, empirical studies have shown that discourse is judged to be to be ambiguous, intelligible, or unclear, based on systems of rules that gain authority among a group of users. For example, the legal usage of a term might be

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different from its commonly accepted usage in conversational discourse, which in turn might be different from its scientific usage. Gullvag noted (p, 1408) that once such a system gains authority, it affects what is said to be ambiguous. On this basis it is argued that the universal conversational postulate 'Avoid ambiguity' is too broad to fit all cases, and that specific rules governing ambiguity in different conversational situations need to be developed. The problem studied in this paper is how to formulate general conversational policies that deal with ambiguity in a broad way, but can be tailored to specific circumstances and to different types of conversations.

1. When Can Ambiguity be Tolerated?

Ambiguity is generally thought to be a bad thing, from a point of view of rational argumentation, especially in a scientific demonstration. Perelman and Olbrechts-Tyteca (1969, 120) wrote, "Every demonstration requires that the elements on which it is based should be univocal". It has also been held to be bad in conversational exchanges. Grice (1975, 67) has a conversational submaxim, "Avoid Ambiguity". However, when judged problematic or inappropriate, the condemnation of ambiguity has often been tempered with qualifications. Rule ten for the critical discussion (van Eemeren and Grootendorst, 1984, 292) says, "Formulations must be neither puzzlingly vague nor confusingly ambiguous and must be interpreted as accurately as possible". The occurrence of an ambiguity in a critical discussion need not violate this rule as long as it is not "confusingly ambiguous". Also, in (Walton, 1996, 4) we find the statement that ambiguity is not "wholly wrong" and should not be subject to condemnation in all types of discourse. These qualified remarks raise the question of what sorts of conversational rules, called conversational maxims by Grice (1975) and conversational policies in artificial intelligence (Greaves, Holmback and Bradshaw, 2000), should govern ambiguities. Obviously ambiguity is wrong, or is thought to be a problem for rational argumentation, when it occurs in arguments that commit fallacies like equivocation or amphiboly. Clearly it can lead to unfortunate miscommunications of a kind that can have bad consequences. But if ambiguity not always bad, is there a conversational policy, or set of them, that would enable us to judge ambiguities, so that we could sort out harmless ambiguity from the kind of occurrence of an ambiguous expression rightly judged to be inappropriate, dangerous, harmful, or even fallacious?

In Grice (1975, 67) the submaxim 'Avoid ambiguity' comes under the supermaxim 'Be perspicuous', which in turn comes under 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". A weaker maxim of clarity proposed in (Walton, 1996, p. 268) does not ban ambiguity. Instead, it requires only checking for ambiguities to see if a meaning shift has occurred, and if so, considering whether a distinction is needed. The cooperative principle is a good general rule to apply to the problem of how to formulate more specific conversational policies to deal with problematic ambiguity. But recent work in artificial intelligence (Pitt and Mandami, 2000) indicates that ambiguity can often be quite tolerable in many kinds of goal-directed conversations, suggesting that even the weaker policy may not apply to all of them. It will be argued here that conditions for ambiguity tolerance and evaluation are

not universal, and need to be set in way that varies not only with regard to different speech acts but also with regard to different types of dialogue.

Even in everyday argumentation, ambiguity and vagueness are not bad things, in themselves, for a great many terms in natural language are vague and/or ambiguous without any serious impediment to communication. Polysemy is a linguistic fact often exploited by communicators to send messages using devices like innuendo and irony to persuade each other. Communication is often achieved by basing an interpretation on an ambiguity. Consider the threat, for example, “Do you know what happens to those who talk too much? Sometimes they don’t speak at all.” Some speech communication experts (Eisenberg, 1984) have even advocated the theory that democratic politics (and argumentation generally in large organizations with multiple goals) would not be possible, as productive processes, without ambiguity and vagueness of the key terms. Williams and Goss (1975) even argued that ambiguity can be a good thing in argumentation because it can contribute to collaborative communication by helping to reach agreement. One might wonder if democratic politics could ever be possible without ambiguity, for if conflicting viewpoints were to be stated precisely, conflicting interests would become sharply apparent, and agreement might be impossible to attain. This view on political discourse fits with another view expressed in artificial intelligence (Pitt and Mandami, 2000, see below) that certain kinds of conversational argumentation like negotiation need to be seen as somewhat tolerant of ambiguity.

Those of us who teach logic tend to adopt a high standard of rationality and truthfulness as an ideal of discourse. Thus we tend to frown on ambiguity as being, if not fallacious, at least something to be avoided. But standards of ambiguity toleration are highly variable depending on the type of dialogue one is supposedly engaged in. For example, in information-seeking dialogue, ambiguity is potentially at odds with the goal of the dialogue. For if the hearer takes the speaker’s pronouncement in a different way than the speaker intended it, the information that was supposed to be passed from the one to the other has failed to be transmitted. In addition, the hearer now thinks he has information from the speaker, but may be wrong about that. Such a failure, caused by ambiguity, is clearly contrary to the goal of an information-seeking dialogue. Now contrast this type of case with one of ambiguity in a negotiation dialogue. Ambiguity is not necessarily a bad thing here if it helps the two parties reach an agreement they can both live with. Of course, ambiguity could be the basis of a misunderstanding on the part of one participant, and the other participant could exploit that ambiguity. But should such deceptive strategies always be ruled out in negotiations? Possibly not. Or at any rate, it is evident that ambiguity needs to be dealt with in a different way in a negotiation dialogue than in an information-seeking type of dialogue. This dialogue relativity of ambiguity has many implications for the development of agent communication languages (ACL’s) in computing. Many current ACL’s have conversation policies based on sincerity assumptions, and other kinds of requirements to the effect that the speaker believes the statement she is making is true, or that the statement is one that the hearer does not already believe to be true (Greaves, Holmback and Bradshaw, 2000). It is clear that a speaker’s putting forward an ambiguous sentence could violate such sincerity conditions, or make their policing problematic.

Pitt and Mandami (2000, pp. 51-52) have presented a nice example that shows how the formalization of negotiation needs to be seen as at least somewhat tolerant of

ambiguity. In the price agreement stage of negotiation between a buyer and seller in commercial speech, there is a three-way ambiguity concerning the term ‘price’. This term can refer to the offer (asking) price, the actual price (known cost) or some intended sale price. The seller will sell at the offer price or “top price” if she can make a sale. The buyer will try to get the lowest possible price, or more realistically, one that is as close to the actual price as possible. Presumably, in this kind of discourse, both parties know what the game is. So when the seller says x dollars is the price, the buyer knows that this is the opening of negotiations, and that x represents the offer price, and not the actual price. If the buyer fails to understand this aspect of the ritual, he is at a strong disadvantage, and may come out of it badly. But it is generally presumed in a typical kind of negotiation of this sort that both parties understand the kind of price bargaining dialogue they are engaged in. Now suppose the seller opens by saying ‘ x dollars is the price’. The question Pitt and Mandami pose is: “Is the seller telling a lie?” Or to put it another way, the question is whether the seller’s opening move should be condemned as an ambiguity that could represent a real price that has been set or could merely represent an opening move. Does such an ambiguity contravene the aims of the negotiation dialogue? The answer Pitt and Mandami offered is negative. The reason they gave (p. 51) is that much human social activity, including negotiation, requires the freedom “to be economical with the truth”. You don’t have to correct the other party if he takes what you said the wrong way, or derives some unintended or wrong conclusion from what you have said. Pitt and Mandami argued (p. 51) that this principle is such an important aspect of intelligence that one could say generally that only the naïve or unintelligent will tell the whole truth. This general principle is clearly fundamental to the whole subject of argumentation strategies in dialogues. Strategies that depend on the use of ambiguity or on potentially misleading implicatures in dialogue should not routinely be judged to be fallacious arguments or improper argumentation tactics.

It may be easy to assume in logic that ambiguity is merely a result of not defining one’s terms precisely enough, and therefore that it can easily be eliminated by adopting precise standards of language use and avoiding sloppy language. Sidgwick (1901, 176) observed that there is a popular preconception that precise definition of a term will resolve all problems arising from ambiguities. But the problem is that ambiguity in a term is always a possibility in any natural language argumentation even when a precise definition of that term has been set down. As shown by Hart (1957-58) terms used in framing laws are open-textured, meaning that even when precisely defined in relation to all existing cases they can still lead to “hard cases” in law when applied to borderline cases that arise in the future. This problem of vagueness also applies to ambiguity. It cannot be ruled out in advance as argumentation moves to new cases subject to dispute, and to differing interpretations of a term that had a precise and univocal meaning as applied to past situations. Ambiguity may be inevitable as new technology or other new developments lead to complications concerning what the term should be taken to mean. Indeterminacy, either in the form of vagueness or ambiguity, can be shaped into a cognitive tool (Dascal, 2002, p. 19). For example vagueness has been elaborated into fuzzy logic (Zadeh, 1975), an interpretative tool that can lead to increasing precision, aiding the resolution of a dispute.

Thus it is not practically feasible to try to eliminate ambiguity altogether. Ambiguity is not always a problem. It only becomes a problem in certain types of dialogue, for

example in cases where deliberations or negotiations require participants to agree on a specific meaning to prevent the occurrence of harm. Such harm can be in the form of miscommunication that leads to confusion or misunderstanding. In some cases it can cause serious damage with financial implications, or even lead to loss of life. There are two kinds of cases to be considered. One is that where the harm occurs through failed communication but where the speech act is not part of an argument. The ambiguity could occur in another speech act, like that of making an assertion or asking a question. The other kind of case, highly featured in the logic textbooks under the headings of fallacies of ambiguity like equivocation, is that where the ambiguous expression occurs within an argument.² Here there is a special problem, because if there is a misunderstanding about what the argument is supposed to be, there is a very real possibility of erroneously evaluating it. Fallacies of ambiguity, like equivocation and amphiboly, arise in arguments containing an ambiguous term or premise, in cases where this ambiguity leads to confusion. Multiple arguments are wrongly taken to be a single argument. But many of the more everyday kinds of cases that are important to deal with for purposes of informal logic are ones where there is just an ambiguous word or phrase in a text of discourse. Even if the ambiguity does not occur in a specific argument, it can lead to confusion that could be the source of problems.

These views suggest that ambiguity should not be seen as inherently wrong or fallacious in all instances, but only when we run into problems with it. Arguments often require identifying and trying to resolve an ambiguity by clarifying terms before the process of rational argumentation can move forward toward a successful resolution of a disagreement. There is already a considerable literature on these matters (Walton, 1996; van Laar, 2003). According to Hamblin (1970), resolving an ambiguity in argumentation is a procedural matter that should take place in formal dialogue by standard kinds of moves. Once one party detects an ambiguity in the other's argumentation she can ask him for clarification and they can decide which meaning should be adopted in interpreting the argument. Van Laar (2003) has illustrated how such a method should work by applying formal dialogues to case studies of ambiguity in argumentation. The problem remains of how to judge cases to arrive at a determination of whether such an ambiguity should be regarded as tolerable or whether it seen as inappropriate or even fallacious. This problem too seems best approached from a viewpoint of the type of dialogue the argument was used in. Ambiguity that might be quite tolerable in a negotiation might be more of a problem in a critical discussion, and even more of one in a scientific inquiry where a great deal of precision is needed to properly prove or disprove a claim. But there are problems arising from imprecision of language that are comparable.

2. Obscurity, Vagueness and Ambiguity in Language as Problems

There are three closely related basic problems with the language used in arguments that prevent the resolution of a critical discussion by the use of rational argumentation –

² As shown in the cases below, in some cases it is hard to judge whether the speech act in question is an argument or not, or was meant to be taken as one. There is also the perennial issue of whether a fallacy has to be a fallacious argument, or whether speech acts that are not arguments, like asking a question or making a statement without offering support for claiming it, can be fallacious. Despite these difficulties, it is theoretically useful to consider the two kinds of cases separately.

(i) obscurity, (ii) vagueness and (iii) ambiguity of words, phrases or sentences. Related problems of language use, including the use of loaded terms and one-sided definitions, will not be dealt with here.³ Obscurity refers to the lack of understanding by one or both participants in a dialogue. An expression is vague if there are doubts about its applicability to particular cases (Gullvag, 1996, p. 1408). Ambiguity refers to multiple meaning, where a term can be interpreted in different ways (Gullvag, 1996, p. 1408). Polysemy (radiation), refers to a species of ambiguity in which a word acquires a wider range of meanings. Originally the word ‘paper’ referred to writing material made from plants (like papyrus) or trees. However, it has now evolved in common usage to refer to newspapers (the morning paper), and to various kinds of official reports of one sort or another like academic journal articles and government documents (a white paper on such-and-such). Polysemy represents a kind of ambiguity that pervades natural language.

Vagueness refers to a lack of precision, so that in some cases there is no way of knowing or proving whether something is a such-and-such or not. The term ‘rich’ is vague, because there is no precise amount of accumulated money that can (non-arbitrarily) be cited to mark when someone is rich. The term ‘bank’ is ambiguous, because it can mean savings bank or bank of a river. Sometimes it is clear from the context which meaning the term is supposed to have. In other cases it may not be clear, and there is uncertainty. In still other cases, the context may suggest one meaning while the speaker (or the hearer) may take the term the other way. Both vagueness and ambiguity are different from lack of specificity, as the following example shows (Gullvag, 1996, p. 1408). The statement ‘There is a man at the door’ does not specify whether the man is tall or short, but that is not to say it is ambiguous. The statement ‘There is a tall bald man at the door’ is more specific, but it would be incorrect to say it is less vague. It might be said to be more vague because it has more terms like ‘tall’ and ‘bald’ in which there are more doubts about their applicability to specific cases. Thus although ambiguity is, in principle, different from vagueness, obscurity and lack of specificity, in studying examples of problems and fallacies of ambiguity, these other notions are often involved.

Obscurity is a problem in argumentation, because if you have no idea what someone is trying to say, you can’t identify what his or her argument is supposed to be, so you are in no position to make any use of the reasoning in it, or to criticize it. Obscurity requires clarification. If someone’s argument is obscure, because it is too abstract or metaphorical, or cannot be grasped intelligibly, then you ask for clarification, by saying, “What do you mean?”. Or alternatively, you can suggest an interpretation, by saying, “Is this what you mean?”. Obscurity is relative to a context of dialogue. A highly abstract discussion of a point in theoretical physics might be highly obscure to you or me, or if it were broadcast to a television audience. But the arguments might be perfectly clear to a group of theoretical physicists taking part in a physics colloquium. Sometimes, however, obfuscation is used as a deliberate tactic to confuse people, or to make something appear to be very profound and technical when it really makes no sense at all.

³ By limiting scope mainly to ambiguity, and not discussing related topics treated in (Walton, 1996) and (van Laar, 2003) like figure of speech, relevance, innuendo and bias, the intent is to narrow the investigation to a manageable length. Even so, fallacies of ambiguity are so closely related to problems of vagueness and obscurity, that some discussion of the latter notions cannot be avoided.

Lutz (1989, pp. 5-6) defined gobbledygook as the use of sheer volume of complex words and convoluted language that does not make sense in the context it was supposed to be part of. The following example was the response of the associate administrator of NASA when asked, during the investigation of the Challenger space disaster in 1986 whether the performance of the space shuttle had been holding its own or improving with each launch (Lutz, 1989, pp. 5-6).

I think our performance in terms of lift-off performance and in terms of orbital performance, we knew more about the envelope we were operating under, and we have been pretty accurately staying in that. And so I would say that the performance has not by design drastically improved. I think we have been able to characterize the performance more as a function of our launch experience as opposed to it improving as a function of time.

As noted above, obscurity is contextual. In this case, the answer might have been appropriate if directed to other engineers familiar with the NASA way of speaking. However, when directed to a lay audience trying to grasp the technical reasons for the failure, the language that is obscure to them looks like an attempt to evade the question, while still trying to make it appear that things were going well with the space program. Obscurity is not only confusing, it can conceal ambiguity, even though in general it is different from ambiguity as a phenomenon. Ambiguity is multiple meaning of an expression, whereas if an expression or discourse is obscure, it may not be possible to give it a clear enough interpretation to sharply enough distinguish the multiple meanings. Obscurity is one kind of problem for critical argumentation to deal with while ambiguity represents a somewhat different problem.

Ambiguity can be a problem in many kinds of communication. For example, offering directions to a motorist in ambiguous wording can be a problem because it might send the motorist off in a wrong direction. Any kind of exchange or request for something can go wrong if terms in the wording of it are ambiguous. Consider the following dialogue.

Library User: Do you have any books on cats?

Librarian: Little ones or big ones?

Library User: Oh, little ones, please.

Here the phrase ‘little ones or big ones’ is ambiguous. Are the participants in the dialogue referring to size of books or size of cats? If each means something different from the other, the outcome could be problematic. The way to resolve ambiguity is to see that a word has two different senses, and to ask the speaker which one was meant. But the problem is that it may seem natural for a listener to take a word, in context, in one way, and then only later realize that the speaker meant it in the other way.

Goffman (1981) collected many examples of ambiguous sentences where an unfortunate turn of phrase suggests an unintended interpretation.

Social News: “We note with regrettable sorrow that Mrs. Vandermeer is recovering from a bad fall on the ice.” (Goffman, 1981, p. 249).

In this case, the ambiguity relates to the scope of the ‘noting with regrettable sorrow’. Is the speaker regretting Mrs. Vandermeer’s bad fall on the ice or her recovery? Also, did Mrs. Vandermeer fall on the ice, or is she recovering on it? On the first question, the

former is probably the intended interpretation while the alternative interpretation is a kind of suggestion or innuendo that makes the speaker's intentions sound not so nice. Another example suffers from a similar problem.

Laundry Commercial: "When your clothing is returned there is little left to iron."(Goffman, 1981, p. 249).

Amusing examples of ambiguity of a comparable sort are often found in newspaper headlines that have an unintended interpretation.

Red Tape Holds Up New Bridges

Iraqi Head Seeks Arms

Astronaut Takes Blame for Gas in Spacecraft

Such cases may seem fairly trivial, but ambiguity can be a serious problem in communication if it leads to misunderstanding, as in the following case from Lepenies (1992), cited in (Walton, 1996, 44).

When the writer Ernst Jünger, then an officer in the German army's staff, had to leave Paris, he visited Sacha Guitry for the last time. Guitry gave him, as a present, good advice which he himself had been given by Octave Mirbeau: 'Ne collaborez jamais!' Jünger was utterly nonplused. Did Sacha Guitry really repent and was he willing to regret his considerable involvement in the activities of Nazi cultural propaganda? Not at all. It was a misunderstanding on Jünger's part. Sacha Guitry had only wanted to give him collegial advice: 'Young man, write your books alone!'

In context, the sentence 'Never collaborate!' would naturally be taken to warn the hearer not to get involved with the Nazi government of Paris at the time (during the German occupation in World War II). But that, of course, was not what Guitry had meant. This kind of misunderstanding could have serious consequences. Ambiguity resulting in miscommunication can be a serious matter, leading to loss of money or property, and in some cases, even to loss of lives.

The pilot of a plane taking off from Los Rodeos airport in the Canary Islands radioed the message, "We are now at takeoff." to the tower. The pilot meant the message to say that the plane was now in the process of taking off, but the air controller took it to mean, 'We are now at the takeoff point' - that is, getting ready to start taking off. The result of this failure of communication was a collision with another aircraft, in which 583 lives were lost (Cushing, 1994, p. 10).

It is useful to mention this kind of case because of the widespread belief that matters of clarifying language are trivial or mere "hair-splitting". Huge amounts of money in lawsuits every day turn on the meanings of terms like 'contract' or 'wetlands', and many fallacious arguments are widely accepted because the public refuses to take problems like ambiguity and obscure language seriously. This attitude seems to be part of our positivistic heritage. We think that collection of data is all that matters to prove or disprove a claim, and that matters of analysis and clarification are of little serious import.

Given the vagueness, ambiguity, and obscurity of terms in language of all sorts, effective communication in deliberation and information-seeking types of dialogue is a lot more difficult than we seem to think. Moreover, as indicated by the cases above,

miscommunication because of ambiguity can often have serious consequences. In such cases, ambiguity, while it may be tolerable in some instances, becomes seriously bad where it interferes with the progress of the dialogue towards its goal. For example, suppose the dialogue is intended to transfer information from one party to a user so the user can then make intelligent deliberations on what to do, based on this information. If the user gets the wrong information based on an ambiguity in the message, but he thinks it is the right information needed to make the decision, this deception, even if quite unintentional, can be a serious problem. It is a problem if bad consequences result from the miscommunication.

Of course, the point needs to be made that ambiguity can also be a good thing in some instances. A person might miss her plane because of ambiguous instructions from her travel agent. The plane crashed, and she wasn't aboard. Or consider the classic case of the monk who saves a man's life by uttering an ambiguous sentence that could mean 'He is not here' or 'He did not pass by here'.

Ambiguity is a problem if it produces bad consequences (i.e. a harm) and also a problem of a possibly different sort if it hinders the goal of a dialogue. But these two points can be connected in some instances. For example, if I misunderstand what the vendor says, and because of this pay more than market value for a product, has this hindered the goal of the negotiation? Even supposing the goal is to sell the product at a fair price, or one where neither party does too badly, if I did not feel cheated, maybe the goal has been met. Or have I been harmed because I could have paid less if I had not misinterpreted what the vendor said through an ambiguity?

These kinds of kinds of cases in which some harm results from an ambiguous utterance are not properly classifiable as instances of equivocation, at least in the narrower meaning of this term appropriate for logic. In this meaning, equivocation is a fallacy that occurs in an argument where the argument somehow goes wrong or is defective because of the ambiguity of a term used in one or more of the premises and/or the conclusion. The problems in the two kinds of cases are similar, and both arise from ambiguity, but they are also partly different. Equivocation will be studied below. Before getting to that point, we need to consider whether cases of harmful ambiguity like those studied above (as well as cases of equivocation) could be disarmed if we had a method for detecting an ambiguity in a text of discourse and arriving at a decision on which interpretation is the better or preferred one.

3. Methods for Disambiguating

Serious cases of harm arising from ambiguities like the ones studied above take us from the problem of judging ambiguity to the prior problems of interpreting a text of discourse and identifying potentially problematic ambiguities in terms or sentences. Detecting ambiguity has always been a central problem for informal logic, especially if, like Alfred Sidgwick (1901), you realize that often the most important task is trying to determine what an argument is by figuring out what some statement or term in it means. The central problem, in so many cases of evaluating an argument in logic, is one of interpreting what is meant by a text of discourse. In some cases, the ambiguity just needs to be noted or recognized, and no hypothesis about which way the arguer meant the term in question to be taken is needed. In other cases, one interpretation may be more plausible

than the other. Although there is a genuine ambiguity, the textual evidence indicates that the one meaning should be chosen as the one that was plausibly meant. But what kind of evidence could support such a hypothesis concerning interpretation of an argumentative text? And if the evidence is there, what kind of method could be used to draw justifiable conclusions on how to interpret the argument, based on that evidence? Could there be any set of objective rules that could be used in informal logic to apply to a given text of discourse to give guidance on these questions of interpretation?

One tool advocated in the literature has been the principle of charity (Govier, 1987, chapter 7). According to Scriven's version (1976, p. 71), this principle is a rule of fairness of criticism that requires picking the best, as opposed to the worst possible interpretation of what was likely to have been meant by a text of discourse you are criticizing. What standards are used to judge better and worse interpretations? To answer this question the instrumental question of the purpose of a speech act used in some conversational context has to be taken into account. Gricean conversation principles are based on understanding and evaluating an argument, or other speech act, as a contribution to a goal-directed collaborative conversation. Govier (1987, p. 150) drew a distinction between two versions of the principle of charity. A strong version says an arguer must make "true or well-warranted claims even in the face of empirical evidence to the contrary" (p. 151). A more moderate version "directs us not to interpret others as having made implausible claims or faulty inferences unless there is good empirical reason to do so." Govier (p. 150) viewed both versions as based on the Gricean Cooperative Principle (CP): "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, 1975, p. 67). This link suggests a principle for evaluating competing interpretations of an ambiguous term. A speech act, like an argument used in a dialogue, is better if it moves the dialogue along towards its collective goal, worse if it fails to move the dialogue forward, and even worse if it blocks or impedes such progress. One might wonder then, if we already implicitly use such standards of judgment in everyday conversational argumentation, is there already a systematic use of them in existing institutions? There is evidence of such existing uses.

Miller (1990) cited sets of principles and maxims of textual interpretation that have been used for centuries. One such set is a collection of principles for interpreting sacred Hindu texts that dates from 500 BC. One Hindu principle cited (p. 1184) is: "An interpretation which makes a word or phrase meaningless should be avoided." Another is a set of principles of interpretation of religious writings that can be identified in Judaeo-Christian doctrines. Miller (p. 1184) cited this principle as an example: "The meaning of an ambiguous word or passage should be understood as consistent with the preceding and following parts." There is a comparable widely known legal literature on so-called maxims of statutory interpretation (MacCormick and Summers, 1991) that offer broad guidance in law on how to arguably interpret statutes containing ambiguous expressions. One such maxim is: "There is a strong presumption against interpreting a statute so as to render it ineffective" (p. 1184). Another is this principle: "The meaning of a statute is to be looked for, not in any single section, but in all the parts together" (p. 1184). Some legal scholars have contested the worth of these principles, and it seems hard to know how they could be justified by appealing to some deeper logical principles of orderly rational argumentation (Arnio, 1987; Alexy, 1989). To respond to these questions Miller argued

that such maxims of interpretation might be based on Gricean conversational postulates (Grice, 1975). One might wonder then if, beyond invoking the principle of charity, more precisely formulated guidelines somewhat like those used in religion and law, can be devised for use in informal logic.

A set of ten rules for dealing with ambiguous terms in argumentation has been proposed in (Walton, 2000). These rules apply to cases where the context does not itself disambiguate the multiple meanings. They apply to problem cases where there is doubt concerning which meaning was meant. In the statement of these conversational rules the word 'term' is taken to refer to a word or phrase as used in a given text of discourse. Accordingly, a term is said to have a "meaning" or "sense" that can be the same or can be different in different occurrences in a given text. When the same term has a different meaning in another occurrence in the text of discourse, it is said to be ambiguous.⁴ This definition of ambiguity is contextual, in that it refers to uses of a term in a given text of discourse.

New Dialectical Rules for Dealing with Ambiguous Terms (Walton, 2000, 267-268)

1. Evidence of how the term was used at a previous occurrence in a text of discourse should be relevant to interpreting an ambiguous term one way or another at any given point in the text of discourse.
2. When interpreting an ambiguous term in a text of discourse, the interpretation that makes sense of the discourse should be preferred. A meaning that makes the text absurd or meaningless should be avoided.
3. An interpretation of an ambiguous term should avoid making the text of discourse contradictory, if it is possible to assign meanings that avoid or reconcile the contradiction.
4. Given a choice, an ambiguous term should be interpreted in such a way that it contributes to the goal of the dialogue that the text of discourse is supposedly part of. Or if there is doubt, it should be interpreted in the way that best seems to support the goal of that type of dialogue.
5. If a term occurs twice in the same text of discourse, there should be a presumption that it has the same meaning at both occurrences.
6. If an ambiguous term has been explicitly defined at some prior point in the text of discourse, the meaning that conforms to this definition should be chosen.
7. If the discourse is part of some special context, like that of a scientific discipline or domain of expert knowledge, the technical meaning appropriate for this discipline or domain should be presumed.
8. If a term first occurs in a non-ambiguous way that makes its meaning evident, then if it occurs later in an ambiguous way, it should be interpreted in line with the first occurrence.
9. If a later clear meaning of a term occurs, then it should be relevant evidence to determining an earlier ambiguous occurrence of the same term.
10. If the author or speaker of the text of discourse makes known a preference on how to interpret an ambiguous term at some occurrence, some weight should be given to accepting that preference on what the term should be taken to mean, other things being equal.

⁴ A distinction can be drawn here between actual and potential ambiguity (Walton, 1986, p. 262). Actual ambiguity is indicated above, but there are also many cases of potential ambiguity is a problem.

Some relationships among the rules were clarified in (Walton, 2000, 268). Rule 5 and Rule 8 are special instances of Rule 1. Rule 1 is subject to exceptions if there is a conflict with Rules 2, 3 or 4. Rule 9 is the converse of Rule 8, and a weaker rule than Rule 8. The earlier rules tend to be more general than the later ones. The rules can be put in certain categories. Rules 6 and 10 are based on the author's intentions. Rules 1, 5, 8, and 9 relate to the author's past usage. Others deal with concerns that are contextual (7), hermeneutic (2) logical (3) or pragmatic (4).

These rules can help to identify ambiguity, and deal with it constructively by using textual evidence as a basis for reaching a rational decision on what a term should be taken to mean in different occurrences in a text. The rules may not give a clear decision in every case, but they should not be expected to. They merely offer some guidance on whether there is more evidence for one interpretation rather than another. If an ambiguous term occurs in an argument, which of the possible meanings should the critic choose for purposes of interpreting the argument prior to venturing criticisms of it, if the original arguer cannot be consulted, and made to commit to one meaning or another? Maybe the critic should not be entitled to make such presumptions at all. But in fact, as critics, we do often make them. And in at least some cases, it can be justified to make them, based on good textual evidence. In many cases it is necessary to make them in order to support the claim that making the criticism is justifiable. In such cases, making a useful criticism requires the critic to venture hypotheses or presumptions, based on evidence from the given text of discourse, about which way a term in an argument should most plausibly be taken. In this regard, the rules can be seen as fulfilling an abductive function of picking out the best explanation of the way a term should be taken, as opposed to other interpretations that also have some evidence in their favor. An abductive inference is an inference to the best explanation of a given set of facts or data. In the case of ambiguity explanations, the data is the written text of discourse and the contextual knowledge we have on what the purpose of the discourse is supposed to be.

The principle of charity and the rules for dealing with ambiguous terms can help to pick the better, or most likely intended meaning, from two or more possible interpretations of an ambiguous term. Does this solve the problem of evaluating ambiguity, or at least make it unnecessary to deal with it? Once an ambiguity has been identified, and the best meaning has been chosen, surely now the potential damage can be avoided. Unfortunately, it is not so easy. In some cases it is very difficult to detect an ambiguity. And even in cases where the potentially troublesome ambiguity has been identified, there may be not be enough evidence to determine which meaning was intended, or is the best one to choose. Indeed, in some cases the ambiguity is designed to be deceptive, and even in cases of unintentional ambiguity there may be no strong or decisive evidence to show that one interpretation is to be preferred. There are cases of statutory interpretation, for example, that are fought out in lengthy court battles. Thus the existing tools for disambiguating a text, by themselves, do not solve some of the more serious problems arising from ambiguity.

4. Equivocation

The cases studied so far are instances of failed communication that have occurred because of obscurity or ambiguity in the language used. Another special kind of case occurs where the same word or phrase is used once in a sequence of argumentation, and is then used a second time, where it has a different meaning. In cases of this special type, there is a shift from one meaning to another. This failure can be an even worse kind of error, for two reasons. One is that it may be harder to detect, because in a longer chain of reasoning, the context of use of a word may be slightly different, and the shift in meaning may be subtle. Another reason is that if you get the argument wrong in the first place, by shifting to a different meaning of a key term in a premise or conclusion, you can really go off the rails when you come to the task of evaluating it.

This shift in a second occurrence of a term is the basis of the fallacy of equivocation. An equivocation occurs when a term is used in an argument in two different ways, meaning one thing in one premise, and something else in another premise or the conclusion. The following simple example of an argument can be used to illustrate how the fallacy works. The problem is more complex than a simple case of ambiguity. The same term is used in two different premises of the argument, and naturally taken one way in one premise and the other way in the other premise.

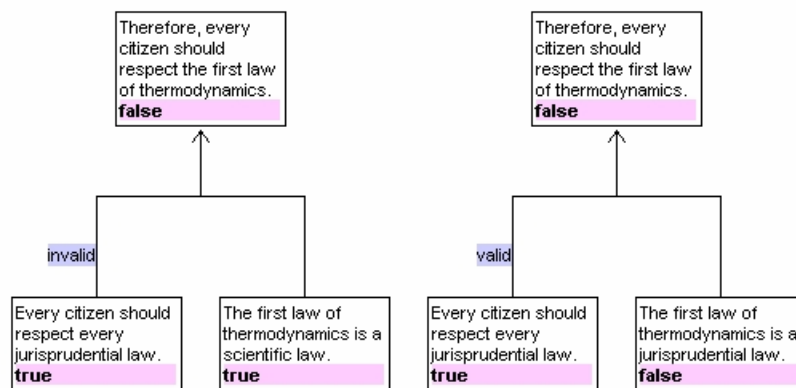
Every citizen should respect every law.

The first law of thermodynamics is a law.

Therefore, every citizen should respect the first law of thermodynamics.

The problem with this argument is that the term ‘law’ is most plausibly interpreted to mean ‘statutory law’ in the first premise, but most plausibly interpreted to mean ‘scientific generalization’ in the second premise. So interpreted, both premises are highly plausible. And the argument has the form of a deductively valid inference (or appears to). Yet obviously the conclusion is absurd. What went wrong? The problem is that the so-called argument is not really one single argument at all, but a bundle of arguments that can be gotten by disambiguating the word ‘law’. None of these arguments is both deductively valid and has all (plausibly) true premises. Consider, for example, the pair of arguments pictured below.

Figure 1: A Pair of Arguments in an Equivocation (fig. 1a on left and fig.1b on right)



So the apparent argument in the example above is deceptive. It only looks like a single argument, but is really a bundle of four different arguments (two of which are pictured above), only one of which could be used to prove a conclusion. The problem in this case doesn't look too serious, because the equivocation isn't disguised enough to be seriously deceptive. This is only a textbook example. But it is not too hard to see how an ambiguity can easily slip by unnoticed in a longer chain of reasoning, especially where abstract words are involved that may be difficult to define. Judging by such simple cases, ambiguity may seem trivial, but in many cases it is not.

A shift can occur because a word is normally taken to have a particular meaning, but then an arguer introduces a second occurrence of the word where it has a different meaning that she has invented, or where it has an odd kind of meaning. The following example is from Campbell (1974, p. 185).

For example, an anti-labor man might say, "National statistics tell us that four per cent of the labor force is unemployed, but I can attest to the fact that the true percentage is much higher than that. Because of union-encouraged featherbedding, a large proportion of workers drawing big pay are unemployed a large part of the time."

Campbell goes on to comment (p. 185), about the speech in this case (in which, we may assume, the speaker draws some conclusion):

The national statistics referred to represent the proportion of people in the labor force not on company payrolls but wishing they were. To be unemployed in this sense, therefore, would entail not being on a payroll of some kind. To be unemployed in the second sense would entail standing around doing little or nothing for one's pay - that is, to not be employed in productive activity.

The word 'unemployed' in the second sense is not the usual meaning that is referred to when unemployment statistics are being reported. The problem here is to detect the shift to an unconventional meaning of the word.

In other cases, the shift in the meaning of a term used in one context and then another is even subtler. Normally an inference of the following kind is reasonable.

An elephant is an animal.
Therefore, a gray elephant is a gray animal.

But inferences of this same form can, in some cases, be not so reasonable.

An elephant is an animal.
Therefore, a small elephant is a small animal.

The fact that the word 'small' is vague is not, in itself, a problem. But there can be quite a significant shift to a different meaning in context of the word when it is used in a different case. When the dialogue is about elephants, how one interprets 'small' is relative to the class of elephants - meaning that what is small is relatively big when the talk is about animals generally, and not just about elephants. Hence the conclusion of the inference above is false - a small elephant is not, relatively speaking, a small animal. So what is small, large, compatible, warm, poor, and so forth, relative to one case, may be on a different scale from what is said to have these same properties (or not) in a different

case. The shift of context from one case to another is what disguises an equivocation, making an argument seem plausible on the surface because the shift in meaning has not been observed.

Equivocation is more than merely ambiguity that results in miscommunication. It is a failure that arises from a deception that makes an argument, or what appears to be a single argument, useless to fulfill the purpose an argument is supposed to have in a dialogue. For example in a critical discussion, the purpose of the dialogue is to resolve a conflict of opinions by using rational argumentation to prove or cast doubt on a thesis to be proved by one side. An argument is useful for this purpose because it can fulfill a probative function by giving rational grounds that support the thesis by evidence, or by using evidence to cast doubt on it. This purpose may appear to be fulfilled by an apparent argument containing an ambiguous term, but the problem is that you can take such an argument one way or another. Taken one way, it may have true premises but a weak inferential link between them and the conclusion. Taken the other way it may have a strong inferential link but have false or implausible premises. Either way, it is of no use to fulfill the probative function. Still, it may look to be of use for this purpose to one who has not detected the ambiguity. Here then is the reason for condemning such an argument, or what looks like an argument, as fallacious.

5. Amphiboly

Some sentences have more than one meaning, not because of the ambiguity of a single word or phrase, but because of the structural ambiguity of the whole sentence. Such grammatical ambiguity, illustrated by the newspaper headlines below, leaves the respondent in doubt on how the sentence should be taken.

Teacher Strikes Idle Kids

Juvenile Court to Try Shooting Defendant

Hospitals are Sued by 7 Foot Doctors

These cases are typical examples of the kind cited in the textbooks under the heading of amphiboly. But is it really a fallacy? For one thing, it's only an ambiguous sentence. It's not clear that it is (part of) an argument, or if it is, what the premises and conclusion are supposed to be. For another thing, it doesn't seem to represent a kind of deception that is a serious problem for critical argumentation that would be difficult or problematic to deal with. What then is amphiboly?

When a wrong inference is drawn from a grammatically ambiguous sentence, the outcome was traditionally called the fallacy of amphiboly, as in the following case cited by Michalos (1970, p.71).

Suppose, for example, you are in a restaurant and have just finished a delicious tossed salad. You call the manager to ask him what was in the dressing and who made it. The manager replies 'The chef tossed the salad with greasy hair tonic.' Hopefully, he meant to say that the chef who uses greasy hair tonic tossed the salad. But he might have been suggesting the ingredient for the dressing, namely greasy hair tonic. The

fallacy of amphiboly is committed if one infers from the manager's reply that greasy hair tonic must have been used in the salad dressing.

Here there is more evidence that some sort of fallacy might have been committed. The manager meant what he said to be taken in one way, but his phrasing naturally suggests another less fortunate interpretation. Yet this case too seems harmless enough. The problem it poses seems easy to recognize and deal with, even though it is evident enough that the misunderstanding could have financial consequences for the restaurant. So far, amphiboly is amusing, but doesn't really seem to be too serious a problem.

Going on to examine some additional cases can show that grammatical ambiguity can be a serious matter. Commercial ads sometimes exploit grammatical ambiguity to suggest the consumer is getting a better deal than the seller is really willing to give.

A large ad in a newspaper stated "Two pizzas for one special price. Because pizza outlets had been offering a special "two pizzas for the regular price of one" in the past, readers of the ad got the impression that if you buy one pizza at the regular price, then you get another pizza for the same size free. When pizza outlets who ran the ad were contacted however, the price they quoted for the two pizzas was higher than the regular price of one. A pizza outlet owner denied that the ad was misleading, saying, "The bottom line is that our menu says two pizzas for one great price." (Walton, 1996, pp. 117-118).

The grammatical ambiguity in this case can be explained by punctuating the sentence, 'Two pizzas for one special price' in two ways.

(P1) Two pizzas for one (special price).

(P2) Two pizzas (for one special price).

The pizza outlet owners claimed that all they really meant to offer was the deal expressed by (P2). But they knew that the public would take the offer to mean what is expressed by (P1), as indicated by their excuse that "with all the other places selling two-for-one," we "didn't have much choice" (Walton, 1996, pp. 117-118). In this case, the grammatical ambiguity was being used deliberately as a "come-on" sales tactic sometimes called the bait-and-switch technique. Such a use of misleading advertising can be illegal, and is generally regarded as a deceptive business practice consumers need to watch for.

In other cases the use of a grammatically ambiguous sentence by a proponent can unintentionally leave a respondent unclear on what kind of action to take, in order to fulfill a directive or follow advice. The following sentence (cited in Walton, 1996, p. 4) was printed on the label of a bottle of capsules containing a herbal remedy.

Recommendation: Two capsules with three meals each day, or as desired, as an addition to the everyday diet.

What does the direction mean? Are you supposed to take two capsules with each one of your three meals (every day)? Or are you supposed to take a capsule with two of your three meals (each day)? Or does it refer to both capsules with the three meals taken all at once? The problem here is one of uncertainty for the respondent of the message. Clearly this kind of uncertainty could lead to serious harm. Suppose the patient takes an overdose of medication, for example, because she misinterpreted the instructions on the bottle. This kind of uncertainty can lead to serious disputes about what was meant.

In legal cases of contracts, wills, and other written agreements, the grammatical ambiguity of a sentence frequently leads to serious legal disputes. Consider the following simple example illustrating the problem in outline.

Ms. Spender signs a contract with Mr. Roller, a house painter, for him to paint her house. The contract, signed by Ms. Spender, reads as follows: “In exchange for painting my house, I promise to pay Mr. Roller five thousand dollars and give him a bonus of five hundred dollars if he completes the job by June 2, 1998”. Roller completed the job by June 4, 1998. But Spender argued that by the terms of the contract, she was not required to pay him either the five thousand dollars or the five hundred dollars. Her reason: “He did not complete the job by June 2, 1998.”

Many a legal case has been fought over this kind of sentence ambiguity. Lawyers are skilled at wording contracts and other legal documents carefully in order to avoid ambiguity (Plug, 2002), but some cases can be very tricky.

In the following case (*Gorgichuk v. American Home Assurance Co.*, CCHDRS 43-004 I.L.R., Ontario S.C., April 19, 1985) the disputed issue was whether a man's accidental death was covered by his insurance policy, according to the contract.

The plaintiff's husband died as a result of a motor vehicle accident which occurred in Barbados. The bus in which the man died was transporting him, the plaintiff, and others from their hotel in Barbados to the airport at the end of their 14-day vacation. The couple had purchased the vacation package through an agent. As part of the package they purchased accident insurance under a group policy. The policy provided \$45,000 in coverage for death occurring in consequence of riding in: (1) any aircraft . . . ; or (2) ‘any airport limousine or bus or surface vehicle substituted by the airline’. The policy provided \$15,000 in coverage for death arising out of the use of other public conveyances. The plaintiff argued that the words ‘substituted by the airline’ in (2) above referred only to the words ‘surface vehicle’.

The issue was how clause (2) was to be interpreted, depending on its grammatical structure. Did it mean the first or the second of the following punctuated versions?

- (V1) any airport limousine, or bus or service vehicle substituted for an aircraft by the airline.
- (V2) any airport limousine or bus, or service vehicle substituted for an aircraft by the airline.

The insurance company argued that clause (2) should be interpreted as meaning (V1). In fact, the bus had not been “substituted” for an aircraft by the airline. The bus was the normal mode of transport from the hotel to the terminal. So the insurance company argued that they did not have to pay the \$45,000 death benefit. However the plaintiff argued that clause (2) should be interpreted as meaning (V2). So interpreted, the bus did not have to be “substituted” for an aircraft. That interpretation would mean that the insurance company would have to pay out the \$45,000 death benefit for the fatal bus accident.

The court ruled that the phrase ‘substituted by the airline’ referred to all the modes of transport mentioned in clause (2). They ruled that (V1) was the correct interpretation, in other words. So the plaintiff's claim to collect the larger death benefit of \$45,000 was not supported by the court's ruling of what the contract should be taken to mean. Such

disputes can often be avoided if more care is taken with punctuation of a sentence. But once such a grammatical ambiguity is present in a carelessly worded document, it may be difficult to resolve the ensuing dispute. Some guidance can be offered by trying to determine what seems to be the most natural interpretation of the ambiguous wording in the context of the case - the meaning that would normally be expected. Here we could employ the rules for disambiguation. But court cases are fought when each side can put up a fairly plausible argument for its interpretation.

The faults in the cases of amphiboly studied in this section can be similar to the basic fault of equivocation diagnosed above, where the ambiguity leads to the drawing of a wrong conclusion by confusing two arguments that are weak in different ways. In other cases, like the herbal remedy one, the failure is more one of a failure to transmit information that could possibly result in a failure of intelligent deliberation. Separating the cases into the two categories requires a prior classification. Does the ambiguity simply give rise to a miscommunication that does or may have bad consequences, or is the ambiguity within an argument, resulting in the multiple argument type of deception characteristic of equivocation? In both types of cases, the failure is not just in the linguistic unit itself – the term or sentence. Nor is it just in the argument the term or sentence occurs in. It resides in how such linguistic units are used in a dialogue to fulfill some purpose of argumentation or communication. Judging the ambiguity as a failure, as something bad or problematic, requires an evaluation of how the use of the term or sentence has failed to fulfill a function in a conversational context of use.

6. Using Ontologies to Detect Ambiguities on the Semantic Web

Ambiguity is a very real problem for the communication of information in multi-agent systems of the kind now commonly used for transactions of many kinds on the internet. For such purposes, different kinds of communication systems are now being devised. Such systems require that key concepts and terms important for an application be standardized and defined in a systematic fashion. The device now widely used for this purpose is called an ontology. In philosophy, ontology was traditionally taken to be the science of fundamental principles that categorizes the essences of things. In computer science, an ontology is a system of concepts that provides the means to classify the things in a given domain by giving the classifications names and labels, and defining the properties and relationships that can be assigned to them (Passin, 2004, p. 142). An ontology, in the sense of the term used in the semantic web, is similar to a system of classification sometimes called a taxonomy. A well-defined syntax is necessary for an ontology to be used in machine processing of information (Antoniou and van Harmelen, 2004, p. 110). Current multi-agent systems for electronic commerce have to depend on ontologies, so there are many ontologies currently in use in these systems.

The problem of ambiguity arises on the semantic web because agents that need to communicate on the web may not use the same terms to mean the same thing, and hence there needs to be a way to find out when a sending agent uses a term, the receiving agent might be taking it to mean something different (Uschold, 2003, p. 27). The way to do this is for the sending agent to declare its ontology, and then the receiving agent can check to see if its ontology uses the term in a way that fits that of the sender. The problem is that each agent is a specialist in carrying out a specific task, and hence each agent requires its

own private ontology to carry out that task. Communication on the internet thus becomes problematic because of these heterogeneous ontologies. The receiving agent may assign a different meaning to a term than the one intended by the sending agent. Various solutions to this problem have been proposed, all of which aim at providing the group of communicating agents with a shared set of concepts called a ground ontology (van Diggelen et al., 2003, p. 2). The problem is how to use the ground ontology as a basis for a dialogue between a pair of agents so that an ambiguity can be recognized, and any misunderstanding or communication difficulties it might have created can be removed.

An ontology that has become standard in the semantic web is called OWL, which stands for web ontology language (even though the letters are not in the right order). OWL supports description logics that apply restrictions to the kinds of things that can be said. For example, in an ontology of places, the place Winnipeg is related to the place Manitoba, which is in turn related to the place Canada. As shown in figure 2 below, these three places exhibit a certain kind of relationship (located in) to each other.

Figure 2: Example of an Ontology of Places

Using these relationships an OWL processor can figure out that Winnipeg is in Canada. The ontology doesn't actually say that Winnipeg is in the Canada, but by knowing that the property of being located in is transitive, the processor knows that it is so.

Figure 3: Inference Drawn by the Ontology

As shown in figure 3, the ontology can deduce the conclusion that Winnipeg is in Canada. The question is whether ontologies of the kind used on the semantic web could be applied to arguments and used to disambiguate ambiguous words or sentences that occur in an argument and might be problematic.

It seems quite plausible to propose as a hypothesis that once ontologies have been developed for applications to specific domains, they could be used to resolve problematic ambiguities of the kind cited in the examples above. Let's consider the first example of equivocation studies above, the one that turned on the ambiguity of the word 'law'. One way an ontology could be used is to classify two different species of law, one being a statutory law and the other being a scientific generalization. There could be a problem, however. The term 'law' has quite a different meaning in the field of law than it has in the kind of usage it would have in a scientific field. What we really require to deal with this ambiguity are two separate private ontologies, a legal ontology and a scientific ontology. In addition, the word 'law' is also used in everyday speech, as it was in the example of equivocation at issue. This common usage could be seen as a grounding ontology. The problem posed by an equivocation in this case is for the arguer and respondent to have a dialogue to determine which of these two private ontologies fits the common usage of the word 'law' in the given case. The solution is for the two agents to ascend to a metadialogue level where they resolve the problem posed by the equivocation. This problem is quite a general one in dealing with legal examples of equivocation and amphiboly of the kinds studied above.

Ontologies could also be used to identify problematic ambiguities of the kind cited in the examples above. One specific way ontologies could be employed to deal with

problematic ambiguity is to pick up the error by deducing absurd consequences. For example, suppose it was stated in a given case that Winnipeg is in Holland. The ontology might be able to deduce, as shown in figure 3 above, that Winnipeg is in Canada. But suppose it is clear from the ontology that Canada and Holland are different countries. Hence it might be rule of inference that if a city is in Canada, that same city is not in Holland. Hence it can also be deduced from what is known in the ontology that Winnipeg is not in Holland. Hence an inconsistency is revealed by deducing the contradiction 'Winnipeg is in Holland and Winnipeg is not in Holland'. This technique could also be applied to the diagnosis of the equivocation in the example at issue.

Still another way ontologies could be employed to deal with ambiguity would be to recognize that even a term fits an ontology, it might have another meaning that only fits a different ontology. In one meaning of the word 'law', the concept of a law of physics would be included as a subclassification, while under another meaning of the same word, this subclassification would not fit the ontology. Thus if the word 'law' had to be used in its legal meaning in a premise in a given argument, in order to make that premise plausible, and used in a different sense to make another premise plausible, the need to apply different ontologies might pick up the problem. Once again, if the wrong meaning were to be chosen, the ontology would deduce absurd consequences.

Implementing computer systems that could carry out these tasks is a problem for ongoing research. Still, one can already see how both the fields of argumentation and multi-agent computing can benefit from a joint program of research in this area. Using ground ontologies and a dialogue system for integrating them with ground ontologies for groups of agents, problematic ambiguities can not only be identified, but interfaces for dealing with fallacies and other problems arising from ambiguity can be developed.

7. Conversation Policies for Different Types of Dialogue

The general method now proposed is to evaluate each text of discourse containing an ambiguity, once the ambiguity has been identified, based on what type of dialogue the text represents, and on what conversational policies are appropriate for that type of dialogue. In some cases, the task of evaluation is not needed. One can simply comment that two interpretations are possible, and then each can be considered separately. For example two separate argument diagrams could be drawn, each representing a different legitimate interpretation of the given text. It could also be argued, using the rules, that one interpretation is more plausible than the other, based on the textual evidence of the case. In other cases, the rules for dealing with ambiguity can be used to show one meaning is more plausible than another, and should therefore be selected as the one to work with. Now we are left with the more problematic cases. In such cases, neither interpretation is clearly the one intended. Or even worse, the shift of meaning is deceptive. Evaluation comes more to the fore when the ambiguity is a factor in miscommunication, or occurs in an argument, giving rise to a fallacy allegation. These cases require evaluation based on the prior tasks of disambiguating the key term or sentence that gave rise to the problem. It is contended here that such an evaluation requires the formulation of conversation policies specific to a type of dialogue. For example, rules for the critical discussion must include rules, like the one formulated by van Eemeren and Grootendorst, governing the use of ambiguous and vague expressions.

However, different kinds of policies are required for different types of dialogue like negotiation.

The general conclusion reached here is that ambiguity evaluation should not be based on conversation policies mandated for speech acts across different types of dialogue. Ambiguity needs to be evaluated by different conversation policies in different types of dialogue. As noted above in discussing artificial intelligence, the rules governing ambiguity in negotiation dialogue may not need to be very strict. Where ambiguity does seem to be an especially acute problem is in the kind of case in which an information-seeking dialogue is embedded in a deliberation dialogue. The case of the air crash on Tenerife could be cited again as an example. The pilot was trying to send information on the location of the aircraft to the air controller. However the ambiguous message was taken by the air controller to refer to a different location. The outcome was that the deliberation of the air controller on how to coordinate the flights, and on how to advise the pilots on what to do, turned out to be catastrophic. The problem is that deliberation needs to be based on good information, but ambiguity can thwart the transfer of information from a speaker to a hearer. It may not just be the failure of transfer of information that is the only problem, but also how that failure affects subsequent deliberation based on information.

The potential number of kinds of interactions on the semantic web is varied, and they are not merely restricted to transmissions of requested information. In order to communicate and coordinate their activities on the web, agents jointly plan actions in deliberations, negotiate with each other, request actions of other agents, change plans based on the actions of other agents, and decide to interact with agents based on estimates of their trustworthiness (Passin, 2004, p. 210). In light of this variety of types of conversational interactions, the following basic types of dialogue need to be considered as representing kinds of conversational exchanges on the semantic web.

TYPES OF DIALOGUE

TYPE OF DIALOGUE	INITIAL SITUATION	PARTICIPANT'S GOAL	GOAL OF DIALOGUE
Persuasion	Conflict of Opinions	Persuade Other Party	Resolve or Clarify Issue
Inquiry	Need to Have Proof	Find and Verify Evidence	Prove (Disprove) Hypothesis
Negotiation	Conflict of Interests	Get What You Most Want	Reasonable Settlement that Both Can Live With
Information-Seeking	Need Information	Acquire or Give Information	Exchange Information
Deliberation	Dilemma or Practical Choice	Co-ordinate Goals and Actions	Decide Best Available Course of Action

Eristic	Personal Conflict	Verbally Hit Out at Opponent	Reveal Deeper Basis of Conflict
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Table 1

For each type of dialogue, a conversation policy relating to ambiguity can be given. Each general type has various specific subtypes, so policies will be formulated only in quite a general way here.

Persuasion Dialogue. Ambiguous questions are a problem occasionally, but the main problem to be addressed is that when judging an argument, you need to be sure it is a single argument or equivocation and amphiboly are dangers. Ambiguous sentences or terms must be disambiguated, by drawing distinctions, before an argument is judged. The normative model called the critical discussion (van Eemeren and Grootendorst, 1984) can be classified as a type of persuasion dialogue in which two participants try to resolve a conflict of opinions using rational argumentation.

Inquiry. In a demonstration, the statements must be univocal, and thus the conversation policy for ambiguity should be roughly the same as that in the persuasion dialogue.

Negotiation. Nothing in the conversational policies binding on all parties rules out ambiguity, but strategically, a party should be careful not to be deceived by it.

Information-Seeking. Misunderstanding stemming from ambiguity of a question or answer can prevent transmission of information. Thus there should be a general policy not permitting use of ambiguous terms or sentences wherever possible.

Deliberation. Getting incorrect information about a situation or describing a goal incorrectly can be a result of ambiguity. It should not be tolerated.

Eristic. Ambiguity can generally be a good thing here as it can serve to reduce conflict and tensions. There doesn't seem to be any reason to ban or discourage ambiguity.

Ambiguity can be a problem in negotiation, however, when it comes to offers and binding agreements. In the pizza ad case, the ad made an offer, but then used the ambiguity to get out of giving two pizzas for the normal price of one, as the ad seemed to say. This kind of case represents the problems with ambiguous contracts, wills, and other agreements and directives that are legally binding.

It is a little uncertain just whether ambiguity should always be excluded from information-seeking dialogue, as the following example might indicate.⁵ Suppose Maria asks Bob where his parents live in order to try to find out where Bob goes when he goes home to visit his parents. But suppose that Bob has both birth parents and adoptive parents. The term 'parents' is thus ambiguous in the question. But suppose further that both sets of parents live in the same town. Here, although the term is ambiguous in the question, and in the answers as well, Maria has gotten the right information. Here no harm has occurred in the transmission of information despite the ambiguity. In other instances of information-seeking dialogue, however, protocols of dialogue should direct a questioner to ask for exactly the information she wants. In still others, it may be important only to collect reliable information, and to exclude information that might have a good chance of being unreliable or incorrect. Thus even though it may be too strict to

⁵ This example was suggested by David Godden in discussion.

try to exclude ambiguity altogether from information-seeking dialogue, the fairly strict type of policy indicated above appears to be justified.

The same variability seems to affect the other types of dialogue as well. In the rigorous type of persuasion dialogue (RPD), all moves are defined precisely, while in the permissive persuasion dialogue (PPD), there is more flexibility and freedom in the kinds of moves that can be made (Walton and Krabbe, 1995). No ambiguity can arise in an RPD, whereas it is possible for an ambiguity to occur in a move in a PPD. Thus although general policies regarding the levels of ambiguity that can be tolerated within dialogues of various types can be formulated, these policies may have to be implemented in different ways in dialogues that have more specific rules.

8. General Observations and Conclusions

The main problem with language we have concentrated on that is obstructive in preventing argumentation from going forward in a constructive way in a dialogue has been that of ambiguity. However, in passing, we have also considered vagueness and obscurity, and offered some help in distinguishing between ambiguity and these other phenomena. Vagueness is lack of precision while obscurity is lack of clarity. One species of obscurity in language use is gobbledygook, the use of a barrage of complex and convoluted terminology that does not make any sense (in context). Ambiguity is defined as occurring in a text giving rise to multiple meanings of an expression, and it can be a problem in two main kinds of cases. Ambiguity can be a communication problem when it results in serious misunderstanding in a dialogue. It can be a special problem when it arises in arguments. Equivocation is a special type of case of the ambiguous use of a term where the term occurs twice (at least) in an argument, where it means one thing in one use, but something else in the other use. Such a meaning shift is often disguised by the context, where the ambiguous term is naturally taken a certain way, but then, when the context has shifted, it is more naturally taken another way. Grammatical ambiguity is a kind of ambiguity that arises from the structure of a whole sentence. It too can lead to serious problems of failed communication, associated with the fallacy of amphiboly. Grammatical ambiguity can be exploited for deceptive purposes in commercial speech. But in contracts, wills and other written agreements, grammatical ambiguity can give rise to uncertainty about exactly what was meant, resulting in legal disputes.

There are three main problems concerning ambiguity that need to be differentiated. The first is the problem of how to recognize ambiguity. This is a hard problem, because it requires precise definitions of terms in a language. However, ontologies of the kind currently being developed on the semantic web can be used for this purpose. The ontology can pick up inconsistencies that reveal ambiguities. The second is the problem of how to determine which meaning was intended, or at any rate can justifiably be selected for attempting to judge the text. In some cases, just the recognition of an ambiguity is enough, or almost enough to solve the problem. It may be just a question of continuing the dialogue by asking the speaker what she meant. But in other cases, recognizing an ambiguity then poses the biggest problem – that of trying to figure out what was presumably meant by the ambiguous sentence. This kind of problem is typical of cases dealing with interpreting a text of discourse like a written document. The author of the document may be unavailable for further dialogue. He may even be long dead. The third

problem is how to evaluate the text of discourse containing multiple meanings or multiple arguments, once the ambiguity has been recognized. Tackling the third problem is much of the work that is required in dealing with allegedly fallacious arguments like those associated with equivocation and ambiguity.

Problematic legal cases of ambiguity of the sort cited above are extremely common (Plug, 2002), and would appear to be extremely interesting from a viewpoint of informal logic (Walton, 1996). As noted above, interesting cases occur in wills, and in cases of commercial speech. The problems are substantive, and neither the fallacies approach nor the conversational postulates approach by itself seems to represent a complete solution that would be of practical use. What seems to be needed is a different approach that considers the argumentation in a text of discourse on a case-by-case basis, without making blanket pronouncements that try to ban ambiguity or declare it fallacious. Instead of invoking shallow generalities, what is needed is an orderly approach that gives helpful guidance on how to disambiguate a term that is ambiguous in a text of discourse, by looking at the evidence provided in the case by the given body of discourse. Conversation policies of the kind currently being developed for agent communication languages can be used as pragmatic contexts to situate language use in a framework of dialogue.

Speech acts are implemented in agent communication languages by formulating them using preconditions and postconditions. An example from (Dignum and Greaves, 2000, p. 6) illustrates this feature. For example, suppose one agent has a set of numbers in its knowledge base and the other agent asks some question about these numbers. A precondition is that the question is expressed in such a way that numbers can be used to answer it. A postcondition is that the question is answered successfully if a number is given as a reply to the question. Ambiguity can be filtered out at either end.

How such a filter is built and used, judging from the examples studied above, needs to vary with the type of dialogue. In a scientific inquiry, there should be no ambiguity in the question asked or the answer offered, or in any proof set forth. In a negotiation dialogue, ambiguity can be allowed in both preconditions and postconditions of an argument. In an information-seeking dialogue, neither a request for information, nor the answer that purports to supply it, should be ambiguous. Similarly in deliberation, ambiguity is a problem, and should be ruled out both in formulating a goal and devising a course of action to fulfill it. In an eristic dialogue, ambiguity is generally tolerable. In a persuasion dialogue, ambiguity is especially crucial in the speech act of putting forward an argument, where it can lead to equivocation and amphiboly, as shown above. Although ambiguity can be excluded in a rigorous persuasion dialogue, it is unrealistic to think that it can always be identified and excluded in a permissive persuasion dialogue. Here it is tolerable in the precondition of arguing, but in the postcondition it should be open to challenge, and such a challenge must be met by disambiguation.⁶ Each speech act, like that of putting forward an argument, asking an information-seeking question, or demanding an argument to prove a claim, needs to be treated differently. Thus in agent communication languages, in addition to general conversation policies at the global level, there need to be specific preconditions and postconditions set for each type of speech act. These specific conditions need to be tailored to fit the global conversation policies.

⁶ We will not go into details of precise rules for responding to allegations of equivocation and amphiboly in persuasion dialogue here. The reader can be referred to the discussions of the problem in (Hamblin, 1970), (Walton, 1996) and (van Laar, 2003).

As shown above, dealing with ambiguity is very important for informal logic, because we must often evaluate an argument that has a premise or conclusion that can be interpreted in more than one way. If that premise (or conclusion) is ambiguous, we cannot determine whether the premise is acceptable as evidence for the conclusion. So ambiguity is important for informal logic, not only in cases of equivocation, amphiboly, and like fallacies. It can be important, in many cases, in its own right, in clarifying discourse and aiding communication. The general method advocated here applies not only to dealing with ambiguity in cases of equivocation, and cases where fallacies arise from ambiguity. It also applies to ambiguity of the kind that obstructs communication even if an argument is not involved. The problem of identifying and disambiguating problematic expressions is a linguistic one that depends on the skills of natural language interpretation of the native speaker. The problem of choosing the better interpretation can be dealt with by applying the rules for dealing with ambiguity in textual interpretation. A set of dialectical rules of this sort was offered in section three above.

It is the third problem we have mainly addressed here. We have proposed a pragmatic method for not only dealing with equivocation and amphiboly, and more generally for judging arguments and texts of discourse containing ambiguities. By 'judging' we refer to the task of critical evaluation, that of finding weaknesses in an argument that can be addressed by asking critical questions, or even in some instances by alleging that a fallacy has been committed. The approach advocated is to judge cases by using conversational policies that are specific to a type of dialogue. The judging procedure passes harmless cases of ambiguity and polysemy without comment, but raises a red flag in cases where the ambiguity is judged to be questionable or problematic. In still other cases, ambiguity of a more serious sort can be associated with fallacies like equivocation and amphiboly.

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