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EPISTEMIC AND DIALECTICAL MODELS OF BEGGING THE QUESTION

ABSTRACT. This paper addresses the problem posed by the current split between the two opposed hypotheses in the growing literature on the fallacy of begging the question: the epistemic hypothesis, based on knowledge and belief, and the dialectical one, based on formal dialogue systems. In the first section, the nature of split is explained, and it is shown how each hypothesis has developed. To get the beginning reader up to speed in the literature, a number of key problematic examples are analyzed illustrating how both approaches can be applied. Useful tools are brought to bear on them, including the automated argument diagramming system *Araucaria*, and profiles of dialogue used to represent circular argumentation in a dialogue tableau format. These tools are used to both to model circular reasoning and to provide the contextual evidence needed to properly determine whether the circular reasoning in a given case is better judged fallacious or not. A number of technical problems that have impeded the development of both hypotheses are studied. One central problem is the distinction between argument and explanation. It is concluded that the best way to move forward and solve these problems is to reformulate the two hypotheses in such a way that they might be able to co-exist. On this basis, a unified methodology is proposed that allows each hypothesis to move forward as a legitimate avenue for research using the same tools.

The fairly large and growing literature on the fallacy of begging the question has reached an impasse on the methodological question of how best to move forward.[1] One hypothesis is that begging the question can only be properly understood in a context that is epistemic, referring to knowledge and belief, of the kind studied in epistemology (Biro 1977; Sanford 1981; Wilson 1988; Ritola 2001). This approach is called the epistemic hypothesis. The other hypothesis is that begging the question is a matter of the question at issue, supposedly being begged, which can only be properly taken into account in a framework of rule-governed, orderly question-reply dialogue (Walton 1991; Hintikka 1992; Yuan et al. 2003). This is called the dialectical hypothesis.[2] These hypotheses are taken to be opposed to each other (Ritola 2004), and exponents of each approach for some time now have criticized what are

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taken to be the defects of the other. Here it will be shown how the two hypotheses actually exhibit many of the same, or very similar problems, and it is concluded that they can be fitted together into a broader approach, showing that each is a legitimate line of research.

This inquiry into begging the question begins in Section 1 by outlining how this polarization in the literature came about. Sections 2 through 5 review some of the basic concepts and methods that have been developed as tools for formal analysis of cases where the fallacy has supposedly been committed. Several leading examples are analyzed, the central problems that have impeded previous systematic attempts to formally analyze the fallacy are presented, and proposed solutions are discussed. Each of the two hypotheses has its problems shown to arise when one tries to use them to explain and analyze begging the question as it occurs in the examples analyzed and discussed below. Some of the problems are shown to arise when cases involving trust and referral of kinds often cited in textbook treatments of the fallacy of begging the question (Hamblin 1970) are analyzed in multi-agent systems for reputation management. Others occur in epistemic analyses of knowledge and belief, as applied to examples of question-begging. Still others arise in formal dialogue systems of argumentation that allow for retraction of commitment, when such systems are applied to cases of begging the question (Walton and Batten 1984). A central problem posed in all such systems is that of diagnosing faults in circular reasoning more precisely in cases where one needs to distinguish between an argument and an explanation in a given text of discourse (Rips 2002; Brem 2003). A way towards solving these problems is presented.

It will be shown that what is called the probative function, a notion closely related to other key notions of argumentation like burden of proof and evidential priority, is the key to analysis of the fallacy. The conclusion of the paper is that whether or not the fallacy has been committed in a given case depends on whether the probative function of the argument in that case has been fulfilled or not. It is shown how this probative failure is at the root of the fallacy of begging the question.

1. THE SPLIT

The origin of this fallacy is to be found in Aristotle, where it is one of the *sophistici elenchi* treated in his list of fallacies, and comments

on it are found in his other works as well (Woods and Walton 1982; Hintikka 1987). In his account, the fallacy can be treated in two different ways, as a dialectical failure or an epistemic one. On the dialectical account, as shown below, the fallacy was taken to be one of "begging for" the question that is at issue in a dialogue between two parties where one has a burden of proof to prove a proposition and fails to fulfill it by offering an argument that is circular. However, the Greek notion of argumentation as a kind of orderly dialogue procedure fell into disuse for two millennia, and makes no sense to the modern reader. Hence the expression "begging the question" seems peculiar to present-day speakers of English. They don't know what to make of it. It is now often taken to refer to a failure to answer a question (for example in a media interview).[3] Aristotle's epistemic account of the fallacy is no less perplexing to the modern reader, since it is based on a notion of axioms being self-evident truths, a notion now widely discredited.

Let's consider the dialectical analysis first. Aristotle's dialectical account of the fallacy presumes a dialogue structure in which two parties are engaged in argumentation with each other. One participant, called the proponent, puts forward an argument that is supposed to prove something to the other, called the respondent. The fallacy of begging the question has to do not just with the validity of an argument, or the lack thereof. It has to do with how the argument is used in such a framework of dialogue. The initial problem is that modern-day persons have lost the idea of ancient Greek dialectical argumentation, in which an argument is seen as a contribution to an orderly dialogue in which there are rules about what kinds of moves can be made and what kinds of arguments can properly be used to contribute to the moving the dialogue forward (Hintikka 1992, 1993). To explain begging the question Hintikka (1987, p. 213) has put forward an interrogative model based on Aristotle's work on dialogue games, which in turn follows the Socratic paradigm (Hintikka 1992, 1993). In Hintikka's model of such an interrogative game, the goal of the game is to answer a "big" or principal question, but the questioner has to lead up to this by first asking a series of smaller questions that lead up to the asking of the big one (1987, p. 219). According to Hintikka's interpretation, Aristotle forbids the asking of this big question too early in the game, and the phrase "begging the question" refers to violations of this prohibition (1987, p. 220). According to this dialectical type of account, the burden of proof in rational argumentation requires that the presenter of

an argument offer an argument with premises that provide evidence that supports the conclusion, the very conclusion that the respondent doubts or disagrees with as his role in the dialogue. The circular argument fails to fulfill this burden because the only way the doubter can come to accept one of these premises is by using the conclusion as his support for it.[4] Such an argument is quite useless to remove the respondent's doubt about the conclusion. This account is classified as dialectical because two parties are involved and one is trying to prove something to the other according to procedural (dialogue) rules.

On Aristotle's epistemic account, a kind of proof he calls a demonstration always proceeds from premises that are more certain, or more well-established in the order of proving things, than the conclusion (*Prior Analytics* 64b30). If the prover tries to use premise that are less known, or only equally well known as the conclusion, that attempt would be a species of failure to prove. Begging the question is such a failure. It occurs whenever a man tries to prove what is not self-evident by means of itself (*Prior Analytics* 64b37). Such a failure can happen in many ways, however, according to Aristotle (64b29). It would take us too far afield to try to analyze all these ways described by Aristotle, for his remarks have often been found perplexing by commentators, but the reader can be referred to the discussion in Hamblin (1970), and to the detailed account in (Ritola 2004, pp. 9–22). Basically, the analysis turns on the epistemic principle there is an ordering of knowledge so that the less well known should always be proved only by using premises that are better known. If one of the premises in an argument is the same proposition as the conclusion to be proved, or depends on in the order of proof, the argument would be defective in that it violates this ordering epistemic principle.

Curiously, this split in Aristotle's accounts of begging the question has resurfaced two millennia later, as modern logicians and argumentation theorists, after this long period of neglect of the subject, tried to diagnose the fault. The modern version of the problem can be traced to chapter 7 of Hamblin's book *Fallacies* (1970), where he reviewed three sets of criteria that can used to evaluate arguments: alethic (truth-based), epistemic (based on knowledge and belief) and dialectical (based on commitment in dialogue). Hamblin subjected the first two sets of criteria to critical scrutiny, finding problems in each that led to a rejection of each as a suitable model of argument that could be used to analyze fallacies

like begging the question. In his book he advocated using the dialectical model, and he constructed formal systems of dialogue for this purpose. This way of proceeding left the literature polarized. A few followed Hamblin in exploring the dialectical approach, but the majority in analytical philosophy, epistemology, and logic had long embraced the epistemic model. They were not convinced by Hamblin's arguments, or were unaware of them, and simply went ahead with the conventional wisdom of the time that cognitive structures should be based on the notions of knowledge and belief.

The literature taking the epistemic approach to studying the fallacy of begging the question by examining epistemic conditions of inference has been extensively surveyed by Ritola (2004). In the epistemic approach, circular argumentation is diagnosed as a failure in relation to general principles of knowledge and rational belief (Biro 1977; Sanford 1981). Jacquette (1993) proposed an analysis based on the notion of presupposition, which is in turn analyzed in epistemic terms. Wilson (1988) surveyed a number of epistemic principles that could be used to analyze begging the question as a fallacy, and discussed many examples and discussions in the earlier literature. But he concluded that the project of analyzing the fallacy of begging the question in epistemic terms has not been successful and should be given up. Ritola (2004) criticized Wilson's attack, and formulated an analysis of begging the question using what he called a subjective epistemic criterion. On this analysis (Ritola 2004, p. 165), an argument is judged to commit the fallacy of begging the question in cases where the arguer's belief in the premise is dependent on his or her reason to believe the conclusion. Needless to say, all such analyses presuppose some prior epistemic account of the notions of belief, reason to believe, presupposition, knowledge, and so forth.

Hamblin's reasons for not pursuing the epistemic approach are varied, but basically he found the notions of knowledge and belief, as conceived in the epistemology of the time, not very useful for analyzing fallacies. For one thing, they are psychological notions, and it is not necessary to evaluate an argument as fallacious or not by having to try to pin down the individual intentions, beliefs, or states of knowledge of the arguer. Another difficulty is that knowledge and belief tended to be analyzed in the epistemology of the time as highly abstract notions, defined using possible worlds, an approach that give rise to technical problems, like iterated knowledge operators, and how to retract a defeated knowledge claim. In light of subsequent developments in distributed knowledge-based

computing, Hamblin's reservations appear to have been amply justified, because defeasibility of knowledge-based reasoning turned out to be a central feature. We return to this point in the concluding section. At any rate, there was now a clear split between two approaches to solving the problem of analyzing begging the question and other fallacies, posing a large question. Which is better, the epistemic or the dialectical approach? There was quite an array of supporters on both sides (Ritola 2004), and quite a large literature on begging the question that was pretty well split down the middle.

Many of those working in the field of argumentation have been convinced that the dialectical approach is the best path to pursue (Hamblin 1970; Walton 1994; Hintikka 1992, 1993), and many working in distributed computing have now adopted a commitment model in applying argumentation to multi-agent systems. However, there has been work continuing to develop the BDI model in studies on computing, suggesting that, at this point, the time is ripe for a rapprochement or integration of the two views. Commitment is a weaker notion than belief. Belief logically implies commitment, but as Hamblin showed, commitment does not necessarily imply belief. Knowledge does not imply commitment, but it might be more closely related to commitment than it has been traditionally been thought to be, if knowledge claims sometimes need to be retracted during the process of discovery. Thus it may be a good time now to explore the relationship between commitment on the one hand, and knowledge and belief on the other. Picking a specific fallacy is not a bad way to help such a project, especially one as fundamental to studying rational thinking since antiquity as begging the question. The aim of this project is to see where we are now in working on the fallacy of begging the question by building on the strength of what has been found using the dialectical model to point to some directions in which the epistemic model could be reconfigured.

The main problem posed by the cases studied in Sections 2 through 5 will be how to formulate a context of use for a given case of circular reasoning so that the argument or explanation in the case can be judged to beg the question or not. Such a context of use has to have some structure, so that it represents a context of use in a systematic normative framework. What is meant by the characteristic of being normative is that the framework must have some clearly formulated set of requirements or rules. These rules must be such that a given argument used in that framework can be

judged to beg the question (and hence be fallacious) for the reason that it violated one of the rules of the system. Or if it is judged to be a case of circular reasoning that does not beg any question (and hence is not fallacious, at least on grounds of being question-begging), the reason is that it can be shown to not be in violation of a rule in the system. The problem can then be stated as a question. Is there such a normative framework that can be used to help judge whether cases of circular reasoning beg the question, and if so, what is it?

One class of cases concern reputation management problems in multi-agent systems. The hypothesis suggested by these cases may be that multi-agent systems can function as normative frameworks in which to evaluate cases of begging the question. However, multi-agent systems technology does not, by itself, at any rate, provide a normative structure of the kind needed to evaluate cases where the fallacy of begging the question has allegedly been committed. It is true that there are rules called conversational policies that are used to control multi-agent communications of various kinds on the internet, and that an international organization called FIPA exists for the purpose of standardizing and improving these rules. However, there is no single set of rules that have been agreed upon as universally binding. There are many multi-agents systems used for many purposes. It is not the multiplicity that is the problem, however. The problem is that there is little or no reason to think that any system for multi-agent communication represents a normative structure of the kind needed to analyze and evaluate problematic cases where it is suspected that a fallacy of begging the question has been committed. That is not to say that the study of conversation policies is of no interest in this connection. It is only to say that no particular multi-agent system can automatically be held up as a standard for dealing with cases of reasoning suspected of containing fallacies like begging the question. Still, agent technology can be used to study the reasoning of rational agents who need to communicate using rational argumentation (Wooldridge 2002). And automated reputation management systems like those of Yu and Singh (2000) and those of Yu et al. (2002), as shown below, provide tools like referral graphs that model circular reasoning. And yet there is quite a ways to go between bridging the gap between such a practical technology and a normative system of the kind that is required to deal with serious cases of begging the question.

2. EQUIVALENCY AND DEPENDENCY CIRCULARITY

The fallacy of begging the question, or *petitio principii*, as it is usually called, is especially interesting as a problem for logical theory because it is so clear that the fallacy is not one of deductive logic. The form of argument, "*A*, therefore *A*", the paradigm of circular argumentation, is deductively valid. Precisely what is wrong with circular reasoning, when it is wrong, it can be argued, stems from a pragmatic and contextual notion of how an argument is used for some probative purpose (to prove something) to another arguer (Walton 1994). But is this notion of argument use best analyzed in a dialectical or epistemic setting? Before returning to this problem, let's examine some examples, and try to see how the argumentation in each case can be analyzed as a set of propositions formed from premises and conclusions given in the case. This exercise, carried out in Section 2 through 5, will give us some basis for approaching the problem.

Following the literature and tradition in logic, the fallacy of begging the question is said to occur only in argumentation that is circular. A circular chain of argumentation is one that comes back to one of the same points it started out from earlier.[5] In such a circular pattern, there is the normal chain of reasoning from the premises to the conclusion, but there is another chain of reasoning going back from the conclusion to one of the premises, as in the sequence in Figure 1 below.

The technique for representing chains of reasoning from a set of premises to a conclusion is called argument diagramming. Theoretically then, a circular chain of reasoning like the one in Figure 1 should be capable of representation by this technique.

In systems of argument diagramming, an argument is analyzed as a set of points (nodes) representing the premises and the conclusions drawn from them by inferences. Each inference is represented by an arrow (line, edge) drawn from a set of premise nodes to a conclusion node (Freeman 1991). A linked argument, in which both (or all) premises are required to give a reason to support the conclusion, is drawn in a special way to distinguish it from a convergent argument, in which each premise offers a separate reason to support the conclusion. Once such an argument diagram is drawn up, it displays the chain of reasoning from a set of premises to a conclusion. In the diagramming system called *Araucaria* (Reed and Rowe 2002), the diagram always takes the form of a tree. This means that there

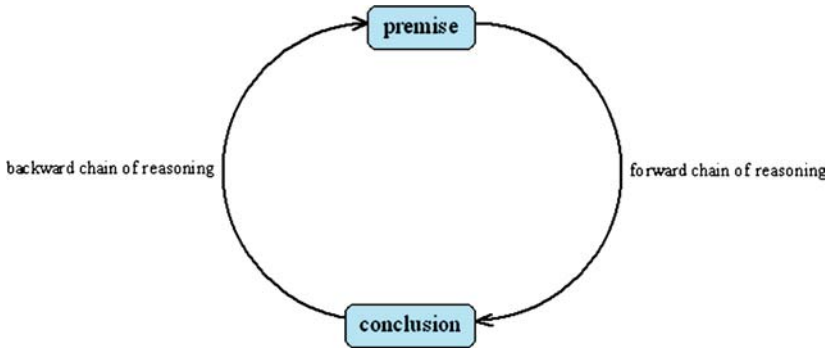

Figure 1. Circular chain of reasoning.

is always a single proposition at the root of the tree representing the ultimate conclusion of the whole argument. In law, this proposition is called the ultimate *probandum*. It also means that certain kinds of arguments cannot be represented in an *Araucaria* diagram. One is the multiple conclusion argument, also called the divergent argument, where two different conclusions are drawn from the same premise, or set of premises. Another is the circular argument, where the conclusion leads back by an arrow or pathway of arrows, to one of the premises.

There are two basic types of circular reasoning recognized in the literature on begging the question, equivalency circularity and dependency circularity (Woods and Walton 1975). In the equivalency type of circularity, a premise of an argument is either the same proposition as the conclusion to be proved, or is equivalent to it, meaning that it represents the same proposition even though the wording of the two sentences expressing the proposition is different. For example, suppose Kyle asks Paris to prove that Bay of Islands is in New Zealand, and she replies, "Bay of Islands is in New Zealand, therefore Bay of Islands is in New Zealand". This argument is an instance of equivalency circularity. It has the form "*A* therefore *A*" (where *A* is a proposition). It is deductively valid, but it is of no real use as an argument to persuade Kyle that Bay of Islands is in New Zealand, if he doubted that, and requested that Paris prove it to remove his doubt. The problem with the argument is that it fails to fulfill what is called a probative function below. In the dialogue between Paris and Kyle, the circular argument failed to prove anything to Kyle, where the term "prove" refers to a probative function of argument that uses the premises to pro-

vide evidence of a kind that gives the respondent a reason to accept the conclusion.

In most cases of equivalency circularity there is enough difference in the wording of the two propositions that their sameness is disguised. The classic case offered in so many logic textbooks is that of Whately (1870, p. 134).

The Freedom of Speech Example

> To allow every man an unbounded freedom of speech must always be, on the whole, advantageous to the State; for it is highly conducive to the interests of the community, that each individual should enjoy a liberty perfectly unlimited, of expressing his sentiments.

This argument fails to fulfill a probative function because the premise and the conclusion state the same proposition even though they use different words. Thus it is said to be an instance of the fallacy of begging the question.

The argumentation in the freedom of speech example can be represented as an argument diagram using *Araucaria*. The first step is to represent the propositions in the argument in the form of a key list.

Key List for Freedom of Speech Example

(A) To allow every man an unbounded freedom of speech must always be, on the whole, advantageous to the State.

(B) It is highly conducive to the interests of the community, that each individual should enjoy a liberty perfectly unlimited, of expressing his sentiments.

The second step is to construct an argument diagram (Figure 2) based on the key list.

The diagram in Figure 2 shows the premise and the conclusion of the argument, but it does not show any circle in the argument, nor does it give any visual indication why the argument commits the fallacy of begging the question. The reason why the argument begs the question is that the premise is equivalent (in some sense) to the conclusion. But the diagram does not show or prove equivalence of these two sentences. Indeed it treats them as two separate propositions. To spot the fallacy, the analyst has to recognize

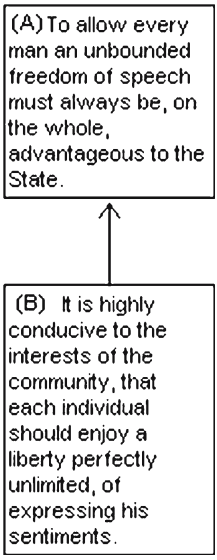

Figure 2. Araucaria diagram for the freedom of speech example.

a linguistic equivalence of the two sentences and see that they both represent essentially the same (or an equivalent) proposition. The diagram does not make such a recognition explicit, nor is there any obvious way that it can be modified to do it.

In an argument where there is dependency circular reasoning, one of the premises depends on the conclusion, meaning that the line of reasoning used to support the premise requires the conclusion as a part of the reasoning. The problem of this arrangement is with the probative function of the argument. The premises are supposedly being used to prove the conclusion. That is, they are supposedly used to remove the respondent's doubt about the conclusion. But if the conclusion has to be used to prove one of the premises, then surely that premise is dubious, because the conclusion (which is in doubt) can't be used (probatively) to remove the doubt attached to that premise. So the whole circular structure of reasoning, as a whole, is quite useless as a means of removing the respondent's doubts about the conclusion. The mutual dependency between the premise and conclusion makes the whole argument useless to prove anything. Consider the dialogue in the following example.

A standard example is the following argument, noted by Hamblin (1970, p. 34) as a common case used to illustrate the fallacy of

begging the question. The context is a dialogue between a man, Smith, and his bank manager.

The Bank Manager Example

Manager: Can you give me a credit reference?
Smith: My friend Jones will vouch for me.
Manager: How do we know *he* can be trusted?
Smith: Oh, I assure you he can.

Giving a reference is a common kind of activity in business and other affairs of practical life. It is based on trust for the person giving the reference, and relates to whether the person who is the subject of the reference is trustworthy as well. In many cases, there might not be anything fallacious in a sequence of circular reasoning. It depends on what the reasoning is supposedly being used to prove in a dialogue (Walton 1991). In this case, it has to do with what could be called the endorsement relation. When Smith gives Jones as a reference who can endorse him, the argument presumes that Jones is trustworthy, or at least that the manager can find reasons to accept Jones as trustworthy. For example, Jones might be a member of a profession that is trustworthy, or he might have a good reputation in the community. His reputation is thus used as a basis for endorsing Smith. Once the manager accepts these reasons as endorsements, they can transfer over to lead to his accepting Jones as trustworthy. From that point, a sequence of endorsements forming a chain of argumentation can function as reasons to trust Smith. This kind of chain of reasoning can go through several steps. But if, as illustrated by the dialogue in the bank manager case, it comes back to the point of origin, there is a problem. The problem is that endorsement is a kind of argumentation for assessing the trustworthiness of someone. If one person endorses another, then the second cannot be used as a reference to endorse the first. The circular argument so used is a failure of proving something that is in question in a dialogue.

The bank manager example is in the form of a dialogue. Still, it looks like it contains an argument that could be represented on an argument diagram. Let us construct such a diagram using *Araucaria*, by first formulating a key list for the example.

Key List for the Bank Manager Example

(A) My credit is good.
(B) Jones will vouch for me.
(C) Jones can be trusted
(D) I will vouch for Jones.

Given this key list, an *Araucaria* diagram can be constructed as in Figure 3.

Here once again, as in the freedom of speech example, the problem is that the diagram does not visually exhibit the circle in the reasoning, or display any other clear reason to classify the argument as an instance of the fallacy of begging the question. There may be a reason for this failure. Arguments in *Araucaria* can only be represented in a tree structure that does not allow for circular reasoning to be represented. Still, this restriction could be altered, so that we could have an automated argument diagram system that allows for circular chains of argumentation to be formed. Below, we will see how the argumentation in the bank manger example can be simply represented by such a circle in a diagram.[6] But even so, the argument in the bank manager example, as noted above, is in the form of a dialogue, and involves dialogue features concerning how Smith uses the bank manager's commitments to prove something to him.

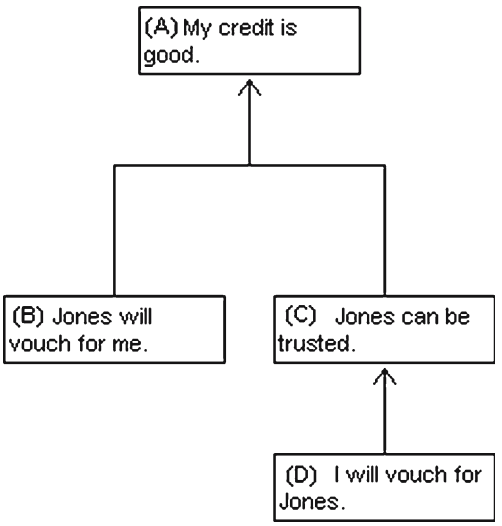

Figure 3. Araucaria diagram for the bank manager example.

Committing the fallacy of begging the question is a failure that relates to how the respondent's commitments are used by the proponent's argument attempt. To rationally convince the respondent to come to accept the conclusion that he doubts, the proponent needs to use an argument with premises that consist only of propositions that the respondent is committed to, or is prepared to accept, independently of the proposition to be proved by the proponent. The respondent is not committed to that proposition. It is in question for him, and he doubts it. This failure of independence through attempted misuse of the respondent's commitments is a key factor to spot in evaluating cases of the fallacy of begging the question. The best method for judging such more complex cases is to keep careful track of the respondent's commitments in the dialogue in relation to the theses to be proved by both sides (Walton 1994). The bank manager example above is a relatively simple one used to illustrate how the idea works. In more complex cases it can be useful to reconstruct the dialogue showing how commitment is distributed, and construct a profile of dialogue that depicts the lines of argumentation used in a given case (Walton 1991). Then you can judge where a line of argumentation is meant to go, as far as can be determined from the evidence given, and whether, in particular, it follows a path back to the conclusion to be proved in the case. The notion of the profile of dialogue will be introduced below.

The bank manager example is a very good case of the dependency *petitio* that can be used to illustrate the fallacy to beginners. But like any real example, it has a few special twists. Like many examples of a fallacy, it is on the borderline with some other fallacies. Because it has to do with the giving of a reference, it relates to other fallacies, like the *ad verecundiam* and *ad hominem* that have to do with matters of the reputation of an agent and the trustworthiness of a source.

3. REPUTATION MANAGEMENT PROBLEMS IN MULTI-AGENT SYSTEMS

Curiously, many of the issues of trust reputation and sincerity of arguers raised by the bank manager case have now surfaced in multi-agent computing (Ramchurn et al. 2004). Information on the world wide web is more and more being accessed and collected by software devices called agents. The agent is an entity that can not

only collect information but can also carry out actions based on it. For example, as indicated by Maximillien and Singh (2002, p. 22), a personal money management software like *Quicken* could integrate with a brokerage firm to collect the latest stock and mutual fund information, and then help with a client's portfolio management. An agent must not only perform the task of collecting information, but also that of sorting out the reliability of the information. In particular, an agent must be able to judge whether another agent should be considered an expert source of information. The need for agents to have this capability has led to another that is vitally important, the capability to produce accurate referrals. According to Yu et al. (2002, p. 1), the quality of the network is maximized when an agent can exercise both of these capabilities. Recent research in computing is giving much attention to the problem of these referrals. These referrals, unlike hard security procedures like passwords, are based on trust. What is required is a technology for reputation management (Yu and Singh 2000, p. 1). This technology represents the problem faced in the analysis of *ad verecundiam* and *ad hominem* argumentation. The structures of these forms of argument are based on assumptions about the reliability, character and reputation of a participant in a dialogue.

These issues of trust and referral raise a larger question. How should we see the two participants engaged in argumentation in a dialogue? Are they merely repositories of commitments, as Hamblin's treatment of them seems to suggest? Or should they be treated as having commitment to qualities of trustworthiness and sincerity that are important to collaboration in a dialogue. These properties are important not only in recent technologies for multi-agent systems. In the past they have been stressed in the maxims of politeness in Grice (1975) and in the Aristotelian notion of *ethos*, or the character of a speaker. The obvious suggestion would be to extend the notion of a participant in a dialogue to make it have some of the properties of a rational agent, in the sense of (Wooldridge 2000). According to this way of proceeding, the proponent and the respondent in a dialogue could be treated as agents that not only have the capability to interact with each other, but also have some perception of their environment, and the capability to react to that perception. There are four characteristics of the so-called "weak notion of agency" given by Wooldridge and Jennings (1995, p. 116).

1. *autonomy*, or control over actions.
2. *social ability*, or interacting linguistically with other agents.
3. *reactivity*, the agent's ability to perceive its environment.
4. *pro-activeness*, the ability to not only be affected by that environment, but to anticipate it, and to exhibit goal-directed behavior, by taking an initiative.

The four additional characteristics of an agent, characteristic of a "stronger" notion of agency, are mobility, veracity, benevolence, and rationality (Wooldridge and Jennings 1995, p. 117). Their notion of veracity is especially worth remarking on in connection with the fallacies cited above.

In the approach of Yu and Singh (2000, p. 4) an agent *a* assigns a reputation rating to an agent *b* based on three kinds of evidence: *a*'s direct observations of *b*, the ratings of *b* given by *b*'s neighbors, and *a*'s ratings of these neighbors. This rating is a measure of the trust *a* has in *b* as a source of reliable information. The trust rating can be then be updated as an exchange of messages on the internet proceeds. For example, if *a* encounter a "bad partner" during the course of an exchange, *a* can penalize this partner by decreasing its rating and informing its neighbors (p. 6). The so-called neighbors are other agents that a given agent would normally contact and refer other agents to (Yu and Singh 2002, p. 2). For example, suppose *a* appeals to expert source *b* in order to support his argument against dialogue partner *c*, but *c* shows that *b*'s opinion is inconsistent with other opinions that *b* has offered in the past, *a* could then decrease his trust rating of *b*. In logical terms, this would amount to *a* using an *ad hominem* argument to attack the reputation of *b*. So both *ad verecundiam* and *ad hominem* as potential fallacies would be involved in such a case. Neither form of argument might be fallacies.

It can easily be seen how exchanges of this sort by agents on the internet take the form of a dialogue. The agent asks a question by sending out a query on the internet. The responses are then collected. Then the responses must be evaluated to judge their worth as evidence useful as a basis for taking action. This sequence can easily be seen as parallel to argumentation in a dialogue using appeal to expert opinion and other forms of argumentation cited above. The arguer must ask a question. Then when he gets some information from a source in answer to the question, he must evaluate the worth of the argument using critical questions. The critical questions raise

the same kinds of issues about trust and reputation as trust ratings in agent technology.

One of the agent technology methods devised by Yu et al. (2002, p. 6) is a referral graph, which shows how computation spreads in a social network. Each node of the graph is an agent and the lines connecting the nodes represent queries that are attempts to get information. A simplified version of the example given by Yu et al. (p. 6) illustrates a referral graph, shown in Figure 4.

In this example, a makes a query to *b*, who in turn makes a query to *e*, but gets no answer. Then *a* makes a query to *c*, who in turn makes a query to *d*, who gives a good answer. The outcome is that the expertise ratings of *d* and *e* are updated accordingly. Of course, this case is a very simple example. A real case might have quite a long chain of questions and replies with many referrals.

This same sort of graph structure can be used to model the argumentation in the bank manager case, revealing a very simple circular sequence of argumentation (Figure 5).

Even in this very simple case, the referral graph reveals the essence of the problem of how begging the question can be judged as a fallacy. It is clear that it should be a requirement of referral graphs that circles in the graph should be banned. For example, any graph of the following sort might be found to have a circular sequence of referrals in it (Figure 6).

Any chain of argumentation based on a sequence of referrals represented by a referral graph with a circle in it may need to be revised, in order to deal with the issue of whether the fallacy of begging the question has been committed. A tree is an acyclic graph (Harary 1972), but the diagram above contains a circle (*a*, *c*, *b*). The argumentation in Figure 6 is even more problematic, however, since node *d* seems to provide independent support for *b*. This form of

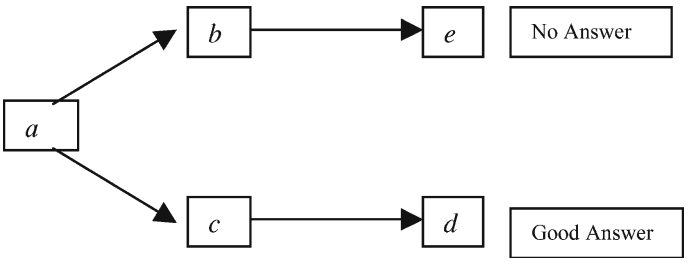

Figure 4. Example of a referral graph.

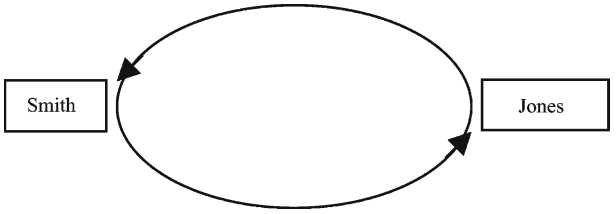

Figure 5. Referral graph of the bank manager case.

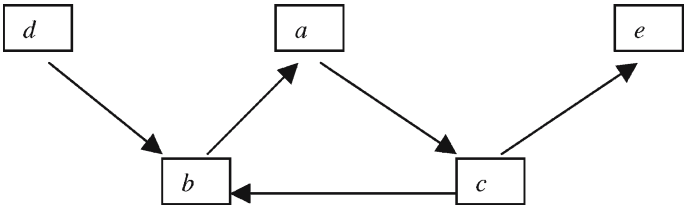

Figure 6. Referral graph with circle in the sequence of argumentation.

referral argument is circular, but does not seem to commit the fallacy of begging the question in the chain of referrals. Dealing with hard cases of this sort seems to require some data other than that merely furnished by the argument diagram, perhaps some information about the context of use of the argument.[7]

One of the problems with referral graphs is that dialogue sequences of referrals in them can be extended indefinitely, as illustrated in Table I.

Such a sequence of referrals can continue indefinitely. The respondent needs to keep asking for another referral, and the proponent can move to a new source each time. Thus the sequence of referrals becomes an infinite regress. The proponent can keep the sequence moving by simply using a new source each time. Such a continuing sequence is a legitimate form of argumentation, but the problem is

TABLE I

Continuing referral dialogue sequence

Proponent	Respondent
Source *a* is trustworthy.	How do you know that?
Because source *b* says that source *a* is trustworthy.	How do you know that source *b* is trustworthy?
Because source *c* says that source *b* is trustworthy.	How do you know that?

that the probative function is never fulfilled. Thus some rule of dialogue must ban the possibility of an infinite regress.

The same kind of problem arises from a circular sequence of referrals, as illustrated in Table II, below. The circular sequence shown in Table II has only three sources that have been consulted, but the possibility arises that there that could be quite long sequences of this sort. The problem posed by such circular sequences of argumentation is a failure of the probative function. If you have an argument based on referral from a source, why can't you have a line of argumentation that comes back to reliance on that original source? It is because the worth of the original source is in question. Allowing the source to testify to its own worth as a source is a failure of the probative function to be fulfilled. To ban circular argumentation in a referral sequence, the following referral rule can be adopted.

Non-circularity Rule. In a continuing referral dialogue sequence, once a referral to a source x has been appealed to at any given point in the sequence, that same source x must not be used for a referral at any next point.

The reason for the non-circularity rule is essentially the same as the reason for the failure of a continuing referral dialogue sequence that goes on and on without coming to a source that can be trusted without further references. It is a failure to fulfill the probative function. Both failures relate to the premises required to fulfill a probative function in a dialogue. The argumentation may be formally reasonable as a structure of argumentation, meaning that it is an instance of an argumentation scheme. But as used by a proponent in a dialogue, it may fail to prove anything to the respondent. If the respondent has doubts about the conclusion, he can

TABLE II

Circular sequence of referrals

Proponent	Respondent
Source *a* is trustworthy.	How do you know that?
Because source *b* says that source *a* is trustworthy	How do you know that source *b* is trustworthy?
Because source *c* says that source *b* is trustworthy	How do you know that source *c* is trustworthy?
Because source *a* says that source *c* is trustworthy	You have begged the question.

only be persuaded rationally to remove those doubts if the premises of the argument are statements he either accepts already or can be brought to accept through further argumentation (Walton and Krabbe 1995). At some point, he must be presented with premises he can commit to, independently of his doubts about the conclusion. It is uncertain whether the non-circularity rule applies to all cases equally well (Walton 2006). But its formulation is a first step toward dealing with the kind of problem posed by the bank manager case.

4. CONTEXT DEPENDENCE OF BEGGING THE QUESTION

It has been hypothesized that whether circular reasoning begs the question is context-dependent, both with respect to the type of investigation the reasoning was used in, and the stage the investigation was in Walton (1991). But the difference may even be more deeply context-dependent. It may depend on the field (domain of knowledge) of the investigation. Abelson and Sussman (1996, pp. 21–22) have presented an example from the field of computing, showing an important difference between mathematical functions and computer procedures, that supports this hypothesis. In mathematics, the square root function can be defined as follows (p. 22).

$$\sqrt{x} = y \quad \text{such that} \quad y \geq 0 \text{ and } y^2 = x.$$

This equation represents a genuine mathematical function that could be used to recognize whether one number is the square root of another, or to derive conclusions about square roots. However, "it tells us almost nothing about how to actually find the square root of a given number" (p. 22). Suppose we were to re-express the definition as a computer programming procedure as follows: define square root of x such that y is either greater than or equal to 0, and $x =$ the square of y. This paraphrase of the pseudo-Lisp definition that Abelson and Sussman wrote out (p. 22) does not describe a procedure that is useful in computing, for "it tells us almost nothing about how to actually find the square root of a given number". In this context, it "only begs the question" (p. 22). The example might be taken to show that a proposition that describes a legitimate mathematical function and represents an item of mathematical knowledge only begs the question when reformulated as an equivalent proposition in a different field, computing.

However, there are some questions about how the example should be interpreted. One interpretation is that the function not saying that the square root of x equals y because y squared equals x, but the square root of x equals y only when y squared equals x. As such, one could say that the formula remains valid in computing, but may not be as useful, because the computer lacks the intelligence to handle it. The function, so interpreted, may be an item that needs a different representation in computing than it does in mathematics, where a different kind of knowledge is involved. The reason for this variability, according to Abelson and Sussman (p. 22), is that mathematics is normally concerned with what they call declarative knowledge (descriptions of what is), while computer science is usually concerned with imperative knowledge (descriptions of how to do things).

Such examples suggest that an analysis of begging the question that takes subtleties in the context of how an argument is used in a context of knowledge into account may do more justice to problematic cases. The fallacy of begging the question can be explained as a kind of knowledge-dependent reasoning as follows. Circular reasoning occurs in a case where there has been a chain of reasoning from a premise to a conclusion, but also another chain of reasoning going from the conclusion back to the premise. Such a case of a circular argument becomes a case of begging the question where it is argued that the conclusion is known to be true on the grounds that the premise is known to be true, but where it also argued that the premise can only be known to be true on the grounds that the conclusion is. Thus begging the question is matter of how claims about knowledge are justified by other propositions that are also claimed to be knowledge. Thus the example above suggests that whether something is an instance of begging the question is dependent on how it is interpreted, how it is used, and what field of knowledge it is used in.

Such matters of context-dependency makes us wonder whether the context that accounts for the variability of whether circular reasoning begs the question is epistemic, an issue we return to below. This case from computing also might even make us wonder whether all circular reasoning is immune from some kind of subtle charge of question-begging. People tend to be suspicious about circular argumentation, but not all cases where circular reasoning has been used are fallacious (Walton 1985). In the following dialogue, the respondent is asked a question requesting an explanation, but the sequence of reasoning in the explanation is circular.

The Recession Example

An economist is asked why the economy is in recession in a certain state at present, and she replies: "Right now a lot of people are leaving the state, because taxes are too high". But when asked why taxes are so high, she responds: "Well, a lot of people are unemployed, because of the recession".

In this case, it is easy to see how the reasoning of the economist is circular, as shown in the diagram of the recession example (Figure 7).

But should this circular reasoning be taken as an indication that the economist has committed the fallacy of arguing in a circle? Not necessarily, because the circularity in this case could be simply due to the feedback loops inherent in human behavior. It's true that as people leave the state, that makes the recession in the economy worse, especially if these persons are taxpayers, and productive contributors to the economy. But as the recession gets worse, and is perceived as being worse by the people in the state, this perception causes more of them to leave, and to seek employment elsewhere. The circularity is inherent in the situation.

A parallel situation in a physical system where feedback produces a circular process is the following case: the more overweight a diabetic gets, the more insulin is produced in his blood, but the more insulin there is in his blood, the more he eats, and the more he becomes overweight. Such a process is known as a vicious circle – a circular sequence of causally connected events that makes itself worse and worse by a continual process of feedback around the circle. Similarly, in the previous case, the recession becomes worse and worse, as more and more people leave

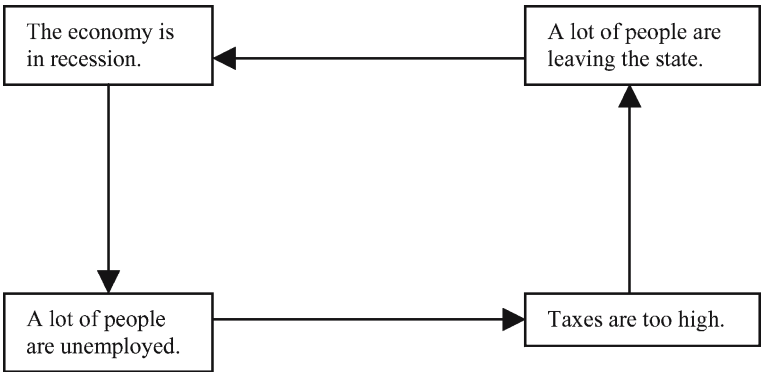

Figure 7. Diagram of the recession example.

to escape it. In the recession case, we are not sure whether the economist is attempting to give an explanation of the recession, or to give an argument to show that such a recession really exists. But in either case, she is using a sequence of reasoning. That the reasoning is circular, however, doesn't necessarily mean it is fallacious. In other words, not all vicious circles are fallacious.[8]

Normally, a circular explanation would fail to fulfill the increase of understanding function, because what is initially not understood, as indicated by the request for explanation, cannot itself provide the increased understanding the questioner needs (Walton 2005, p. 198) if the reasoning used in the explanation rests on this same notion. Despite this general failure of circular explanations to be useful in performing this function, in some cases, a certain kind of clarification can be achieved, even where the sequence of reasoning is circular. In the example above, the economist's explanation does clarify the situation, to some extent, to the respondent, by showing how a complex feedback relationship exists among several variables, represented by the propositions exhibited in Figure 7. In this case, the explanation given by the economist is a causal explanation that clarifies the causal relationships among a number of connected factors in an economic situation. In the recession example there is a time dependence that cannot easily be shown on the diagram. Many of the explanation methods currently used in heuristic expert systems do not take such factors into account (Lacave and Diez 2004). By exhibiting these relationships, and showing the feedback effect exhibited by how they work, the economist has offered the respondent some increased understanding on why the economy is in recession in this particular state at present. It could be seen as a valid explanation of an independently occurring cyclical system. As a somewhat useful explanation, the economist's reply is not a total failure. It does help the questioner to understand what is going on, in a certain respect. Hence in this kind of case, it is important to be able to recognize that the sequence of reasoning used in the explanation is circular, but it would be inappropriate to wholly condemn the explanation as completely useless for all purposes of increasing understanding.

5. CIRCULAR ARGUMENTS AND CIRCULAR EXPLANATIONS

Circularity, however, is a problem that can affect explanations as well as arguments. Circular explanations are commonly criticized in logic

textbooks, and the circularity in such cases is generally felt to represent a significant failure. It is unclear whether such cases fall under the category of the fallacy of begging the question. Indeed, the traditional treatment of circular reasoning in logic textbooks and manuals shows little consensus on several key issues. Is circularity of reasoning always fallacious? Is the failure of a circular argument, when it commits the fallacy of begging the question, the same as the kind of failure exhibited in a circular explanation? What is the difference between an argument and an explanation? What is the difference between reasoning and argument? Are explanations based on reasoning? All these unanswered questions show how little we know about the precise nature of the failures alleged in circular arguments and explanations. A viewpoint I have advocated elsewhere (Walton 1990) is that reasoning is used in arguments. In recent work in computing, especially in expert systems technology, it is assumed that reasoning is also used in explanations (Cawsey 1992). It is assumed that an explanation involves a tracing back from a proposition to be explained by a chain of reasoning to other propositions in a database.[9] Thus in what follows the assumption will be adopted that reasoning is used in both arguments and explanations.

A main problem with begging the question that argumentation theory is still far from being in a position to solve concerns cases in which the circular reasoning occurs in a chain of reasoning mixing arguments and explanations. This phenomenon is highly visible in the examples studied empirically by Rips (2002). The main example he used in his experiments concerns a chain of argumentation used to support the claim, 'Evanston should make it illegal to tear down warehouses'. Rips (2002, pp. 768–769) presented the argumentation in the form of a dialogue.

The Warehouse Dialogue

Allen: The Evanston City Council should make it illegal to tear down the city's old warehouses.
Beth: What's the justification for preserving them?
Allen: The warehouses are valuable architecturally.
Beth: Why are they so valuable?
Allen: The older buildings lend the town its distinctive character.
Beth: a. But what's the reason the warehouses give it character?
b. But, anyway, why do you personally like these warehouses?
Allen: The warehouses are valuable architecturally.

Rips (2002, p. 771) constructed an argument diagram, shown in Figure 8, to exhibit the sequence of reasoning in the warehouse dialogue.

Notice that the diagram in Figure 8 represents a dialogue sequence in which several why-questions are exhibited at various stages. For example, after the initial claim was put forward, the other side made what Rips calls an "explanatory query" asking "Why should Evanston make it illegal to tear down warehouses?" In answer to this query, an "explanation" is put forward, containing a "subargument". The subargument is "Warehouses are valuable". At the next step, another explanatory query is made, "Why valuable?", and a claim "They have distinctive character" is made as a subargument that answers the question. The example is quite a good one to illustrate begging the question, but from a point of view of argumentation it is terribly problematic. The reason is that the sequence of reasoning, as Rips analysed it, contains a mixture of arguments and explanations, linked to each other in the sequence.

Even the classifications of the speech acts that Rips has offered are, I believe, problematic. He classifies a question like, "Why should

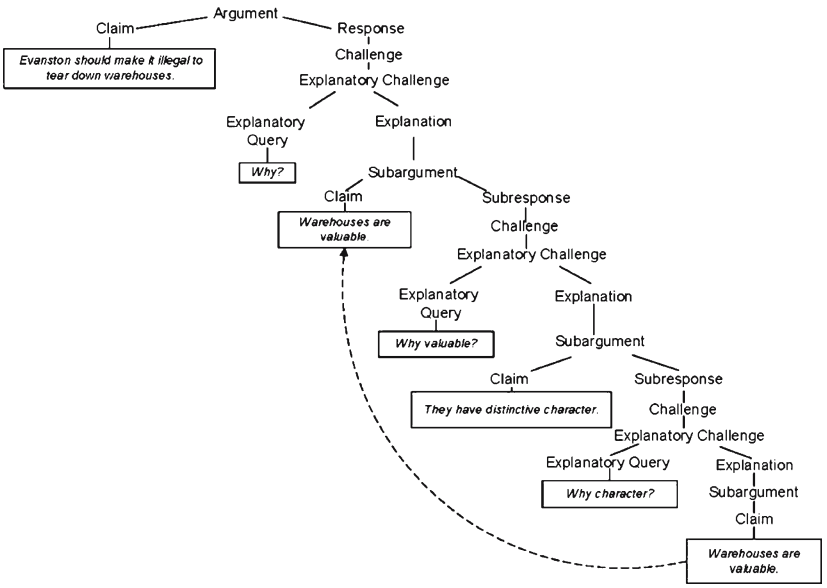

Figure 8. Sequence of reasoning in the warehouse dialouge.

Evanston make it illegal to tear down warehouses?" as an "explanatory query". But following the analysis of why-questions in formal dialogue systems offered by Hamblin (1970), such a question would be analyzed as a request for justification. It is a speech act of a kind that requests a reason to support the claim that Evanston should make it illegal to tear down warehouses. On the other hand, the question "Why are warehouses valuable?" could be taken either way. It could be taken as a request for an explanation of why they are valuable, or as a request for an argument supporting the claim that they are valuable. I certainly agree with Rips that there are examples of circular reasoning like the ones he cited in which there is a mixture of argumentation and explanation in the sequence of reasoning in the case. But such a mixed case is uniquely difficult to evaluate when it comes to the question of judging whether the circular reasoning commits the fallacy of begging the question. The reason is that circular explanations are fallacious, or at least deficient, for a different reason than circular arguments are fallacious. The failure of a circular argument is that it is useless to fulfill the probative function. The failure of a circular explanation is harder to diagnose until we have some proper analysis of the speech of explanation, something currently lacking in argumentation theory (Walton, 2005). All argumentation theory can tell us at this point is that argument and explanation are different speech acts, and that in analyzing and evaluating cases, it is vitally important not to confuse the two speech acts.

Reasoning can lead in any direction, and in many cases, inferences may be drawn purely for the sake of curiosity to see where a sequence of reasoning might lead. In such cases, a line of reasoning may go off on a tangent, leading far away from the subject of the original premises. In other cases, reasoning can go in a circle, where some premises are used to reason forward towards a conclusion, but then when reasoning backward to support the premises, we come right back to the conclusion. In such a case, the chain of reasoning comes right back to the point of origin. There is nothing necessarily wrong with a circular sequence of reasoning, as reasoning, because each step in the sequence could be structurally correct (as a deductively valid, inductively strong, or practically acceptable inference). But there can be a problem if the circular reasoning is supposed to be used for some purpose in a dialogue – for example

to put forward an argument or an explanation. Consider the following pair of dialogues.

The Melatonin Dialogue

Rob: Melatonin is so effective. Why does it make you go to sleep?
Fay: It has dormative powers.

The Free Will Dialogue

Alex and Judy are having a philosophical argument about free will. Alex doubts whether free will exists, claiming that all actions seem to be determined by prior causes. Judy replies: "Free will certainly exists because as human beings, we have the power to choose."

In the Melatonin dialogue, Rob's why-question asks for an explanation of what is taken to be a fact (Melatonin makes you go to sleep). It is a requirement of a successful explanation that increases the questioner's understanding of something he fails to understand. Rob does not understand why Melatonin makes you go to sleep, or so his question implies. Fay's reply that it has dormative powers fails to increase his understanding because it is circular. To say something has "dormative powers" only means that it makes you go to sleep. The offered explanation fails because it is circular. It doesn't tell Rob anything he doesn't already know. In the free will dialogue, in contrast, Judy's reply is an argument. Likewise, it fails because it is circular. But the failure in this case is not one of a failed explanation. It is one of a failed argument.

Sanford (1972, p. 198) stated that a primary purpose of an argument is to increase the degree of reasonable confidence in the conclusion. Wilson (1988, p. 39) criticized this view as too narrow, by citing other purposes an argument can have. It can be used to refute a proposition. It can be used to better understand a passage or text of discourse. It can be given to explain, understand or predict. It can play a part in solving a puzzle. Only by moving forward on Sanford's hypothesis that there is a central purpose of using an argument can we get out of the quagmire rightly indicated by Wilson's remarks to the effect that, in real cases, argument and explanation are often inextricably combined. What needs to be stressed is that the central purpose of using an argument is to try

to prove something, some proposition that is in doubt, and is not known to be true or false. Sanford describes this central purpose in BDI terms as one increasing reasonable confidence in the conclusion.

Whether or not the fallacy of begging the question occurs in a case of an argument depends on what is called the *probative function* of the argument in the dialogue. The probative function involves the use of the premises in the argument as a basis to justify the conclusion so that the respondent, who initially doubted the conclusion, will now come to accept it because of how these premises (and the argument itself) were used by the proponent. The probative function is the use of an argument to remove doubts or reservations that the respondent has about accepting the conclusion of the argument (Walton 1991, pp. 293–297). Whether an argument can rightly be said to commit the fallacy of begging the question or not in a case depends on whether the probative function has been fulfilled or not. The problem with an argument that is an instance of the fallacy of begging the question is that such an argument cannot fulfill the probative function it is supposed to be used to fulfill. It is this probative failure that is at the root of the fallacy of begging the question. The fallacy of begging the question is a probative failure, because it is a failure of an argument to be useful as a reasonable means by a proponent to prove something to a respondent in a dialogue where the respondent initially doubted that proposition. In the bank manager case, the manager initially questioned the trustworthiness of Smith. His doubts about this can only be resolved through the reference procedure by getting a reference from someone he does trust, or can be led to accept as trustworthy by appealing to others he trusts. In this chain of reasoning, it is pointless to appeal to Smith himself as a person who can be trusted, because that is precisely what is in doubt. Because of this circular dependency, the probative function cannot be fulfilled. The argument is useless to fulfill its function in the dialogue.

Thus circular reasoning can be useless for two purposes when used in a dialogue between two parties. If the speech act is that of an argument, the fallacy of begging the question can be a failure on the part of the arguer to fulfill the probative function in the dialogue exchange. If the speech act is that of an explanation, the circular reasoning can also be fallacious, but for a different reason. The reason is that it fails to fulfill a function required by a successful explanation. That function is one of increasing

the understanding of the questioner who asked for the explanation (Walton 2005, chapter 6). Where circularity is detected in a sequence of reasoning in a dialogue, the analyst needs to look at the evidence given in the text of discourse to see whether the reasoning is meant to be an argument or an explanation.

6. WHEN IS CIRCULAR REASONING FALLACIOUS?

What then is the difference between a case where circular reasoning has been used fallaciously and a case where it has not? The difference has to do with the probative function of argument, or with the clarifying function of an explanation. Thus the first job of analyzing a given case is to determine whether the text of discourse in the case represents an argument or an explanation. As shown above, dealing with cases identified as explanations is more problematic. In the case of an argument, the failure is easier to pin down, assuming that the probative function can be clearly defined and identified. The probative function of an argument is the use of the premises by the proponent in a dialogue as evidence to get the respondent to accept the conclusion by, first of all, accepting the premises, and then inferring the conclusion from those premises by reasoning that it is structurally correct. When the proponent of an argument presents it to a respondent, the probative function is what makes an argument useful to persuade the respondent that the conclusion is true (or acceptable). It brings forward an inference containing premises that the respondent has already accepted (or can be led to accept) as commitments. Given the probative function of such an argument, the respondent's doubts about the conclusion can be overcome. How? If he has no comparable doubts about the premises of the argument, and the inference is of a kind he generally accepts, or recognizes as valid or strong, such a probative argument moves forward, requiring the respondent to accept the conclusion. By such a probative argument the respondent's doubts are removed, and he is reasonably persuaded to accept the conclusion. However, the probative function works in a unidirectional way that cancels out its effectiveness or value as an argument, if it goes both ways, as in a circular argument.

Consider the following example.

The Tipping Example

Bob and Helen are having a dispute on whether tipping is a bad practice or not. At one point, Helen argues for her thesis that tipping is a bad practice by saying that people who receive tips feel undignified. Bob then asks, "Why do they feel undignified?" and Helen replies, "Because tipping is a bad practice".

The problem with this circular argument is that it cannot fulfill the probative function, because Helen is using the same proposition as premise that she is supposed to prove as her thesis in the dialogue. Hence the fallacious use of circular reasoning to merely ask or "beg for" the thesis one is supposed to prove in a dialogue is called begging the question. This fallacy is the use of circular reasoning to avoid fulfilling the probative function in an argument, where fulfilling the probative function is required by the type of conversation the participants are supposed to be engaged in.

The tipping example is a clear case where it can be shown the fallacy of begging the question has been committed. The reason is that the description of the example makes it clear that there is a dialogue in which one party has taken on the burden to fulfill a probative function by putting forward an argument to the other party. The recession example shows the added difficulty involved when the job of the respondent in the dialogue is one of offering an explanation, as opposed to offering an argument. The circle there does seem to be a failure akin to the fallacy of begging the question, because there is a failure to properly explain what has been queried by the other party. Instead of a failure to fulfill the probative function, as would be required of an argument, there is a failure to say something that would increase the questioner's understanding. However, even by exhibiting the circular sequence of reasoning, the explanation attempt may be partially successful in this regard. It may reveal to the questioner a sequence of reasoning exhibiting feedback among several variables that he didn't understand before.

Below is an additional dialogue that can serve as a case study problem for analysis.

The Bus Service Example

City Hall: Why should the bus services to this suburb be improved?

[300]

Citizens
Committee: Because the bus service is poor. Also, the suburb is well populated by city workers who commute, and many signatories are in favor of improved services. Both these things are true, and if they are true, the bus services to this suburb ought to be improved.
City Hall: Why is the bus service to this suburb so poor? Isn't it because not enough people take the bus?
Citizens
Committee: Yes, in a way it is because not enough people take the bus. If not enough people take the bus there is no incentive to improve the services. If there is no incentive to improve the services, the service remains poor.
City Hall: Perhaps, but why is it that not enough people take the bus?
Citizens
Committee: Because the service is so poor. If the service is so poor, fewer people are inclined to use it. Instead, they take their cars.

This case is interesting for several reasons. It is in the form of a dialogue, and the dialogue evidently contains an argument in which one participant argues for its claim that the bus service should be improved. But as the dialogue proceeds, it becomes clear that what is going on is not just an argument, but also partly an explanation. At the same time, it is easily evident that the chain of reasoning goes in a circle, and that begging the question is involved. It would be quite easy for a textbook to convince students that the case is an example of the fallacy of begging the question. Yet the case is very complex to try to analyze. Let us begin by forming a key list of the propositions.

Key List for the Bus Service Example

(A) The bus services to this suburb should be improved.
(B) The bus service is poor.
(C) The suburb is well populated by city workers who commute.
(D) Many signatories are in favor of improved services.

(E) If the bus service is poor, and many signatories are in favor of improved services, the bus services to this suburb should be improved.
(F) Not enough people take the bus.
(G) If not enough people take the bus there is no incentive to improve the services.
(H) If there is no incentive to improve the services, the service remains poor.
(I) If bus service is poor, fewer people are inclined to use it.

The formation of this key list is based on an analysis of the steps of reasoning in the example that requires deletion of some parts of the text not thought to be required to represent the basic steps of reasoning, on an initial analysis, at any rate. To visualize these steps, and the sequence of reasoning connecting them, the diagram in Figure 9 has been constructed.

The argument is an enthymeme, an argument with an unstated premise or conclusion (Walton and Reed 2005). An implicit conclusion, "There is no incentive to improve the service" has been inserted, which also functions as a premise in the argument for conclusion B. The linked argument from C, D, and E to A has a kind of *modus ponens* structure, which could be represented on the diagram. However, we leave the analysis in a preliminary and rough form that is adequate for your purposes. What is important to see is that it can be seen from the dialogue in the example that the line of reasoning continues one step further than is represented on the diagram. In a linked argument supporting F, premise I is meant to be used along with premise B. Thus to complete the diagram, we need to draw an arrow from B going along with I and leading as a linked argument into F. Drawing such a line would display a circle in the right side convergent argumentation leading into the ultimate conclusion A.

This case is an interesting one, as mentioned above, for several reasons. It shows that although the argument diagram is useful to sum up an analysis of the main lines of reasoning, it is insufficient to provide all the evidence needed to prove that the case is one of begging the question. First, it does not represent the circle in the reasoning. That has to be added in. Second, it does not represent other complex things going on in the dialogue. One of these is the mixture of argument and explanation.

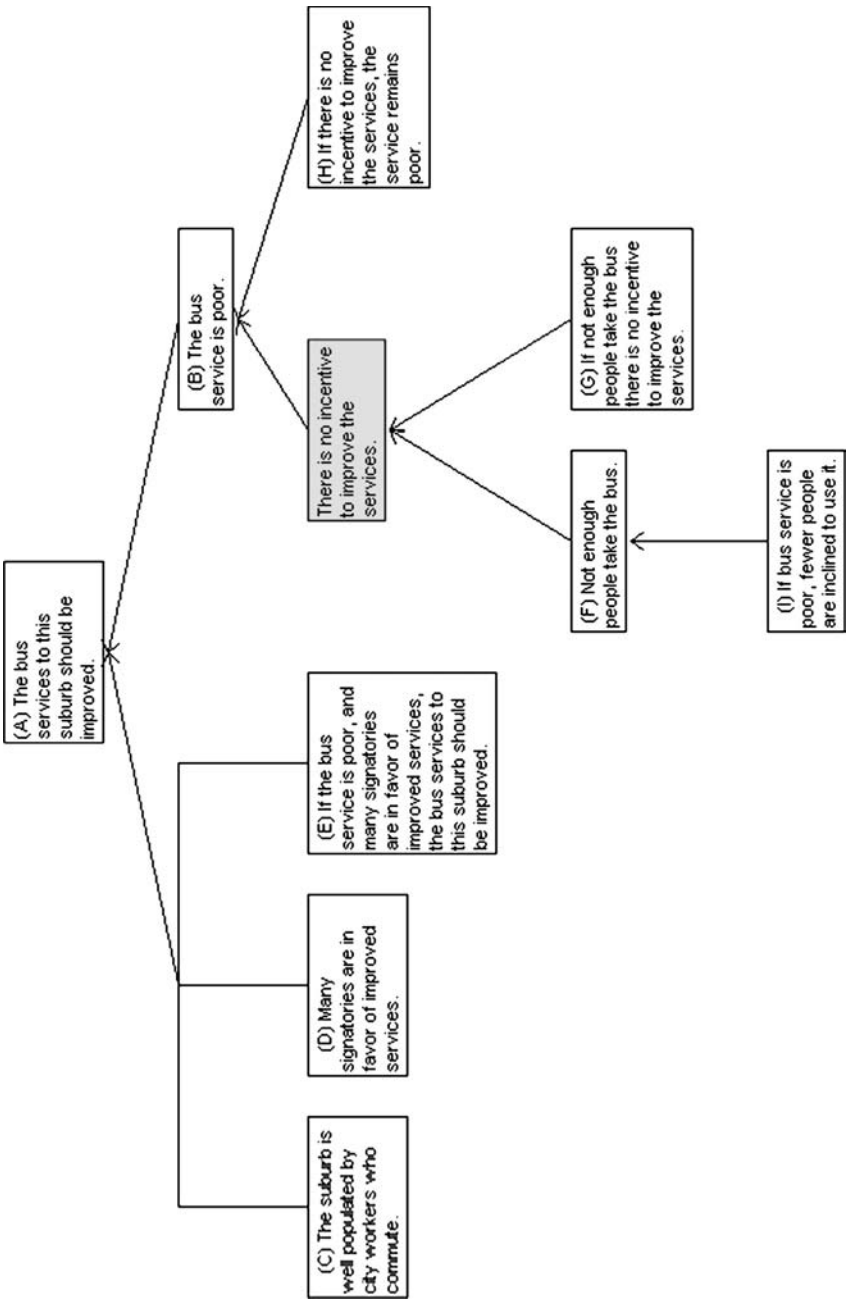

Figure 9. Araucaria diagram for the bus service example.

Through analyzing such cases several main lessons are brought out. One is that circular reasoning is not inherently fallacious. Another is that whether the circular reasoning is fallacious or not depends on how it was used in the given text of discourse as part of a goal-directed dialogue. Is the purpose of the reasoning to prove something that is in doubt, or it supposed to make the questioner come to understand something he didn't understand before, or at least says he doesn't understand? In the first instance, the fallacy of begging the question is a failure of the reasoning to fulfill the probative function. In the second instance, the failure of the circular sequence of reasoning used by the respondent is that it fails to enable the questioner to understand what he asked about.[10]

In both instances, the failure is not in the reasoning itself. It is in how that reasoning was used to fulfill some goal in a conversation that represents a goal-directed dialogue that the questioner and respondent are supposedly taking part in. This point is made abundantly clear by the fact that in order to even begin to analyze any case of circular reasoning where begging the question is suspected, the analyst must examine the issue of whether the speech act in the given case is that of argument or explanation. For the analysis, and how the alleged fault is to be diagnosed and treated, will be different. As shown above, the cases where the text is supposed to represent an explanation are subtler in certain respects and the fault is harder to pin down. Also, less is known about how to identify explanations, and what their properties are generally. They represent a frontier for argumentation theory that has not been much explored yet.

7. PROBLEMS OF RETRACTION IN THE DIALECTICAL HYPOTHESIS

According to the account given in (Woods and Walton 1978), the fallacy of begging the question can easily be modeled in the formal games of dialogue described by Hamblin (1970). In such games of dialogue, the asking of a why-question by one participant is a request for the other party to prove the statement queried, or offer an argument supporting it. For example, if the proponent asks "Why *A*?", the respondent is supposed to offer another statement, or set of statements, that are premises in a valid argument that has *A* as its conclusion. Thus if the proponent asks "Why *A*?" and the respondent replies "*B*", it means that the respondent has produced a valid argument for *A* with *B* as its only premise.

The Hamblin dialogue is commitment-based. Thus in order to produce an argument that proves *A* to the respondent, the respondent must be committed to the premise *B*.[11] This commitment is then transferred to the conclusion, assuming the argument is valid. Such an argument is probatively successful in the sense that it proves *A* to the respondent. What we have done, in effect, is to apply the following probative rule.

(PR) If one participant in a dialogue asks "Why *A*?", for the other participant to successfully reply, he must produce an argument containing only premises that the first participant (the question-asker) is already committed to.[12]

This rule shows some promise of banning the fallacy of begging the question, if the fallacy is defined as being committed where an arguer uses some proposition he is trying to prove, but which has not been proved yet and is still under dispute, as a premise in her argument. But (PR) by itself does not appear to ban even the most transparent instances of circular argumentation. Consider the sequence shown in Table III.

The respondent's reply assumes that the proponent must have been committed to *A* when she asked the question "Why *A*?" But that is all right, as long as there is no rule that the asker of a question of the form "Why *A*?" must be uncommitted to *A*.

What happens in the cases of a dependency circularity argument, for example, as illustrated by the circular sequence of argumentation shown in Table IV?

TABLE III

Equivalence circularity dialogue sequence

Proponent	Respondent
Why *A*?	*A*

TABLE IV

Dependency circularity dialogue sequence

Proponent	Respondent
Why *A*?	*B*
Why *B*?	*A*

The proponent asks "Why A?" at her first move, and for the respondent's attempt to prove A to be successful, the respondent must be committed to B. But then there is nothing to prevent the proponent from asking "Why B?" at her next move, and there is nothing to prevent the respondent from answering "A". And so generally, there is no rule banning circles in dialogue games, at least no rule considered so far. The circular dialogue sequence above is consistent with (PR). For the respondent to successfully answer at his first move, the proponent must be committed to B. But it is perfectly legitimate for the proponent to ask the respondent to justify B at her next move. For there is no rule, so far, that requires a participant be uncommitted to a proposition A if she is to be able to ask the question "Why A?". Thus in the circular dialogue sequence above, there appears to be no fallacy of begging the question, as the rules of dialogue stand.

This circular sequence can occur in more complex argumentation involving a series of question-reply moves of this sort involving a chain of argumentation between A and B.

To show the pattern (profile of dialogue) for this kind of argumentation consider the sequence of argumentation shown in Table V, carried through to $n+1$ moves.

At his last move the respondent replies to the request for justification by using as a premise the same proposition he questioned earlier in the sequence. Indeed, in the kind of case represented above, he uses the first proposition queried as his premise for the argument he put forward in his last move. Thus the argument has gone in a circle, even though the circularity of the argumentation may be concealed, or made less visible, by the length of the sequence of moves. Rips (2002) conducted experiments to study how people react to lengthy examples of circular argumentation of

TABLE V

Circular dialogue sequence with chaining

Proponent	Respondent
Why A_0?	A_1
Why A_1?	A_2
Why A_n?	A_{n+1}
Why A_{n+1}?	A_0

this sort. He found that circularity is not a single property of an argument, but depends on contextual factors, like whether the claim is properly grounded in agreed-upon information. This finding suggests that people are sensitive to the pragmatics of an argument (Brem 2003, p. 148), suggesting that dialogue rules governing commitment need to be considered.

What kind of rule for a dialogue game would ban such circular sequences of argumentation? One such rule would be the following question-asking rule.

(QR) A questioner can only ask "Why *A*?", for any statement *A*, if she is not committed to *A*.

(QR), taken along with (PR) bans circles of the kind typified by the circular dialogue in Table IV.[13] For the respondent's first move to be successful as a proof of *A* to the proponent, the latter must be committed to *B*. But if she is committed to *B*, she cannot ask "Why *B*?" at any next move, because of (QR). So it might seem that the fallacy of begging the question can be managed in a system that has rules like (PR) and (QR).

Mackenzie (1979, 1980) developed formal dialogue systems to study the fallacy of begging the question. In system DC, Mackenzie used a rule (RChall), which says that a respondent cannot use a statement to answer a why-question if that statement is under challenge by the proponent. According to Yuan et al. (2003), the problem of banning question-begging in formal dialogue systems remains open, despite several dialogue systems having been constructed by Mackenzie for this purpose. Yuan et al. (2003, p. 4) agreed with Hamblin, Mackenzie, and others however, that the key to modeling the fallacy of begging the question, and other fallacies as well, is the manner of modification of commitment stores in dialogue systems. The big problem with commitment management has always been that of retraction (withdrawal).

What happens with circular argumentation in a system that allows for retraction of commitment? The answer to this question turns out not to be as simple as it looks, as shown by the following sequence of moves in a dialogue game (Woods and Walton 1978, p. 83). *C* is any arbitrary statement that can be filled in at the respondent's second move, to show that he has made an appropriate move at that point. In the Hamblin dialogue framework, each participant has a set of commitments, and statements are added to or deleted

from this set at each move, in virtue of the commitment rules, as the dialogue proceeds. But this means that participants can also retract (withdraw) commitments as well as take them on. The problem can now be posed. In a circular dialogue with retraction, there is a circular sequence of argumentation that is visible. Consider the example shown in Table VI.

The respondent proved *A* by using *B* as a premise, but then later he proved *B* by using *A* as a premise. But is the circular sequence of argumentation somehow wrong or any indication that the fallacy of begging the question has been committed? You can argue that it is not. The problem arises from the proponent's third move. By saying "No commitment *B*", she made it clear she has withdrawn her commitment to *B*. Thus she is now free to ask "Why *B*" without violating (QR). Thus it seems perfectly appropriate for the respondent to use *A* as a premise to try to persuade her to accept *B*. For after all, she has made it clear at move 2 that she is committed to *A*. From a point of view of (PR), *A* is an appropriate premise to fulfill the probative function. The proponent's use of this argument, at this point in the dialogue, seems non-fallacious, even though the sequence of argumentation it is part of can rightly be described as circular. If this interpretation of the Circular dialogue with refraction (CDR) is correct, it seems to follow that there are circular arguments in dialogues that do not commit the fallacy of begging the question.

There has been quite a literature on begging the question that has discussed the problem posed by the CDR (Ritola 2004, pp. 36–48), and indeed several formal dialogue systems have been devised to deal with the problem (Mackenzie 1979, 1980). However, I am not convinced that any of them has got to the heart of the problem, which has to do with the probative function. It should also be said that retraction is a central problem for formal dialogue systems

TABLE VI

Circular dialogue with retraction (CDR)

Proponent	Respondent
Why *A*?	*B*
I accept *A*.	*C*
No commitment *B*. Why *B*?	*A*
B	

of argumentation, and no simple solution to it by constructing any single system is feasible (Walton and Krabbe 1995). This said, the heart of the problem is that even though circular argumentation is evident in the circular dialogue sequence with retraction, the argumentation itself does not show evidence of being fallacious. The reason is that when the proponent says "No commitment *B*", she negates or destroys the success of the probative function in the respondent's first argument in which he used *B* as a premise. In effect, this argument now becomes defunct. Its probative success is now defeated. Thus at move 3, it is appropriate for the respondent to try to persuade the proponent to become committed to *B*, even by using *A* as a premise.

The implications of this analysis of the CDR, if it is correct, are profound. It proves the thesis that not all circular arguments commit the fallacy of begging the question, a thesis that has often been maintained on other grounds (Rips 2002). It also shows that it is the success or failure of the probative function in argumentation that is at the heart of understanding the fallacy of begging the question. The fallacious question-begging arguments are the ones that are circular, and in which the circularity is the reason for the failure of the argument to fulfill the probative function it is supposed to fulfill in a dialogue of the kind having rules like (PR) and (QR).

8. OVERCOMING THE SPLIT

The four main tools that proved useful in analyzing the cases of begging the question studied above are argument diagramming, the probative function, the profile of dialogue technique and the distinction between an explanation and an argument. Each of these tools has problems and controversies surrounding its use, and each of them should be seen as being in a state of development. The cases studied in Sections 2 through 5 showed how the tool needed to model cases where begging the question has occurred or has been suspected is a method of taking the sequence of argumentation in a case and representing how it moves forward. But should this process be seen as one of belief-change or as knowledge growth, as it would be seen in the epistemic model? Or should it be seen as a dialogue process in which commitments are incurred and retracted by the participants? The case studies have shown that it may not really matter all that much, and that you could take them either way, as

long as you apply the tools as methods to determine by an objective means whether there is a circular sequence, and how that sequence should be analyzed. For example, should it be analyzed as an argument or an explanation? And if it should be taken to be an argument, is the context of use such that the premises are supposed to be used to prove the conclusion by evidence that is supposedly better established than the conclusion?

The method currently in use, and most widely in use in argumentation studies, as shown above, is that of the argument diagram (Freeman 1991). The argument diagram represents the chain of argumentation in a given case, representing each set of premises and conclusion as a point (node) in a graph, and each inference from a set of premises to a conclusion as a line (arrow, arc) joining the points. Each point represents a distinct proposition (statement) and each line represents an inference (argument). There are now several automated systems in use that can help to construct such an argument diagram, including *Araucaria*, as shown above. As noted however, a property of such automated diagram systems is that the diagram takes the form of a tree, a form of acyclic graph (Harary 1972). In other words, the argument diagram always starts from a single point, the root of the tree, representing the ultimate *probandum* in the case, and the branches open downwards from that single point. In such a tree structure, there can be no circles, that is no argument that has a certain proposition as premise or conclusion at an earlier point and then uses that same proposition as a premise or conclusion later on in the sequence of argumentation, either by repeating it or by circling back to it.

This limitation of current diagramming systems is not inherent in the graph structure, however. It is quite possible to have a graph containing circles, and to construct an argument diagramming system containing circular argumentation. And it is this sort of system that is needed to represent circular argumentation and to model cases where begging the question is the fallacy that is the object of analysis and evaluation. Although automated systems of this sort have not been built yet, analyses of begging the question have been constructed using graph-theoretic methods of argument diagramming (Walton and Batten 1984). Systems of this sort begin by constructing a dialogue that represents the argumentation in the given case, and then map this dialogue onto an argument graph that represents the chain of argumentation from premises to a conclusion that can be reconstructed from the dialogue. This kind of system

can represent circular arguments, because the graph of the argumentation is not restricted to a tree structure. In fact, case studies of begging the question have shown that this method of representing circular argumentation using a graph model not restricted to trees works quite well. Once the implicit premises and conclusions have been filled in by analyzing the text of discourse in the case, a graph representing a circle found in that argumentation can be quite a useful tool in helping to evaluate an allegation that the fallacy of begging the question has been committed. Of course, such an analysis is always a hypothesis, based on an interpretation of the text of discourse given in the case. But still, such analyses are based on objective methods applied to the textual evidence given in the case. Thus they are a considerable improvement over intuitive judgments of the kind still very commonly found in logic textbooks that treat of the fallacy of begging the question.

Yet even with such methods there is a limitation, because only the propositions in the argument, the premises and conclusions in the chain of argumentation, are represented in the graph. Would it be possible to represent other speech acts on the graph of kinds that might occur in everyday dialogues? For example, could why-questions, of the kind representing requests for arguments or requests for explanations, be represented on the graph? Or could critical questions, representing reactions to an argument by one party put forward in response to a move by the other party, be represented on the graph? It is possible to have such formal systems, and even to have software argument diagramming systems with such a feature. But so far, such systems have not been developed. This is the kind of system it would take to model Hintikka's interrogative game in which the questioner has to lead up to the asking of a "big" question by first asking a series of smaller questions that lead up to the asking of the big one (Hintikka 1987, p. 219). To model this conception of the fallacy, the questions asked in a dialogue need to be represented, along with the answers, in a profile of dialogue.

It was pointed out in Section 1 that it is very natural to frame the analysis of begging the question in a dialogue model or an epistemic model of the Aristotelian sort. Either approach can be helpful up to a point in dealing with cases and trying to give a normative account of rules of rational argumentation and evidence that ban circular reasoning. But we are not yet at the point where we can map an argument diagram representing a circular sequence of argumentation onto either a dialogue model indicating questions asked

and answered, or an epistemic model indicating knowledge increment or change. Both approaches appear to be natural and promising, as all the examples studied suggest, but we always come back to the problem of representing the dialogue or the change in knowledge or belief in the argument diagram. The same problems encountered in using the dialectical hypothesis arise in using knowledge and belief as a framework for analyzing begging. It can be argued that in proving a conclusion as known to be true, or as a justified belief, one has to start from premises that are better known in order to prove a conclusion that is less well known, or open to doubt and questioning. Presumably then, propositions in a knowledge framework are ordered (Mackenzie 1980) just as theorems are numbered in an axiom system. However, knowledge also has to be discovered in systems where questions need to be asked and answered. Such an epistemic system of knowledge discovery, testing and verification surely begins with a target of the investigation, and with gathering evidence used to try to prove or disprove the target proposition. The problem here is how to represent such a context of investigation in an argument diagram, or some other model of rational argument and proof. Thus the same problem encountered in the dialectical systems is central to attempts to use epistemic structures to analyze cases of circular reasoning where begging the question is suspected. In the BDI architecture, the problem is to model how new beliefs are added to a given belief, and how beliefs that have been refuted are retracted. Surely this procedure needs to be governed by different principles, different requirements of burden of proof, for example, in different fields and different epistemic contexts.

In the example of the square root algorithm presented by Abelson and Sussman (1996), the square root equation that was a genuine function in the context of pure mathematics begged the question when formulated as a procedure in computing. The same bit of reasoning was non-question-begging in one field, mathematics, but was question-begging in another field, computing. Based on this example, the hypothesis is suggested that whether or not a given instance of reasoning begs the question depends on the field it is used in. This hypothesis might indeed be true, but does it help us to find a basis for evaluating cases where begging the question is a problem? It would seem not, for two reasons. One is that a field of knowledge is not in itself a normative structure for the evaluation of reasoning of the kind required. There might be normative rules for rational argumentation and explanation in a specific field

that can be identified and articulated. But unless they are formalized in some model, or clearly defined general structure, they are insufficient, by themselves, for determining when an argument or explanation in a given case commits the fallacy of begging the question or not. The second reason stems from the observation made by Abelson and Sussman (1996, p. 22) that the reason for the variability in the square root case is the difference between two kinds of knowledge. On their account, mathematics is primarily concerned with declarative knowledge while computer science is primarily concerned with imperative knowledge. The difference, on their account, is that between descriptions of what is and descriptions of how to do things. This difference is not just one between two fields, but a difference between two kinds of knowledge.

It has been argued in computing that agent communication systems have run into intractable problems when trying to implement communication policies based on notions of knowledge and belief (Singh 1998). Iterated modalities pose one such difficulty. As a result, there has been a move to a commitment-based model and away from the epistemic model (Singh 2000; Reed and Norman 2003). However, there are definite parallels between the epistemic analyses that have been offered and the dialogue-based analyses. The epistemic principles used to attempt to ban circular argumentation tend to mirror the dialogue rules formulated in the literature on question-begging in formal dialogue systems. Ritola (2001) has compared the two approaches, arguing that Wilson failed to show that the epistemic analysis should be given up. There seems to be plenty of room for the legitimacy of both approaches, and Ritola's comparison of them shows that there are many parallels between them. However, it can be argued that the dialogue approach based on commitment is a simpler and clearer entry point than the belief and knowledge based epistemic approach. The reason is that commitment can be determined by analysis of the textual evidence of discourse in the given case. It is a matter of what an arguer has gone on record as saying. Belief, in contrast, is an internal matter. It is more difficult to determine on a case-by-case basis. The same holds for knowledge, if it is seen as a species of belief. Just assuming that we have solved these problems, and that some clear notions of knowledge and belief can be agreed on as forming a basis for analyzing the fallacy of begging the question, has not been successful as a research program.

However, it could be equally well maintained that the same problems, or very similar ones, are at the bottom of the dialectical attempts to provide an analysis of begging the question. Although it is possible to construct a more powerful method of argument diagramming by representing the questions asked as well as the answers given in the dialogue, there are many problems to be considered. What kinds of questions should be allowed? What rules should structure the answering of such questions? In particular, when you ask a question, what does that commit you to? Does it commit you to the presupposition of the question? How can we make a clear distinction between why-questions that ask for an argument and those that ask for an explanation? Does the asking of a critical question in response to an argument by the other party refute that argument if the question is not answered appropriately? Or can the arguer reply by questioning the critical question? These and many other comparable problems need to be considered.

It would appear that no one formal system of formal dialogue or epistemic logic can solve all these problems. Hence, enriching the argument diagramming method to take question asking and answering into account is no easy or simple venture. Problems involving presuppositions of questions, burden of proof, formulations of critical questions matching argumentation schemes, and so forth, all come into it. The solution is to combine the two approaches. The dialectical approach is the easier to represent formally, because the notion of commitment, its basis, is relatively transparent and relatively easy to determine in a given case. What an arguer is committed to is what she has gone on record as saying in a dialogue, judging from the textual evidence in the case. Belief and knowledge are deeper and more private, and harder to determine in any given case. Still these epistemic notions are vitally important, and as Aristotle and many thinkers since have maintained, they are vital to a deeper understanding of begging the question as a fallacy. Thus the research proposal suggested by the case studies and arguments in this investigation is to study ways of enriching the argument diagram as a model of rational argument that use tools that take factors of the context of use into account. Such factors relate to how an argument moves forward dynamically in a setting where old beliefs are given up and new ones taken on by an agent. They relate to the incurring of commitments and their retraction, when an argument is defeated. They include tools like the profile of dialogue to represent such a sequence. But it matters little whether such

a sequence is viewed in an epistemic or dialectical light. In many of the cases we examined, it could be perfectly possible to describe what has transpired in either way. The structural model displaying the sequence of argumentation, namely the profile of dialogue as we have called it, or it could be called an epistemic sequence, simply shows how new propositions are added in as premises or conclusions, or deleted. Whether we think of the set that is added to or reduced as a commitment set or a knowledge base should not really matter. Surely either type of analysis will work. But then, as the formal study of properties of epistemic and dialectical systems matures, the areas where each type of system applies best can be determined.

This research proposal is conducive to better results in the high quality research that is presently being conducted both in the BDI tradition using the epistemic approach and in studies on the formal properties of dialogue systems using the dialectical approach. At some point, once the notions of commitment and belief are better analyzed so that we can more precisely each in terms of the other, the spheres of application of the two systems will be clarified. For the present, both research program should be encouraged, and not seen as so intractably opposed as the current literature suggests. Competition is healthy, especially between competing philosophical viewpoints, but in scientific research, and in developing formal systems that can be useful in computing, collaboration can also be a powerful tool. Once there is some better general account of how belief, commitment and knowledge are related, research on begging the question should be able to overcome this split and move ahead in a unified way.

NOTES

[1] The author would like to thank the Social Sciences and Humanities Research Council of Canada for a grant that supported the work in this paper, and Pinar Yolum and David Moore for providing many useful criticisms, suggestions, and corrections that greatly improved the paper.

[2] Surveys of the literature on begging the question can be found in Walton (1994) and Ritola (2004). There is not enough space in this paper for a full survey, but the first sections offer the beginning reader enough examples to see what the problems are and how each approach has tried to solve them.

[3] In a letter to the editor in the *Globe and Mail* (March 15, 1995, p. A23), John J. Mulhall asked the writers of the paper to consult a dictionary to see that "begging the question" refers to a type of argument in which the arguer assumes what

he is trying to prove. When the writers substitute the erudite sounding phrase "begs the question" for the correct phrase "raises the question", they are printing "pure nonsense", Mulhall wrote.

[4] Not all circular arguments fail to fulfill this function, however. Or so it will be argued below, once certain qualifications are introduced and explained.

[5] A cyclic graph (Harary 1972) is defined as a sequence of nodes (points) and arcs (arrows joining the nodes) that contains a sequence of arcs coming back to an earlier node.

[6] See the referral graph of the bank manager example in Section 2.

[7] Other cases of this sort are discussed and analyzed in (Walton 1985). One such context of use is that of knowledge (the epistemic context). Here we will not go into the question of whether a given agent knows which other agents have been referred to in a referral graph.

[8] Many puzzling cases suggesting this conclusion have been presented in (Walton 1994). In one (pp. 186–193), it was alleged that scientists argue in a circle when they date the succession of fossils found in rocks using the levels of the rocks as data, but also determine the relative ages of the rocks by the organisms they contain. It was argued that there is a circle in this reasoning, but not a vicious one.

[9] How argument diagrams can be adapted to model chains of reasoning in explanations, as well as in arguments, has been shown in (Walton 2005, pp. 186–192).

[10] Understanding is a contextual notion that needs to be defined differently in science than law, for example (Walton 2005, chapter 6).

[11] Actually Hamblin's rule (1970, p. 268) is a bit stronger. It requires that the answer to "Why *A*?" must be by way of statements that are already commitments of both the speaker and the hearer.

[12] Note that the (PR) type of rule can exist in a stronger or weaker form. The stronger form is represented by (PR). The weaker form requires only premises that the other participant is already committed to in the dialogue, or can become committed to as the dialogue proceeds. For the sake of simplicity, only the stronger form is considered here.

[13] Hamblin (1970, p. 268) combined (PR) and (QR) in his rule stating that "Why *A*?" cannot be asked unless *A* is a commitment of the hearer and not of the speaker.

REFERENCES

Abelson, H. and Sussman, G. J.: 1996, *Structure and Interpretation of Computer Programs,* 2nd edn, The MIT Press, Cambridge, MA.

Biro, J.: 1997, 'Rescuing Begging the Question', *Metaphilosophy* **8**, 257–271.

Brem, S. K.: 2003, 'Structure and Pragmatics in Informal Argument: Circularity and Question-Begging', *Trends in Cognitive Science* **7**, 147–149.

Cawsey, A.: 1992, *Explanation and Interaction: The Computer Generation of Explanatory Dialogues*, MIT Press, Cambridge, MA.

Freeman, J. B.: 1991, *Dialectics and the Microstructure of Arguments*, Foris, Berlin.

Grice, J. P.: 1975, 'Logic and Conversation', in, Davidson D. and Harman, G. (ed.), *The Logic of Grammar*, Encino, California, Dickenson, 64–75.
Hamblin, C. L.: 1970, *Fallacies*, Methuen, London.
Harary, F.: 1972, *Graph Theory*, Reading. Mass., Addison-Wesley.
Hintikka, J.: 1987, 'The Fallacy of Fallacies', *Argumentation* **1**, 211–238.
Hintikka, J.: 1992, 'The Interrogative Model of Inquiry as a General Theory of Argumentation', *Communication and Cognition* **25**, 221–242.
Hintikka, J.: 1993, 'Socratic Questioning, Logic and Rhetoric', *Revue Internationale de Philosophie* **1** (nr. 184), 5–30.
Jacquette, D.: 1993, 'Logical Dimensions of Question-Begging Argument', *American Philosophical Quarterly* **30**, 317–327.
Lacave, C. and Diez, F. J.: 2004, 'A Review of Explanation Methods for Heuristic Expert Systems', *The Knowledge Engineering Review* **19**, 133–146.
Mackenzie, J.: 1979, 'Question-Begging in Non-Cumulative Systems', *Journal of Philosophical Logic* **8**, 117–133.
Mackenzie, J.: 1980, 'Why Do We Number Theorems?', *Australasian Journal of Philosophy* **58**, 135–149.
Maximillien, E. M. and Singh, M. P.: 2002, 'Reputation and Endorsement for Web Services', *SIGEcom Exchanges* **3**, 24–31. Available in www.csc.ncsu.edu/faculty/mpsingh/papers
Ramchurn, S. D. Huynh, D. and Jennings, N. R.: 2004, 'Trust in Multi-Agent Systems', *The Knowledge Engineering Review* **19**, 1–25.
Reed, C. and Norman, T. J.: 2003, *Argumentation Machines: New Frontiers in Argument and Computation*, Kluwer, Dordrecht.
Reed, C. and Rowe, G.: 2002, 'Araucaria: Software for Puzzles in Argument Diagramming and XML', Technical Report, Department of Applied Computing, University of Dundee, Available at: http://www.computing.dundee.ac.uk/staff/creed/araucaria/
Reed, C. and Rowe, G.: 2003, *Araucaria, Version 2, User Manual*, Available at http://www.computing.dundee.ac.uk/staff/creed/araucaria/.
Rips, L. J.: 2002, 'Circular Reasoning', *Cognitive Science* **26**, 767–795.
Ritola, J.: 2001, 'Wilson on Circular Arguments', *Argumentation* **15**, 295–312.
Ritola, J.: 2004, *Begging the Question: A Study of Fallacy*, Academic Dissertation, Reports from the Department of Philosophy, University of Turku, Finland.
Sanford, D. H.: 1972, 'Begging the Question', *Analysis* **32**, 197–199.
Sanford, D. H.: 1981, 'Superfluous Information, Epistemic Conditions of Inference, and Begging the Question', *Metaphilosophy* **12**, 145–168.
Singh, M. P.: 1998, 'Agent Communication Languages: Rethinking the Principles', *Computer* **31**, 425–445.
Singh, M. P.: 2000, 'A Social Semantics for Agent Communication Languages', in. F. Dignum, and M. Greaves (ed.), *Issues in Agent Communication,* Springer-Verlag, Berlin, pp. 31–45.
Toulmin, S.: 1958, *The Uses of Argument*, Cambridge University Press, Cambridge.
Walton, D.: 1985, 'Are Circular Arguments Necessarily Vicious?', *American Philosophical Quarterly* **22**, 263–274.
Walton, D.:1990, 'What is Reasoning? What is an Argument?', *Journal of Philosophy* **87**, 399–419.
Walton, D.: 1991, *Begging the Question*, Greenwood Press, New York.

Walton, D.: 1994, 'Begging the Question as a Pragmatic Fallacy', *Synthese* **100**, 95–131.
Walton, D.: 2005, *Argumentation Methods for Artificial Intelligence in Law*, Springer, Berlin.
Walton, D.: 2005a, 'Begging the Question in Arguments Based on Testimony' *Argumentation* 19, 2005, 85–113.
Walton, D. and Batten, L. M.: 1984, 'Games, Graphs and Circular Arguments', *Logique et Analyse* **106**, 133–164.
Walton, D. N. and Krabbe, E. C. W.: 1995, *Commitment in Dialogue: Basic Concepts of Interpersonal Reasoning*, State University of New York Press, Albany.
Walton, D. and Reed, C.: 2005, 'Argumentation Schemes and Enthymemes', *Synthese*, **145**, 339–370.
Whately, R.: 1870, *Elements of Logic*, 9th ed., Longmans, London.
Wilson, K.: 1988, 'Circular Arguments', *Metaphilosophy* **19**, 38–52.
Woods, J. and Walton, D.: 1975, '*Petitio Principii*', *Synthese* **34**, 107–127.
Woods, J. and Walton, D.: 1978, Arresting Circles in Formal Dialogues', *Journal of Philosophical Logic* **7**, 73–90.
Woods, J. and Walton, D.: 1982, 'The Petitio: Aristotle's Five Ways', with John Woods, *Canadian Journal of Philosophy* **12**, 77–100.
Wooldridge, M.: 2000, *Reasoning about Rational Agents*, The MIT Press, Cambridge, MA.
Wooldridge, M.: 2004, *MultiAgent Systems*, Wiley, Chichester.
Wooldridge. M. and Jennings, N. R.: 1995, 'Intelligent Agents: Theory and Practice', *The Knowledge Engineering Review* **10**, 115–152.
Yu, B. and Singh, M. P.: 2000, 'A Social Mechanism of Reputation Management in Electronic Communities', *Proceedings of the 4th International Workshop on Cooperative Information Agents*, Springer-Verlag, Berlin. Available at. www.csc.ncsu.edu/faculty/mpsingh/papers
Yu, B. and Singh, M. P.: 2002, 'An Evidential Model of Distributed Reputation Management', *Proceedings of the 1st International Joint Conference on Autonomous Agents and Multi-Agent Systems*, to appear. Available at. www.csc.ncsu.edu/faculty/mpsingh/papers
Yu, B. Venkatraman, M. and Singh, M. P.: 2002, 'An Adaptive Social Network for Information Access: Theoretical and Experimental Results', Applies Artificial Intelligence, to appear. Available at. www.csc.ncsu.edu/faculty/mpsingh/papers
Yuan, T. Moore, D. and Grierson, A.: 2003, 'Question-Begging in Dialectical Systems', *Technical Report*, Leeds Metropolitan University, 1–12.
Yuan, T. Moore, D. and Grierson, A.: 2003a, 'Computational Agents as a Test-Bed to Study the Philosophical Model DE: A Development of Mackenzie's DC', *Informal Logic*, **23**, 263–284.

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